COMPARATIVE STUDY OF EFFECT OF GOGHRITA AND GODUGDHA SHODHITA GAIRIKA ON HAEMATOLOGICAL PARAMETERS OF WISTAR RATS

A Thesis

SUBMITTED TO THE

TILAK MAHARASHTRA VIDYAPEETH PUNE

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

In Subject Ayurveda

Under the Board of Ayurveda Studies



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UNDER THE GUIDANCE OF

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Year 2019

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CERTIFICATE OF THE SUPERVISOR

It is certified that the work entitled **" Comparative study of effect of Goghrita and Godugdha shodhita Gairika on haematological parameters of wistar rats"** is an original research work done by Dr. Renuka Madhav Suryawanshi under my supervision for the degree of Doctor of Philosophy in Ayurveda to be awarded by Tilak Maharashtra Vidyapeeth, Pune. To best of my knowledge this thesis

- Embodies the work of candidate himself/herself
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- Fulfills the requirement of the ordinance related to Ph.D. degree of the TMV
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I Dr. Suryawanshi Renuka Madhav is the Ph.D. Scholar of the Tilak Maharashtra Vidyapeeth in Ayurved subject. Thesis entitled "Comparative study of effect of Goghrita and Godugdha shodhita Gairika on Haematological parameters of wistar rats" under the supervision of Dr. Lagad C.E., solemnly affirm that the thesis submitted by me is my own work. I have not copied it from any source. I have gone through extensive review of literature of the related published/unpublished research works and the use of such references made has been acknowledged in my thesis. The title and the content of research is original. I understand that, in case of any complaint especially plagiarism, regarding my Ph.D. research from any party, I have to go through the enquiry procedure as decided by the Vidyapeeth at any point of time. I understand that, if my Ph.D. thesis (or part of it) is found duplicate at any point of time, my research degree will be withdrawn and in such circumstances, I will be solely responsible and liable for any consequences arises thereby. I will not hold the TMV, Pune responsible and liable in any case.

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Dr. Renuka……✍

ABBREVIATIONS FOR TECHNICAL TERMS

As- Arsenic

Cd- Cadmium

DC-Disease control

g – gram (s)

Hb%- Haemoglobin Percentage

HCT-Haematocrit Value

HCL – Hydrochloric acid

Hg-Mercury

HGB- Haemoglobin

hrs- Hours

ICP-AES- Inductive coupled plasma-Atomic emission spectroscopy

IDA-Iron deficiency Anaemia

LOD- Loss on drying

MCH-Mean Corpuscular Haemoglobin

MCHC- Mean Corpuscular Haemoglobin Concentrarion

MCV- Mean Corpuscular volume

ml- mililiter (s)

mg- milligram(s)

min- minute

N- sample size

NC- Normal control

Pb- Lead

ppm - Parts per million

Q.S. /q.s. - Quantity sufficient

R- Sample Raw material

RBC-Red blood count

S1- Sample one

S2- Sample two

S.G.-Suvarnagairika

SD- standard deviation

SEM- scanning electron microscopy

SOP - Standard Operative Procedures

STD- Standard control

T1- Trial group 1

T2- Trial group 2

TIBC-Total Iron binding capacity

V/w - Volume/ Weight

WHO - World Health Organization

wt. – Weight

W/w - Weight/ Weight

XRD- X-ray Diffraction

%- Percentage

ABBREVIATIONS FOR TEXTS

AFI - Ayurvedic Formulary of India

AH - Ashtanga Hridhay

A.P.-Auyrved Prakash

API - Ayurvedic Pharmacopoeia of India

AS- Ashtanga Samghraha

ASU - Ayurveda, Siddha & Unani

B.P.-Bhavprakash Samhita

B.P.N.- Bhavprakash Nighantu

CCRAS - Central Council of Research in Ayurveda and Siddha

Ch.Chi. –Charaka Chikitsa

C.S.-Charaka Samhita

Ch. Su.-Charaka Sutrasthana

D.N.- Dhanwantari Nighantu

Kh.-Khanda

K.N.-Kaiyadev Nighantu

M.Kh- Madhyma Kahanda

M.P.N.-Madanpal Nighantu

P.N.-Priya Nighantu

Pu.Kh- Purvakhanda

R.C.-Rasa Chintamani

R.Cha.-Rasachandanshu

Ra.Chi.- Rasendra Chintamani

R.Chu- Rasendra Chudamani

Rn- Rasarnav

R.H.T.- Rasahrudaya Tantra

R.J.N.-Rasajala nidhi

R.K.D.-RasaKam Dhenu

R.N.-Raj Nighantu

R.P.S.- RasaPrakash Sudhakar

R.R.-Rasa Ratnakar

R.R.S.- Rasa ratna Samucchaya

Ra.Sa.S.-Rasendra Sara Samghraha

R.T.-Rasa Tarangini

Sha.S.-Sharangdhra Samhita

Su.Chi- Sushrut Chikitsa

Su.Ka- Sushrut Kalpasthana

S.S.- Sushruta Samhita

Su.Sha.-Sushrut Sharirsthana

Su.Su.- Sushrut Sutrasthana

Su. U.-Sushrut Uttartantra

U.Kh- Uttar Khanda

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INTRODUCTION

Rasashastra is defined as the pharmaceutical science which gives the knowledge of converting the drugs irrespective of their nature (herbal, mineral and animal origin) into the absorbable form. Another definition is, *Rasashastra i*s the science of pharmaceutics in which detailed study of Mercurial processing, operations and the preparations were discussed thoroughly. *Vedas* are the actual origin of knowing the literature of the traditional medicines and *Ayurveda i*s the *Upaveda* of *Atharva Veda*. The single drug treatment was the base which was being fulfilled by the plant origin drug.

Concept of *Ayurveda* crepts into the mind of creature much before the emergence of creation which can be well understood. The curiosity and advancement of mankind, single drug treatment was over ruled by multiple combinations containing numerous ingredients, containing minerals too.

In this era of globalization, the awareness and popularity of *Ayurveda* is increasing day by day. Today as *Ayurveda* is slowly being accepted as a complete health system, there is need to prove its principles to the world and emphasize on its scientific nature. The same fact is applicable in production and testing of pharmaceutical products. Though *Ayurvedic* texts have mentioned the principles of identification, testing, refining, preparing dosage forms and even standardizing the final drug, there is a need to assess all these factors with the help of present parameters and that too in a systemic manner and give them a statistical base so as the large scale pharmaceutical venture is possible.

Application of ingredient (*Dravyas)* is very cautiously made in various combinations depending on their *Rasa*, *Guna*, *Veerya*, *Vipaka* characteristics. By observing low potency and less durability of herbal medicines, the Minerals, Metals were included giving birth to a new field of *Ayurveda* naming *Rasa-Shastra*. The ancient Indian alchemy is dealing with *Parada* (mercury) i.e. *Rasa,* minerals, metals and aquatic substances all are generally considered in *Rasa shastra*.

In the medieval period, it was widely accepted because of its minimum dose schedule and higher efficacy, which gives rise to *Deha Vada* through the *Dhatu Vada*. These substances are categorized under *Maharasas, Uparasas, Sadharana Rasas, Ratnas, Uparatnas, Lauhas (Dhatus), Vishas, Upavishas* etc. as per their quantitative, qualitative differences with reference to its action on *Dhatu* and body.

Rasa Chikitsa is an important branch of *Ayurvedic* treatment which consists of mainly minerals, metals and poisonous drugs processed with highly specialized pharmaceutical techniques. *Rasaushadhies* are very potent *Rasayana* in addition to their therapeutic values.

In the present era when the whole world is looking for the best therapy irrespective of the system it belongs to, it is high time to revive and update *Rasa chikitsa* to meet the demand. This therapy was evolved to overcome the short coming of *Ayurvedic* drug treatment, as *Rasaushadhies* are superior in qualities, active in lower dose, free from unpleasant taste and have quick action.

अल्पमात्रोपयोगित्वारुचेरप्रसंगतः ।
क्षिप्रमारोग्यदायित्वादौषधेभ्योऽधिको रसः ॥

(र०र०समु०– २८/१)

Rasausadhi preparations play an important and major role in curing the ailing human beings. On internal administration of metals and minerals i.e. *Rasausadhies*, in unprocessed or misprocessed form, they are very toxic but when scientifically *Shodhana* and *Marana* of these substances are done with some special processes, they became non-toxic or least toxic with low untoward effects and can be used therapeutically with high gratitude of efficacy.

- **NEED OF STUDY :-**
- **Selection of problem- Anemia**

Anaemia is the most prevalent nutritional deficiency disorder in the world and also a major Public health issue in India today. Figures for anaemia among women & children of India are truly staggering. It is estimated that more than half of all Indian women and 3/4th of Indian children suffer from anaemia. Prevalence of anaemia in India is among the highest in the world.

WHO defines anemia is the condition in which the hemoglobin content of blood is lower than normal as a result of deficiency of one or more essential nutrients[1]. WHO has estimated that more than 2 billion people worldwide suffering from anemia with 50 % attributed to iron deficiency[2].

Iron deficiency anemia is common in our country, because most of the people in our country are suffered from under nutrition unknowingly. Iron deficiency means the condition when red cells do not carry enough O2 to the body tissues due to lack of

haemoglobin. Haemoglobin synthesis is hampered because of less haem synthesis due to deficiency of iron in body.

Iron is important for formation of hemoglobin, myoglobin and other substances, such as cytochromes, cytochrome oxidase, peroxidase and catalase. The total quantity of iron in the body averages 4 to 5 grams, about 65% of which is in the form of hemoglobin[3].

Iron deficiency condition badly affects body as, there is not only the loss of physical productivity but also it is associated with situations like mental retardation, abnormal immune responses. Iron deficiency in pregnancy may become a cause of infant mortality or preterm labour. Childs also cause bad effect on their motor development due to IDA.

That's why; there is much need of an effective and economic drug to cure Iron Deficiency Anaemia. There are number of hematinic preparations in the market of allopath drugs for treating IDA. E.g.: ferrous sulphate, ferrous fumarate. But long term use of these iron salts may lead to side effects like upper gastric discomfort, constipation, metallic taste, heartburn, nausea and recently found that it may generate damaging free radicals in the intestine[4].

These disadvantages of allopathic drugs have turned the focus on the safe and effective medication. From ancient time, medicinal plants classified as *Rasayana* in *Ayurveda* are believed to be useful in strengthening the hematopoietic and immune system of an individual.

- **Selection of the drug: *Gairika***

In *Ayurveda* there are many iron compounds that are very precious in diseases like *Pandu*. *Aacharya Vagbhata* also explained importance of iron compounds in treatment of *Panduroga*,

"पाण्डौ श्रेष्ठमयो ॥"

–अ.हृ. उ.तं 40/48

Mandura, *Lauha*, *Makshika*, *Kasisa*, *Gairika* are some of the important iron compounds in *Ayurveda*. Some studies have been carried out on *Mandura*, *Lauha*, *Makshika*, *Kasisa* etc. regarding its efficacy in *Panduroga* (Iron deficiency anaemia). However, *Gairika* though potent iron containing compound is still untouched by researchers.

Acharya sushruta mentioned the use of *swarnagairika* in the treatment of *panduroga-*

गोमूत्रयुक्तं त्रिफलादलानां दत्वाअयसं चूर्णमनल्पकालम् ।
प्रवालमुक्तांजनशंखचूर्णं लिह्यात्तथा कान्चनगैरिकोत्थम् ॥
(कान्चनगैरिकोत्थमित्यत्रापि, तेन सुवर्णगैरिकचूर्णं गोमूत्रयुक्तं चिरकालं लिह्यादित्यर्थः।

– सु. उ.तं. ४४/२१

In case of *Gairika* there is no need to do tedious procedures like *bhasmikarana*, it can be used internally only after simple *shodhana* process. Moreover, *Gairika* is abundantly available as compared to other *Lauha* containing minerals; also it is affordable to common people.

Gairika is a mineral, mentioned in most of the *Rasashastra* classics under "*Uparasa varga*[5]". It is also included under "*Panchamruttika varga*[6]". *Gairika* mainly constitutes ferrous in the oxide form. So the present study was done to introduce an innovative SOP for *Shodhana* of *Gairika* and to study its efficacy in anaemic rats. So that *Shudha Gairika* may be useful drug to control increasing prevalence of anaemia and may be very useful for poor anaemic group in India.

By this way, the study may help to cure health problem of anaemia and also may solve one of the socioeconomic problem in front of the poor people.

Regulatory Authorities worldwide and key principles laid down in the declaration of Helsinki require that new drugs be tested in animals before being introduced to human beings.

- **Rationale of the study:-**

The present study was designed to study the two methods of *Shodhana* (*Ghritabharjana and Godugdha bhavana*) of *Gairika* on pharmaceutical ground and to analyse these two samples by using various modern analytical tools like XRD, ICP-AES, and SEM etc. The efficacy of purified samples were studied on haematological parameters like RBC, HGB, HCT, MCV, MCH, MCHC, Sr.Iron, Sr.Ferritin, TIBC etc. in experimental wistar rat models.

There are much more haematinic iron products in market, but unable to cure the nutritional iron deficiency of such a large number of population; there are number of causes behind it such as high costs of iron products, effects seen only on longer

consumption (about 3 months) and adverse effects of these drugs. Constipation is the major and common adverse effect of all modern haematinic drugs.

Looking all these obstacles in consumption of modern haematinic, peoples turned their focus towards safe and effective medication. *Ayurveda* serves very safe and effective treatment in anaemia since ancient time.

Mandura, Lauha, Makshika, Kasisa are some of the important iron compounds in *Ayurveda* used in the management of anaemia since ancient time. Various research studies have been carried out on *Lauha, Madura, Kasisa* and *Suvarnamakshika* for its *Panduhar* effect and results of these studies prove that these minerals worked as a very good *Ayurvedic* haematinic in Iron deficiency anaemia without any toxicity to animals. Also, there are some comparative studies done on *Mandura* and *Gairika* in Iron deficiency anaemia and proved haematinic property of *Gairika*.

In ancient period *Gairika* was not used directly in the management of *Pandu.* In *Sushruta samhita* only one reference found regarding use of *Gairika* in anaemia. Recently in *Rasayogsagar,* one formulation of *Gairika* was found which used in the therapeutic of Anaemia. Iron is present in ferrous form in *Gairika*, which is most absorbable among all forms of Iron.

In case of *Gairika*, it can be used internally only after simple *shodhana* process. Moreover, *Gairika* is abundantly available as compared to other *Lauha* containing minerals; also it is affordable to common people.

There are various methods of *Shodhana* of *Gairika* mentioned in *Rasashastra* classics, but out of them for present study *Ghritabharjana* and *Godugdha bhavana* methods were selected. As these methods were mentioned by most of A*charyas* and also easy to perform.

The media used in the purification of *Gairika* was *Godugdha* and *Goghrita*. *Goghrita* have properties like *Rasayana, Yogavahi* and *Sanskaranuvartana*, it pacifies *Pitta dosha* and will help to infiltrate into *sukshma srotasa* rapidly which will help in *Sampraptivighatana* of *Panduroga*. The smooth coating of *Ghrita* on *Gairika* formed in *Shodhana* process helps to get rid from constipation occurred due to consumption of Iron preparation, as caused by all other Iron preparation.

On other hand second media of purification was, *Godugdha*. In classics Properties of *Godugdha* mentioned as *Rasayana, Balya*, Nutritious, Mild purgative to *Pitta* constitution people etc. *A Rasayana drug provides* strengthening to Haemopoitic

and immune system of body. With use of *Godugdha* as triturating agent for purification of *Gairika*, helps to cover nutritional iron deficiency anaemia by strengthening haemopoitic system.

No work was found on SOP of *Shodhana* of *Gairika* and its effect in *Pandu.*

Thus taking into consideration of all above facts, here a humble attempt was made to evaluate efficacy of *Gairika*, purified by two different methods, on various haematological parameters of wistar rats and to offer a safe, cost effective and potent iron preparation to cure iron deficiency anaemia.

REVIEW OF PREVIOUS WORK DONE:-

1) Pharmaceutical study and standardization of different samples of Gairika, Dr. K. S. Guduganatti, KLE's BMK Ayurved Mahavidyalaya, Belgaum- 1998.
2) Comparative study of Shuddha Gairika and Mandura bhasma on panduroga by Vd. Archana P.Sonane, Depaerment of R.S.&B.K., Govt.Ayurved college, Nanded-2002.
3) A Comparative Pharmacitico-Pharmaco-Clinical Study of Loha Bhasma and Mandur Bhasma w.s.r. to its Panduhar effect.,by Dr.Prasantakumar Sarkar, IPGT & R Jamnagar-2005.
4) Standardization of Gairika using ancient and modern parameters, Vd.G.D.Dongare, C.P.G.S. & R.A.Tilak Ayurved Mahavidyalaya, Pune-2010.
5) Scientific evaluation of some Ayurvedic preparation for correction of Iron deficiency and Anemia.by Sharma D.C., Chandiramani D.-2007.
6) Efficacy of Tiktrayadi Loha in Pandurog w.s.r. Iron deficiency Anemia.by Khan S.K., Vyas S.N.-2012.
7) A Clinical study of Panduroga, Iron deficiency Anemia with Trikatrayadi Loha suspention in Childrens.by Kumar A.,Gorai A.K.,J Ayurved Integr. Med.-2012.
8) Dhatrilauha: Right Choice for Iron deficiency anaemia in pregnancy, Roy A, Dwivedi M. Ayu. 2014 Jul-Sep; 35 (3): 283-8.
9) To study the effect of Mandura bhasma in Garbhini Pandu (IDA in pregnancy), by Vd.Mule Kavita, Vd.Chandrashekhar Mule, Ayurlog-2015.
10) Evaluation of Haematinic Activity of the Siddha Drug Pitha Paandu Maathirai on Phenyl Hydrazine Induced Anaemic Rats- P. Parthibhan, P. chilambuselvi,

R.Sarireka, K.Samraj,International Journal of Research in Pharmacy and Biosciences, Volume 2, Issue 7, August 2015, PP 23-27.

11) Evaluation of effects of Mandurabhasma on structural and functional integrity of small intestine in comparison with ferrous sulfate using an experimental model of iron deficiency anemia.- Suchita Rajanikant Gawde,Tejal C.Patel, Nirmala N.Rege, Snehalata Gajbhiye and Dinesh Uchil.- AncSci Life,2015 Jan-Mar; 34(3): 134-141

12) Evaluation of the effect of conventionally prepared Swarnamakshika Bhasma on different bio-chemical parameters in experimental animals, SudhaldevMohapatra and C.B. Jha, J.Ayurveda Integr.Med. 2011 Oct-Dec; 2(4):187-191.

Articles:-

1. Evaluation of Haematinic Activity of the Siddha Drug Pitha Paandu Maathirai on Phenyl Hydrazine Induced Anaemic Rats- P. Parthibhan, P. chilambuselvi, R.Sarireka, K.Samraj,International Journal of Research in Pharmacy and Biosciences, Volume 2, Issue 7, August 2015, PP 23-27.

   Conclusion: In this study the oral administration of Pitha Paandu Maathirai (PPM) significantly increases the hematological parameters from first week of treatment. This study concluded the haematinic activity of Pitha Paandu Maathirai (PPM) was more effective than the standard hematinic drug.

2. Study of Anti-anemic effect of schrebera swietenioides roxb. In rat models. – Prasuna sundari pingali, Prathima srinivas, Madhava reddy. – Asian Journal of Pharmaceutical and Clinical Research. - Vol 8, Issue 5, 2015.

   Conclusion: The collective data of this study revealed that root bark has considerable anti-anaemic activity as shown in PHZ-induced anaemia in experimental rat model indicating the use of this plant for the treatment of anemia. Further studies are required to precisely define the bioactive and to develop suitable formulation to ensure maximum bioavailability and therapeutic efficacy.

3. Hematimic activity of Herbo mineral drug Ayaveera chenduram (AVC) in swiss albino rats. - D.Sangeetha, M.Mohamed Musthafa, G.Sekar.-World Journal of Pharmaceutical research.Vol 3, Issue 9 PP 686-692.

   Conclusion: Acute and sub-acute oral toxicity study proved that the drug was non-toxic and safer up to 400mg/kg p.o. as human therapeutic dose. This safer

dose of drug showed significant increase in Hb, RBC, PCV, MCV and MCH indicating the hematinic activity of traditional siddha herbo mineral drug Ayaveera chenduram (AVC).

4. Evaluation of effects of Mandurabhasma on structural and functional integrity of small intestine in comparison with ferrous sulfate using an experimental model of iron deficiency anemia.- Suchita Rajanikant Gawde,Tejal C.Patel, Nirmala N.Rege, Snehalata Gajbhiye and Dinesh Uchil.- AncSci Life,2015 Jan-Mar; 34(3): 134-141

   Conclusion: - Mandura bhasma in high dose appeared to be a good hematinic agent comparable to the commonly used iron preparation that is ferrous sulphate. In addition to this, it also showed fewer propensities to cause structural damage, exhibiting its protective role in preserving the structural integrity of GI tract. This is an encouraging finding because it indicates less potential of Mandurabhasma to cause GI side effects as compared to Ferrous sulphate. The present study therefore, provides a rationale for the use of 500mg/day of Mandurabhasma in clinical practice which has exhibited hematinic effect comparable to that of ferrous sulphate.

5. Evaluation of the effect of conventionally prepared Swarnamakshika Bhasma on different bio-chemical parameters in experimental animals, Sudhaldev Mohapatra and C.B. Jha, J.Ayurveda Integr.Med. 2011 Oct-Dec;2(4):187-191

- **Review of previous work with present study :**

  In above mentioned article 4 and 5 which are from *Ayurveda* field relates with present study. As both study done on iron containing minerals i.e. *Mandura bhasma* and *Swarnamakshika Bhasma* and had significant result on haematological parameters. Studies also carried in comparison with *Mandura Bhasma* and *Gairika*, having equal efficacy in IDA.

AIMS & OBJECTIVES

- **AIMS:-**

  To evaluate efficacy of *Goghrita* and *Godugdha shodhita Gairika* comparatively on hematological parameters of wistar rats.

- **OBJECTIVE:-**
  1. *Shodhana of Gairika* by *Goghrita bharjana* method. (Sample 1, S_1).
  2. *Shodhana of Gairika* by *Godugdha bhavana* method. (Sample 2, S_2).
  3. Compare and validate the process of *Shodhana* of *Gairika*.
  4. Analysis and comparison of *Shudha Gairika* (*Goghrita Bharjana* method & *Godugdha bhavana* method).
  5. Comparative hematological study of Sample 1 and 2 in wistar rats.

- **Research Question:-**

Which *Gairika (Goghrita* or *Godugdha shodhita)* is more effective in haematological parameters of wistar rats?

- **Hypothesis :-**

- **Null Hypothesis: - (H_0)** - On oral administration of *Goghrita* and *Godugdha Shodhita Gairika* in the dose of 45 mg/kg body weight for 28 days, will not have any effect on haematological parameters of wistar rat.
- **H_1 :-** On oral administration of *Goghrita Shodhita Gairika* in the dose of 45 mg/kg body weight for 28 days, will have better effect on haematological parameters of wistar rats than *Godugdha shodhita Gairika*.
- **H_2 :-** On oral administration of *Goghrita Shodhita Gairika* in the dose of 45 mg/kg body weight for 28 days, will have less effect on haematological parametersof wistar rats than *Godugdha shodhita Gairika*.

DRUG REVIEW

In this section the study of *Gairika, Goghrita* and *Godugdha* was done from *ayurvedic* as well as modern literature. The references found from classics were collected and documented in tabular format as follows.

GAIRIKA

- **HISTORICAL REVIEW**

❖ ***Vedic* era (10000-3000 B.C.)**

Table 2.1.1 shows References of *Gairika* from *Vedic* literature.

Ved	Ref. found	Ref. Not found
Rugved	-	√
Yajurved	-	√
Samaved	-	√
Atharvaved	-	√

From above table it can be said that, in *Vedic* literature references of *Gairika* was not found in any accordance.

❖ ***Pauranika* literature :- (1200-600 B.C.)**

Table 2.1.2 shows references of *Gairika* from various *Pauranika* literatures:-

Literature	**Reference**		**Context**
	Found	Not found	
Agni Purana	-	√	-
Ramayana	-	√	-
Mahabharata	-	√	-
Kautilya Arthashastra	√	-	Suvarṇa Pariksha

❖ ***SAMHITAKALA-***

- ***CHARAKA SAMHITA***

Table 2.1.3 shows review of *Gairika* from *Charaka Samhita*:-

Sr.no.	Reference	Term used	Application	Disease
1	Ch.su.1/70-71	Gairika	Bhauma drug	-
2	Ch.su.3/5	Gairika	E- Pradeha	Kushtha
3	Ch.su.4/18 (46)	Gairika	Mahakashaya	Shonitsthapana
4	Ch.chi.4/73	Gairika	I	Raktapitta
5	Ch.chi.4/79	Gairika	I – pana	Raktapitta
6	Ch.chi.4/99	Gairika	E-Nasya	Raktapitta
7	Ch.chi.20/31	Kanchangairika	I	Chardi
8	Ch.chi.20/33	Gairika	I	Chardi
9	Ch.chi.21/81	Gairika	E-Lepa	
10	Ch.chi.23/79	Gairika	E-Lepa	Visha
11	Ch.chi.23/101	Lohitamruda	I - Ksharagada	Visha
12	Ch.chi.23/220	Gairika	E-Lapa	Visha
13	Ch.chi.25/117	Gairika	E-Lepa	Vyanga
14	Ch.chi.26/210	Gairika	I-Khadiradigutika	Dantaroga
15	Ch.chi.26/232	Gairika	E-Rasakriya	V. Netraroga
16	Ch.chi. 26/235	Gairika	E-Rasakriya	K .Netraroga
17	Ch.chi. 30/91	Gairika	I-Pushayanuga churna	Pradara

Charaka mentioned *Gairika* as *Bhauma* drug and in *Mahakashaya*. It is a content of "*Shonitsthapana*" *gana*. In *Charaka Samhita,* various references of *Gairika* were found in context of Internal as well as external use. It is one of the content of famous formulations like *Khadiradi gutika* and *Pushayanuga churna*. *Gairika* was mentioned in the treatment of *Kushtha, Raktapitta, Chardi*, *Vishavikar, Dantaroga, Kshudraroga* and *Pradara.* In *Charaka samhita Gairika* was mentioned under "*Kanchanagairika*" and "*Lohitamruda*" as synonym.

- ***SUSHRUTA SAMHITA* :-**

Table 2.1.4 shows references of *Gairika* mentioned in *Sushruta Samhita* :-

Sr.no.	Reference	Term used	Application	Disease
1.	Su.su. 1/32	Gairika	Parthiv dravya	
2.	Su.su.13/23	Gairika	Lepa	Samyaka dagdha
3.	Su.su.14/21	Gairikodakapratikash	-	Kaphadushta Raja
4.	Su.sha.10/57	Gairika	Leha	Garbhapatan
5.	Su.chi.5/8	Gairika	Pradeha	P. vatavyadhi
6.	Su.chi.17/10	Gairika	Parisheka	P. Nadivisarpa
7.	Su.chi. 19/30	Gairika	Lepa	P . Vruddhi
8.	Su.chi.19/40	Gairika	I	Upadansh

9.	Su.chi.20/20	Gairika	Lepa	Padadari
10.	Su.chi.20/35	Gairika	Lepa	Nyacha -vyanga
11.	Su.chi.26/38	Gairika	Tailabhyanga	Nilika
12.	Su.ka.3/51	kanakagairika	I	Dushivisha
13.	Su.ka.5/67	kanchanagairika	Tarkshagad	visha
14.	Su.ka.5/77	Gairika	Mandalvishar A.	Visha
15.	Su.ka.6/16	Gairika	Mahasugandhi A.	Visha
16.	Su.U.9/15	Gairika	Gutikanjana	Vatabhishanda
17.	Su.U.10/8	Gairika	Anjana	Pittabhishanda
18.	Su.U.12/16	Gairika	Anjana	Raktabhishanda
19.	Su.U.12/41	Gairika	Anjana	Raktabhishanda
20.	Su.U.17/6	Gairika	Anjana	Pittavidagdha Drushti
21.	Su.U.17/11	Gairika	Anjana	Dinratrandhya
22.	Su.U.17/87	Gairika	Lepa	Akshiroga
23.	Su.U.19/15	Gairika	Anjana	Kukunaka
24.	Su.U.31/4	Gairika	Pradeha	Shakunipratishedh
25.	Su.U.39/311	Gairika	Niruha basti	P. Jwara
26.	Su.U.44/21	Kanchanagairika	I	Pandu
27.	Su.U.45/39	Gairika	Niruha basti	Raktapitta
28.	Su.U.51/19	Gairika	Leha	Hikka
29.	Su.U.51/27	Gairika	Leha	Hikka

In *Sushruta samhita Gairika* was included in "*Parthiv*" drug. While describing *Kaphadushta Raja*, its color was mentioned as "*Gairikodakapratikash*". Apart from *Charakacharya*, *Sushruta* mentioned therapeutic use of *Gairika* in *Garbhapatan*, *Upadansh*, *Jwara*, *Pandu* and *Hikka.* Use of *Gairika* in *Niruha basti* was first told by *Sushruta*. In *sushruta samhita Gairika* was used mostly in external application than internal. "*Kanchangairika*" is the synonym for *Gairika*, found in *Sushruta Samhita.*

- ***ASHTANGA HRUDAYA :-***

Table 2.1.5 shows references of *Gairika* from *Ashtanga Hrudaya*:-

Sr.no.	Reference	Term used	Application	Disease
1.	A.H.su. 10/31-32	Gairika	Kashaya varga	
2.	A.H.Su.17/48	Gairika	Avachurnan	Siravedh
3.	A.H.Su.30/51	Gairika	Lepa	Samayaka dagdha
4.	A.H.Ch.4/40	Gairika	I	Shwas Hikka
5.	A.H.Ch.18/13	Gairika	Lepa	Visarpa
6.	A.H.U.9/39	Gairika	Avachurnan	Pksmaoparadha
7.	A.H.U.11/32	Gairika	Varti Anjana	Kshatshukra

8.	A.H.U.13/45	Lohit-Gairika	Churnanjana	Sarvadrushturoga
9.	A.H.U.13/83	Gairika	Rasakrikya	Nishandhya
10.	A.H.U.13/85	SwarnaGairika	Varti	Doshandhya
11.	A.H.U.13/91	SwarnaGairika	Rasakriya	Ushna vidagdhadrushti
12.	A.H.U.14/24	Gairika	Lepa	Linganasha
13.	A.H.U.16/02	SwarnaGairika	Bidalaka	Abhishanda
14.	A.H.U.16/52	Gairika	Anjana	Pilla
15.	A.H.U.22/30	Gairika	Pratisarana	Upakusha
16.	A.H.U.22/36	Gairika	Nasya	Saushir
17.	A.H.U.22/64	Gairika	Gandush	Kanthavidradhi
18.	A.H.U.22/90	Gairika	I-Gutika	Mukharog
19.	A.H.U.22/105	Gairika	Pratisarana	Mukhapak
20.	A.H.U.32/31	Gairika	Lepa	Vyanga -nili
21.	A.H.U.34/4	Gairika	Lepa	Upadansh vrana
22.	A.H.U.34/46	Gairika	I-Pushyanug churna	Pradar
23.	A.H.U.35/39	Gairika	Dushivishari Agad	Dushivish
24.	A.H.U.37/73	Gairika	Gandhmadan Agad	Visha
25.	A.H.U.38/39	Gairika	Lepa	Nakhadanta visha

In *Ashtanga Hrudaya Gairika* was categorized under "*Kashaya Varga*". In this *Samhita* also, *Gairika* was found mostly in application of external than internal use. *Gandusha kalpana* of *Gairika* was mentioned in *A.H*. Various *netrakalpana* of *Gairika* also found for management of *Netraroga*. *Suvarnagairika, Lohitagairika* are the synonyms of *Gairika* found in *Ashtanga Hrudaya*.

- **ASHTANGA SANGRAHA:-**

Table 2.1.6 shows references of *Gairika* from *Ashtanga Sangraha*:-

Sr.no.	Reference	Term used	Application	Disease
1.	A.S.Su.7/214	Gairika	Gandhavarna sadhita	
2.	A.S.Su.8/49	Gairika	Churna	Vishajushta vayu
3.	A.S.Su.12/13	Gairika	Gairika guna	
4.	A.S.Su.15/42	Gairika	Rudhirsthapan gana	
5.	A.S.Su.18/24	Gairika	Kashayskand	
6.	A.S.Su.36/18	Gairika	gairikodaka	Khaphdushta rakta varna
7.	A.S.Sh.1/16	Gairika	Prakahalan	Pittaj rajodosh
8.	A.S.Sh.4/5	Gairika	I	Garbhastrva
9.	A.S.Ch.2/54	Gairika	Anuvasan basti	Jirna jwara

10.	A.S.Ch.3/38	Gairika	Kwath	Raktapitta
11.	A.S.Ch.3/43	Gairika	churna	Raktapitta
12.	A.S.Ch.3/50	Gairika	Pan	Raktapitta
13.	A.S.Ch.6/45	Gairika	Leha	Hikka Swas
14.	A.S.Ch.8/17	Gairika	Shitambu	Pittaj chardi
15.	A.S.Ch.20/5	Gairika	Leha	Pittaj Visarpa
16.	A.S.Ch.21/82	Gairika	Lepa	Kushta
17.	A.S.U.6/39	Gairika	Pradeh	Shakuni ghrah
18.	A.S.U.6/40	SwaranaGairika	Tailabhyanga	Vranaropana
19.	A.S.U.12/8	Gairika	Anjana	Pothaki
20.	A.S.U.12/16	Gairika	Anjana	Kukunaka
21.	A.S.U.12/20	Gairika	Avachurnan	Pashmoparodh
22.	A.S.U.14/11	SwaranaGairika	Anjana	Shiraharsha
23.	A.S.U.14/27	SwaranaGairika	Varti	Vranashukra
24.	A.S.U.16/53	SwaranaGairika	Varti	Pittaja timir
25.	A.S.U.16/80	SwaranaGairika	Varti	Naktandhya
26.	A.S.U.17/14	Gairika	Lepa	Linganasha
27.	A.S.U.19/3-4	Gairika	Bidalaka	Kaphaj Abhishanda
28.	A.S.U.19/5	Gairika	Bidalaka	Kaphaj Abhishanda
29.	A.S.U.19/25	Gairika	Varti	Vataj Abhishanda
30.	A.S.U.19/30	SwarnaGairika	Aschotana	Pittaja abhishand
31.	A.S.U.19/35	SwarnaGairika	Churnanjana	Akshidaha
32.	A.S.U.19/47	SwarnaGairika	Varti	Kaphaj akshirog
33.	A.S.U.20/33	Gairika	Pratyanjana	Pilla Rog
34.	A.S.U.26/24	Gairika	pratisarana	Upakusha
35.	A.S.U.26/27	Gairika	Nasya	Sushir
36.	A.S.U.26/47	Gairika	Avagharshana	Gala vidradhi
37.	A.S.U.26/52	Gairika	Pratisarana	Mukha nadi
38.	A.S.U.26/53	SwarnaGairika	Gutika	Mukha rog
39.	A.S.U.26/54	Gairika	Gutika	Mukha rog
40.	A.S.U.30/79	Gairika	Lepa	savarnikarana
41.	A.S.U.37/30	SwaranaGairika	lepa	Vyanga
42.	A.S.U.39/7	Gairika	lepa	Upadunsha vrana
43.	A.S.U.39/12	Gairika	Lepa	Pittaja upadunsha
44.	A.S.U.39/78	Gairika	Pushanug churna	Rajodosh
45.	A.S.U.40/85	Gairika	Agad	Vishrog
46.	A.S.U.40/148	Gairika	Agad	Dushivisha
47.	A.S.U.42/80	Gairika	Tarksha Agad	Sarpa visha
48.	A.S.U.44/40	Gairika	Lepa	Pittaja vraa-Lutavisha
49.	A.S.U.44/60	Gairika	Basti	Lutavisha
50.	A.S.U.44/66	Gairika	Anjana	Lutavisha

In *Ashtanga Samgraha, Vagbhata* mentioned properties of *Gairika*. In this *Samhita, Gairika* was included under "*Rudhirsthapana gana*" and "*Kashayaskandha"*. *Shitambu* and *Kwatha kalpana* for internal use of *Gairika* was mentioned by *Vagbhata*. *Anuvasana basti* of *Gairika* composition was described in this *Samhita*. "*Suvarnagairika"* synonym used for *Gairika* in Various contexts of application.

- ***SHARANGDHAR SAMHITA*:-**

Table 2.1.7 shows references of *Gairika* from *Sharangdhar Samhita*:-

Sr.no.	Reference	Term used	Application	Disease
1.	Sha.S.M.Kh. 9/163-167	Gairika	Irimedadi taila	Mukhadanta rog
2.	Sha.S.M.Kh.11/70-71	Gairika	Shodhana	
3.	Sha.S.U.Kh.11/48	Gairika	Bidalaka	Netrrog
4.	Sha.S.U.Kh.11/83	Gairika	Lepa	Aagantuja raktaj shotha
5.	Sha.S.U.Kh.11/96		Lepa	Raktaj agantuj vidradhi
6.	Sha.S.U.Kh.11/108	Gairika	Alepa	Agnidagdha vrana
7.	Sha.S.U.Kh.12/10	Gairika	Kaphadushit rakta varna	
8.	Sha.S.U.Kh.13/31-33	Gairika	Bidalaka	Netrarog
9.	Sha.S.U.Kh.13/87	Gairika	Rasakriya	Netrarog
10.	Sha.S.U.Kh.13/96-97	Gairika	Netrarog	Praklinna vatma

In *Sharangdhar Samhita Gairika* was used in external therapeutics only. It was also mentioned in the "*Irimedadi Taila*" which is a famous remedy in *Mukhroga*. *Shodhana* of *Gairika* also mentioned in this *Samhita*.

- ***BHAVPRAKASH SAMHITA*:-**

Table 2.1.8 Shows references of *Gairika* from *Bhavprakash Samhita*:-

Sr.no.	Reference	Term used	Application	Disease
1.	Pu.Kh.-Mishra Varga-172	Suvarna Gairika	Pratinidhi dravya	
2.	Pu.Kh.-Mishra Prakaran-Dhatu Upadhatu-97	Gairika	Uparasa	
3.	Pu.Kh.-Mishra Prakaran-Dhatu Upadhatu:139-140	Gairika	Types & Synonyms	
4.	Pu.Kh.-Mishra Prakaran:Upadhatu Marana:35-43	Gairika	Rasakarpoor	

5.	Pu.Kh.-Mishra Prakaran:Uparas shodhana:37-38	Gairika	Shodhana	
6.	Pu.Kh.-Mishra Prakaran:Netra Kalpana:16-17	Gairika	Bidalaka	Netra rog
7.	Pu.Kh.-Mishra Prakaran:Netra Kalpana:65-66	Gairika	Rasakriya	Netra rog
8.	Pu.Kh.-Mishra Prakaran:Netra Kalpana:67-68	Gairika	Rasakriya	Netra rog
9.	M.Kh.-Jwaradhikar 241-242	Gairika	Jwaraghni vati	Jwara
10.	M.Kh.:Jwaradhikar:762	Gairika	Lepa	Karnak Sannipat
11.	M.Kh.:Hikka Adhikar:20	Gairika	Leha	Hikka
12.	M.Kh.:Vidhradhi Adhikar:33	Gairika	Lepa	Vidhradhi
13.	M.Kh.:Vidhradhi Adhikar:102	Gairika	Lepa	Vranashotha
14.	M.Kh.:Upadansh Adhikar:10	Gairika	Lepa	Pittaja Upadansha
15.	M.Kh.:Kshrudrarogadhikar:46	Gairika	Kumkumadi tail-Abhyang	Vyang
16.	M.Kh.:Netrarogadhikar:214	Gairika	Anjana	Praklinna vartma
17.	M.Kh.:Yonirogadhikar:60	Gairika	Puran	Yonikanda
18.	M.Kh.:GarbhapatAdhikar:19	Gairika	Churna	Garbhastrav
19.	M.Kh.:Balrogadhikar:65	Gairika	Dhupan	Shakunigraha

In *B.P.S. Gairika* was included in "*Pratinidhi dravya varga*" and "*Uparasa Varga*". In absence of *Suvarnamakshika, Suvarnagairika* was used as *pratinidhi dravya*. Types, Synonyms and *Shodhana* of *Gairika* were mentioned in *Bhavprakash Samhita*. In *Jwara* and *Garbhstrav, Gairika* used as internal application while in diseases like *Netraroga, Vrana, Padadari, and Vidradhi* etc it is used in external application.

- ***NIGHANTU:-***

Table 2.1.9- showing references of *Gairika f*rom *Nighantus*[7, 8, 9, 10, 11, 12]:-

Properties	Rasa	Guna	Veerya	Prabhava
D.N.	Kashaya,Madhur	Snigdha,Vishada	Sheeta	Raktapittaghn,Vishahar,Chardi
M.P.N	-	-	-	Pittaraktakapha shaman,Daha
R.N.	Madhur,Kashaya	-	Sheeta	Vranaropan,Arsha,Agnidaha
B.P.N.	Madhur,Kashaya	Snigdha	Sheeta	Pittaraktakapha shaman,Daha
K.N.	Madhur,Kashaya	Snigdha,Vishada	Sheeta	Raktashamana,Raktasaumya, Daha, Kaphapittashamak
P.N.	Madhur,Kashaya	-	Sheeta	Stambhana ,Raktapittaprakopa shaman,Daha,Visha.

Table 2.1.10- Shows Position and Synonym of *Gairika* from *Nighantus*[13, 14, 15, 16, 17, 18]:-

Nighantu	Varga	Synonym
D.N.	Chandanadi	Raktadhatu, Tamradhatu, Gavedhuk,
M.P.N	Suvarnadi	Raktapahana, Girimrut, Gavedhuk,Swarnavarna, Swarnamandal
R.N.	Suvarnadi	Raktadhatu,Giridhatu, Gavedhuk, Dhatu, Surangdhatu, Girij, Girimrudbhav,Suvarnadhatu, Shiladhatu, Suraktak
B.P.N.	Dhatvadi	Raktadhatu,Gairaye,Girij
K.N.	Dhatu	Girij, Dhatu, Girimrut, Gavedhuk, Raktadhatu, Tamradhatu, Lauhitam, Karaja, Krimihrut, Raktapahana.
P.N.	Suvarnadi	-

- **RASASHASTRA LITERATURE:-**

Gairika is the mineral mentioned in most of *Rasashastra* texts. It is included in the group of "*UPRASA*" by most of *Rasashastra Acharya. Gairika* also one of the constituent of "*PANCHAMRUTTIKA*".

The references from *Rasashastra* texts were compiled here in chronological order.

- ***RASARNAVA*: - (10th Century A.D.)**

Table 2.1.11 shows references of *Gairika* from *Rasarnava*:-

S.n.	Reference (Patala)	Varga	Prakara	Paryay	Grahyagrahyatva	Shodhana' Satvapatana, Guna	Use		
							E	I	O
1.	7/56	✓							
2	7/83		✓						
3	7/84					✓			
4	7/126								✓
5	8/3								✓
6	8/49								✓
7	16/54								✓
8	16/55								✓
9	17/74								✓
10	17/81								✓
11	17/124								✓
12	17/128								✓
13	17/134								✓
14	17/137								✓
15	17/145								✓

In this book *Gairika* was mentioned in the context of *Rasaranjana, Varnotkarsha, Hemadal nirmana, Rasavedha, Rasaviddhanaga* etc.

- ***RASAHRUDAYATANTRA*: - (10th Century A.D.)**

Table 2.1.12 shows references of *Gairika* from *R.H.T.* -

S.n.	Reference (Avabodh)	Varg	Prakar	Paryay	Grahyagrahyatva	Shodhana'Satvapatana, Guna	Use		
							E	I	O
1.	5/27								✓
2	9/5	✓							
3	11/3								✓
4	11/6								✓
5	16/27								✓
6	18/11								✓
7	18/13								✓
8	18/28								✓
9	18/43								✓
10	19/39								✓

In *R.H.T.* book *Gairika* was described in the context of

- *Suvarnajaranarth Bida* nirmana
- *Abhrakasatva Bijanirvahana*
- *Raktaganadi Bijanirvahana*
- *Sarita parade Guna*
- Rasaranjana
- *Varnotakarsha*
- *Ghoshakrashta Tamraveda vidhi*
- *Kramana vidhana*
- *Uarasabadha Paradayaga Varjit yoga*.

- ***RASENDRACHUDAMANI:* - (12TH Century A.D.)**

Table 2.1.13 shows references of *Gairika* from *R.Chu.*

S.n.	Reference (Adhaya)	Varga	Prakara	Paryay	Grahyagrahyatva	Shodhana'Satvapatana, Guna	Use		
							E	I	O
1	9/2								✓
2	11/85-89	✓	✓		✓	✓			

- ***RASAPRAKASHSUDHAKAR* :-(12th Century A.D.)**

Table 2.1.14 shows references of *Gairika* from *R.P.S.*

S.n.	Reference (Adhya)	Varga	Prakara	Paryay	Grahya-grahyatva	Shodhana' Satvapatan Guna	Use		
							E	I	O
1	4/16								✓
2	6/1	✓							
3	6/70		✓						
4	6/70-73					✓			
5	6/84					✓			
6	11/22-31								✓
7	11/34-35								✓
8	11/42-45								✓
9	11/46-50								✓
10	11/61-68								✓
11	13/6-9							✓	✓

In *R.P.S*. book *Gairika* was described in the contexts of –

- *Suvarnabhasma nirmana vidhi*
- *Hemakaran vidhi-6*
- *Hemakaran vidhi-9*
- *Hemakaran vidhi-13*
- *Hemakaran vidhi-14*
- *Hemakaran vidhi-20*

- ***RASARATNASAMUCCHAYA:* - (13th Century A.D.)**

Table 2.1.15 shows references of *Gairika* from *R.R.S.*

S.n.	Reference (Adhya)	Varga	Prakara	Paryay	Grahya grahyatva	Shodhana' Satvapatana, Guna	Use		
							E	I	O
1.	3/1	✓							
2	3/46		✓						
3	3/47-51					✓			
4	6/44								✓
5	10/81								✓
6	17/56-57							✓	
7	23/70						✓		
8	24/48						✓		
9	25/42						✓		
10	25/101							✓	
11	26/33							✓	
12	30/84						✓		

In *R.R.S.* the *Gairika* was described in the context of-

- *Rasamandal- Asthadala Stapana dravya*
- *Panchmruttika*

- ***RASARATNAKAR (Hruddhi Khanda)* (13th Century A.D.)**

Table 2.1.16 shows references of *Gairika* from *R.R.*

S.n.	Reference (Upadesh)	Varga	Prakara	Paryay	Grahyagrahyatva	Shodhana' Satvapatana, Guna	Use		
							E	I	O
1.	1/57	✓							
2	3/67					✓			
3	4/22								✓
4	5/21								✓
5	5/23								✓
6	5/37								✓
7	9/29								✓
8	13/71					✓			
9	13/80								✓
10	15/23								✓
11	19/116								✓

In *R.R. Gairika* was described in the context of-

- *Tamravedha*
- *Sitaswarnaveda*
- *Pakwabeeja nirmana*
- *Ashtavarna swarnasya Dashvarnakarnam vidhi*
- *Sitaswarna Lakshavedhi kalka*
- *Ghrahya Srotonjana-Gharshane Gairikachaym*
- *Rasaranjanam*
- *Kumkumkaranam*

- ***RASACHINTAMANI* (15th Century A.D.)**

Table 2.1.17 shows references of *Gairika* from *R.C.*

S.n.	Reference (Stabaka)	Varga	Prakar	Paryay	Grahyagrahyatva	Shodhana 'Satvapatana, Guna	Use		
							E	I	O
1	1/12								✓
2	2/120							✓	
3	5/22								✓

In *Rasachintamani Gairika* was described in the context of:-

- *Rasakarpura Nirmana*
- *Rasaranjana karma*
- Content of *Suryasiddha rasa*

- ***RASENDRACHINTAMANI* (16th Century A.D.)**

Table 2.1.18 shows references of *Gairika* from *Ra.Chi.*

S. n.	Reference (Adhaya)	Varga	Prakar	Paryay	Grahya grahyatva	Shodhana'Satvapatana, Guna	Use		
							E	I	O
1	3/147								✓
2	6/7,8								✓
3	7/119					✓			
4	8/199								✓

In *Rasendra Chintamani Gairika* was mentioned in the context of:-

- *Varnavruddhi*
- *Swarnashodhana*
- A content of *Tamra yoga* -2

- ***RASENDRASARASAMGHRA*-(16th Century A.D.)**

Table *2*.1.19 shows references of *Gairika* from *Ra.Sa.S.*

S. n.	Reference (Adhaya)	Varga	Prakara	Paryay	Grahya grahyatva	Shodhana'Satvapatana, Guna	Use		
							E	I	O
1	1/119	✓							
2	1/244					✓			
3	1/245-246					✓			
4	1/258								✓
5	2/2/324-329							✓	
6	2/24/5-12							✓	
7	2/1-3							✓	

In *Rasendra Sara Samghra Gairika* was described as:-

- *Uparasa varga*
- One of the content of *Mahajwarankusha rasa, Shleshmashailendra rasa* and *Kandarpa rasa* which was described in this book.

- ***RASAKAMDHENU*: (17TH Century A.D.)**

Table 2.1.20 shows references of *Gairika* from *R.K.D.*

S. n.	Reference Part /Pada/ Adhikar/ Sutra	Varga	Prakara	Paryay	Grahya grahyatva	Shodhana'Satvapatana, Guna	Use		
							E	I	O
1.	1/1/4/287								✓
2	1/1/5/41								✓
3	1/1/6/101, 118,120,160,164,173								✓
5	1/2/1/104								✓
6	1/2/1/301								✓
7	1/2/1/586								✓
8	1/2/3/21					✓			
9	1/2/4/1	✓							
10	1/2/4/232		✓	✓					
11	1/2/4/234					✓			
12	1/2/4/233					✓			

In *Rasakamghenu Gairika* was described in the context of

- *Ragasankhya*
- *Rasaranjana*
- *Lauharanjana*
- *Hemadala nirmana*
- *Kapali yoga*
- *Varnotkarsha*
- *Suvarnadravana*
- *Suvarnabhasma colour – Gairikavarnabham*
- *Satvapatan*
- *Uparas varga*
- *Shodhana*
- *Prakara*
- *Satvapatana*

- ***AYURVEDPRAKASH* (18th Century A.D.)**

Table 2.1.21 shows references of *Gairika* from *A.P.*

S.n	Reference (Adhya)	Varga	Prakara	Paryay	Grahya grahyatva	Shodhana'Satvapatana, Guna	Use		
							E	I	O
1.	1/409-417								✓
2	1/418-425								✓
3	2/1	✓							✓
4	2/228								
5	2/268			✓					
6	2/269		✓						
7	2/270-271					✓			
8	2/272					✓			
9	3/15								✓
10	3/296								✓

In *Ayurved Prakash Gairika* was described in the context of

- *Rasakarpura Nirmana*
- *Uparasa varga*
- *Prakara, Shodhana, Guna*
- *Suvarnashodhana*

- ***RASATARANGINI*: (20th Century A.D.)**

Table 2.1.22 shows references of *Gairika* from *R.T.*

S.n.	Reference (Taranga)	Varga	Prakara	Paryay	Grahya grahyatva	Shodhana'Satvapatana, Guna	Use		
							E	I	O
1.	2/19								✓
2	11/78-82						✓		
3	20/118-122							✓	
4	21/252						✓		
5	22/38								✓
6	22/110			✓					
7	22/111		✓						
8	22/112					✓			
9	22/113				✓				
10	22/114					✓			
11	22/115					✓			
12	22/116-118					✓			

13	22/119					✓			
14	22/120						✓		
15	22/121							✓	
16	22/122						✓		
17	22/123							✓	
18	22/124						✓		
19	22/125							✓	
20	22/126						✓		
21	22/127						✓		
22	22/128						✓		
23	22/129							✓	
24	22/130-132						✓		
25	23/80							✓	

In *Rasatarangini Gairika* was mentioned in the context of

- One of the content of *Panchmruttika, Talkadya malhar, Pradarantak Lauha, Gairikadya malhara.*
- *Srotonjana swarupa*
- *Paryayi name, Guna, Prakara, Grahyagrahyatva,shodhana, Matra,Aamyik Prayoga*

- ***RASAJALANIDHI*: (20th Century A.D.)**

Table 2.1.23 shows references of *Gairika* from *R.J.N.*

S.n.	Reference (Part/Adhyay/ Pg.no.)	Varga	Prakara	Paryay	Grahya grahyatva	Shodhana'Satvapatana, Guna	Use		
							E	I	O
1.	1/2/23								✓
2	1/4/108								✓
3	1/4/148								✓
4	1/4/164								✓
5	1/5/228								✓
6	1/7/302								✓
7	2/2/146		✓	✓		✓			✓
8	2/2/147					✓			
9	2/2/147					✓			
10	2/2/147						✓		
11	2/2/147							✓	
12	2/2/148						✓		
13	2/2/148							✓	

- In *Rasajalanidhi Gairika* was described in the context of
  - *Rasaranjana*
  - *Karpura rasa nirmana*
  - *Parad shweta bhasma nirmana*
  - *Prakara, Shodhana, Paryay, Guna*

- ***RASACHANDANSHU*: (22th Century A.D.)**

Table 2.1.24 shows references of *Gairika* from *R.Cha.*

S.n.	Reference (Khanda/ Page No/Sutra)	Varga	Prakara	Paryay	Grahya grahyatva	Shodhana/Satvapatana/ Guna	Use		
							E	I	O
1.	P/35/224	✓							
2	P/38/238		✓						
3	P/38/239					✓			
4	P/38/240					✓			
5	P/38/241					✓			
6	P/56/357					✓			
7	P/61/388					✓			
8	U/250/1044							✓	
9	U-part.II/ 325/254							✓	
10	U-part.II/ 382/651						✓		

In *Rasachandanshu Gairika* was described in the context of:-

- *Satvapatana*
- *Shodhana*
- *Guna ,Prakara*
- *Uparasa*
- One of the constituent of –*Mauktika yoga, Kandarpa rasa, Gairikadi lepa.*

- **ETHMOLOGICAL STUDY :-**

➢ गैरिकं – ट्ट गिरौभवमिति अध्यात्मादित्वात् .....स्वर्णम् ।

रक्तवर्णधातुविशेषः ।

गिरिमाटी इति भाषा ॥ तत्पर्यायः । रक्तधातुः,गिरिधातुः,गवेधुकम्,धातुः,सुरंगधातुः,गिरिमृद्भवम् ।

इति राजनिघण्टु ।

➢ गिरिधातुः – पुं. (गिरौजातधातुः । शाकपार्थिववन्मध्यपदलोपिसमासः ।) गैरिकम् ।

इति राजनिघण्टु ।

➢ गिरिमृत् – ट्ट स्त्री. गिरेः पर्व्व तस्यमृत् मृत्तिका । गैरिकम् इति त्रिकाण्डकोषः ।

➢ गिरिमृद्भवं – ट्ट गिरेर्मृदो मृत्तिकया भवति इति (भू+अच्) गैरिकम् इति राजनिघण्टः ।

- **VERNACULAR NAMES[19]:-**

English: Red ochre, Hematite

Marathi: Geru, Sona kava

Sanskrit: Gairika

Hindi: Geru

Bengali: Giri mati

Gujarati: Geru, Sonageru

Telagu: Kavirayi

Kannada: Kavi mannu

Arabi: Magra, Magrata, Tine ahamara

Pharsi: Gile surkh

Chemically: Iron oxide Fe_2O_3

- **SYNONYMS**

Table 2.1.25 shows Synonyms of *Gairika* from different *Samhitas.*

Sr.no.	Synonyms	C .S.	S.S.	A.S.	A.H.	Sha.S.	B.P.
1	Gairika	+	+	+	+	+	+
2	Lohitamruda	+	-	-	-	-	-
3	Kanchangairika	+	+	-	-	-	-
4	Kanakgairika	-	+	-	-	-	-
5	Lohitagairika	-	-	-	+	-	-
6	Swarnagairika	-		+	+	-	+
7	Suvarnagairika	-	+	+	-	-	+

Table 2.1.26 shows Synonyms of *Gairika* fron *Rasa* classics:-

Sr.no.	Synonyms	Rn	R. H. T.	R. Chu.	R. P. S.	R. R. S.	R. R.	R. C.	Ra. Chi.	Ra Sa. S.	R. K. D.	A. P.	R. T.	R. J. N.	R. Cha.
1	Gairika	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2	Lohitamruda	+	-		-	-			-		-				
3	Kanchangairika	+	+		-	-			-		-				
4	Kanakgairika	-	+		-	-			-		-				
5	Lohitagairika	-	-		-				-		-				
6	Swarnagairika	-							-			+			
7	Suvarnagairika	+	+			-			+		+				
8	Hemagairika		+				+								
10	Raktamruda		+						+						
11	Kantagairika		+												
12	Girimruttika												+		+

13	Raktadhatu										+	+	+	+	
14	Gaireya											+	+	+	
15	Girija										+	+		+	
16	Girimruda										+		+	+	
17	Lohadhatu												+		
18	Girimrudbhav												+	+	
19	Dhatugairika		+												
20	Raktagairika				+										
21	Varnamruttika								+						
22	Giridhatu													+	
23	Gavedhuka													+	
24	Dhatu														
25	Surangadhatu													+	
26	Vanalakta													+	
27	Gaveruka													+	
28	Pratyashma													+	
29	Lohitamruttika													+	
30	Swarnadhatu													+	
31	Suraktaka													+	
32	Sandhabhra													+	
33	Vabhradhatu													+	

- **TYPES OF *GAIRIKA*:-**

Table 2.1.27 shows types of *Gairika* mentioned by various *Rasa* classics:-

Sr.no.	Name of texts	Types of Gairika	Reference
1	Rasarnav[20]	Rakta, Hema,Keval	7/83
2	Rasendra chudamani[21]	Pashana, Swarna	11/85
3	Rasaprakash sudhakar[22]	Pashana, Suvaran	6/70
4	Rasa ratna Samucchaya[23]	Pashana , Swarna	3/46
5	Ayurvedprakash[24]	Swarna, Samanya,Pashana	2/268
6	Rasajalanidhi[25]	Pashana, Suvaran	2nd Vol./2nd Ch.-146
7	Rasamruta[26]	Pashana, Suvaran	3/165
8	Rasatarangini[27]	Pashana, Suvaran	22/111
9	Rasachandanshu[28]	Pashana ,Swarna	Sh.238
10	Yogratnakar[29]	Swarna, Samanya	Y.R.,Pg .No.128
10	Industrial minerals	Hydrous , Unhydrous	R.K.Sinha 130
11	Web[30] -	Red , Grey	Abstract 80207

- **Properties of suvarnagairika[31] :-**

Table 2.1.28 shows properties of *Gairika:*-

Rasa	Madhura, Kashaya
Virya	Sheeta
Vipaka	Madhura
Guṇa Guna	Snigdha, Masruṇa
Doshagnata	Pitta, Rakta
Rogagnata	Hikka, Chardi, Raktapitta, Visha,Netraroga

- **METHODS OF *SHODHANA* OF *GAIRIKA*:-**

Table 2.1.29 shows types of *Shodhana* of *Gairika* mentioned in different *Rasa* classics:-

Sr.no.	Method of shodhana	Name of the text
1	Godugdha bhavana	Rasendra chudamani[32], Rasaprakashsudhakar[33], Rasaratna samucchaya[34],Rasajalanidhi[35], Rasamruta[36],Rasatarangini[37]
2	Goghruta Bharjana	Ayurveda prakash[38], Rasajalanidhi[39], Rasatarangini[40] Yogratnakar[41]
3	Bhavana of Raktavarga rasa/kwath/pitta	Rasarnav[42]
4	Similar as Nilanjana shodhana(Jambir rasa bhavana and dried in sunlight for 1 day)	Sharangdhar samhita[43]
5	Similar as Varatika shodhana(jambira rasa swedana for 1 yama)	Rasendra chintamani[44], Rasendrasarasamghra[45], Rasachandanshu[46]
6	Jambira rasa swedana and prakshalan by koshna jala	Bhavprakash[47], Rasendrasarasamghra[48]
7	Dipped in Jambira swarasa and kept in sunlight for 1 day	Rasaratnakar[49] (Hruddhi k.)

- ***MARANA*: -** Marana of *Gairika* was not told in any *Rasashastra* texts.
- ***SATVAPATAN*[50.51]:-**

According to *Acharya Nandi*, *Gairika* is itself in *satvarupa*; so there is no need to do *satvapatana*. But, According to some *acharyas* there is necessity to do *satvapatana* of *gairika*; these methods described as follows-

Procedure:-

(*R.R.S.* 3/51) -

- At first *swedana* of *Gairika* with *ksharavargeeya* and *amlavargeeya dravya* should be done; then subjected to strong heat in crucible.
- *Loha* is obtained as *Gairika satva*.
- This *satva* when mixed with *parada* is better than *samanya Gairika*.

Rasaratnakar (13/71)

- First give *bhavana* of *Raktavarga* and *Pittavarga* to *Gairika* for seven days.

- Then *mardana* was done with *mitrapanchaka* and *gutika* prepared.
- Then transferred to *koshtikayantra.*
- *Lauha* is obtained as *Gairika satva*.

- ***Matra of Gairika[52]*** **-**
  - According to *rasatarangigni* 22/119-
  - 2-4 *ratti* (250-500 mg)

- **Iron containing drugs in Ayurveda:-**

Table 2.1.30- Showing iron percentage of various Ayurvedic drugs

Sr.no.	Metal / Mineral	Chemical formula	% of Iron
1	Gairika[53]	Fe_2o_3	> 16 %
2	Gomeda[54]	$[Fe_3Al_2(Sio_4)_3]$	5%
3	Kantlauha[55]	Fe_3o_4	> 60 %
4	Kasisa[56]	$FeS0_4.7H_2o$	> 25%
5	Mandura[57]	Fe_2SiO_4	> 30%
6	Suvarnamakshika[58]	$CuFeS_2$	> 20%

- **MODERN CONCEPT OF *GAIRIKA*- HEMATITE[59]**

The name hematite is from the Greek word 'haimatitis' which means "blood-red". Hematite is the most important ore of iron and which is one of the abundant minerals on the earth. It is iron oxide with a chemical composition of fe2o3.

Table 2.1.31 shows list of Minerals that can be considered as *Gairika*[60]:-

Mineral	Chemical nature	Reason behind the consideration
Red ochre	Fe_2O_3	Red coloured, soft earthy mineral
Hematite	Fe_2O_3	Blood red colour in fine powder form, cherry red streak
Limonite (Yellow ochre)	Fe_2O_3	Golden yellow colour, soft, earthy mineral

Hematite is one of the most abundant minerals on Earth's surface and in the shallow crust. It is an iron oxide with a chemical composition of Fe_2O_3. It is a common rock-forming mineral found in sedimentary, metamorphic, and igneous rocks at locations throughout the world. Hematite is the most important ore of iron.

Physical Properties of Hematite	
Chemical Classification	Oxide
Color	Black to steel-gray to silver; red to reddish brown to black
Streak	Red to reddish brown
Luster	Metallic, submetallic, earthy
Diaphaneity	Opaque
Cleavage	None
Mohs Hardness	5 to 6.5
Specific Gravity	5.0 to 5.3
Diagnostic Properties	Red streak, specific gravity
Chemical Composition	Fe_2O_3
Crystal System	Trigonal
Uses	The most important ore of iron. Pigment, heavy media separation, radiation shielding, ballast, polishing compounds, a minor gemstone

- **Physical Properties of Hematite[61]:-**

Hematite has an extremely variable appearance. Its lustre can range from earthy to submetallic to metallic. Its colour ranges include red to brown and black to grey to silver. It occurs in many forms that include micaceous, massive, crystalline, botryoidal, fibrous, oolitic, and others.

Even though hematite has a highly variable appearance, it always produces a reddish streak. Students in introductory geology courses are usually surprised to see a silver-colored mineral produce a reddish streak. They quickly learn that the reddish streak is the most important clue for identifying hematite.

Hematite is not magnetic and should not respond to a common magnet. However, many specimens of hematite contain enough magnetite that they are attracted to a common magnet. This can lead to an incorrect assumption that the

specimen is magnetite or the weakly magnetic pyrrhotite. The investigator must check other properties to make a proper identification.

If the investigator checks the streak, a reddish streak will rule out identification as magnetite or pyrrhotite. Instead, if the specimen is magnetic and has a reddish streak, it is most likely a combination of hematite and magnetite.

- **Composition of Hematite[62]:-**

Pure hematite has a composition of about 70% iron and 30% oxygen by weight. Like most natural materials, it is rarely found with that pure composition. This is particularly true of the sedimentary deposits where hematite forms by inorganic or biological precipitation in a body of water.

Minor clastic sedimentation can add clay minerals to the iron oxide. Episodic sedimentation can cause the deposit to have alternating bands of iron oxide and shale. Silica in the form of jasper, chert, or chalcedony can be added by chemical, clastic, or biological processes in small amounts or in significant episodes. These layered deposits of hematite and shale or hematite and silica have become known as the "banded iron formations".

- **Uses of Hematite (Iron Ore)[63]:-**

Hematite is the world's most important ore of iron. Although magnetite contains a higher percentage of iron and is easier to process, hematite is the leading ore because it is more abundant and present in deposits in many parts of the world.

Hematite is mined in some of the largest mines in the world. These mines require investments of billions of dollars, and some will remove over 100 million tons of ore per year. These open-pit mines can be hundreds to thousands of feet deep and several miles across by the time they have been worked to completion.

- **Uses of Hematite (Pigment)[64] :-**

The name hematite is from the Greek word "haimatitis" which means "blood-red." That name stems from the colour of hematite when it has been crushed to a fine powder. Primitive people discovered that hematite could be crushed and mixed with a liquid for use as a paint or cosmetic. Cave paintings, known as "pictographs," dating back to 40,000 years ago were created with hematite pigments.

Hematite continues to be one of the most important pigment minerals. It has been mined at many locations around the world and has been traded extensively as a red pigment. During the Renaissance when many painters began using oils and canvas, hematite was one of the most important pigments.

गैरिकं त्रिविधं रक्तहेमकेवलभेदतः ।

रक्तवर्गरसक्वाथपित्तैस्तद्भावयेत् पृथक् ॥

अनेन क्रमयोगेन गैरिकं विमलं धमेत् ।

क्रमात् सितञ्च रक्तञ्च सत्वं पतति शोभनम् ॥ रसार्णव ७/८३,८४

पाषाणगैरिकं चैकं द्वितीयं स्वर्णगैरिकम् ।

पाषाणगैरिकं प्रोक्तं कठिनं ताम्रवर्णकम् ॥

स्वादु स्निग्धं हिमं नेत्र्यं कषायं रक्तपित्तनुत् ।

हिध्मावमिविषघ्नञ्च रक्तघ्नं स्वर्णगैरिकम् ।

पाषाणगैरिकं चान्यत् पूर्वस्मादल्पकं गुणैः॥

गैरिकं हि गवां दुग्धैर्भावितं शुद्धिमृच्छति ।

गैरिकं सत्वरुपं हि नन्दिना परिकीर्त्तितम् ॥

कैरप्युक्तं पतेत्सत्त्वं क्षाराम्लस्विन्नगैरिकात् ।

उपतिष्ठति सूतेन्द्रमेकत्वं गुणवत्तरम् ॥

रसेन्द्रचूडामणि ११/८५–८९ , र.र.स.३/४६–५०

पाषाणगैरिकं चैकं द्वितीयं स्वर्णगैरिकम् ।

पाषाणगैरिकं प्रोक्तं कठिनं ताम्रवर्णकम् ॥

अत्यन्तशोणितं स्निग्धं मसृणं स्वर्णगैरिकम् ।

रसप्रकाशसुधाकर ६/७०–७१, र.र.स.३/४६

सुवर्णभस्म वर्ण –

पाच्यं हेमं च **रक्तगैरिकसमं** सञ्जायते निश्चितम् ॥

स्रोतोञ्जन लक्षण –

घृष्टं तु **गैरिकोच्छायम्** ।

आयुर्वेद् प्रकाश २/२२८, र.र.स.३/९९

अथ गैरिकम् 'गेरु' इति भाषा –

गैरिकं रक्तधातुश्च गैरेयं गिरिजं तथा ।

द्विविधं गैरिकं प्राहुः स्वर्णं सामान्यगैरिकम् ॥

परैस्तृतीयम्प्युक्तं पाषाणाख्यं ही गैरिकम् ।

सुवर्णगैरिकं रक्ततरं शिष्टं तु रक्तकम् ॥

गैरिकद्वितयं स्निग्धं मधुरं तुवरं हिमम् ।

चक्षुष्यं दाहपित्तस्त्रकफहिक्का विषापहम् ॥

अतिकण्डूहरं रुक्षं तथा प्रोक्तमुदर्दनुत् ।

पाषाणगैरिकं त्वन्यद्धिक्काऽलक्ष्मीविषापहम् ॥

सुवर्णगैरिकं श्रेष्ठं द्वितीयाद् गैरिकात्परम् ।

गैरिकं किंचिदाज्येन भृष्टं शुद्धं प्रजायते ॥

आयुर्वेद् प्रकाश २/२६८–२७२

टिका –

सुवर्णगैरिकं अत्यन्तशोणितवर्णं रससिन्दुरादिधातुसदृशं भवति । अवशिष्टं सामान्यादिकं रक्तकं कथितम् ।

वर्णमृत्तिकया लिप्त्वा मुनिशो ध्मापितं वसु ।

विशुध्यति वरं किञ्चिद्वर्णवृद्धिश्च जायते ॥

टिका–

केचित्तु वर्णमृत्तिका 'स्वर्णगैरिकमित्यामनन्ति'।

यथा कुम्भकारा: भाण्डानि रञ्जयित्वा पाचयन्ति सा वर्णमृत्तिकेत्युच्यन्ते, 'काबीस' इति भाषा ॥

सुवर्णगैरिकं स्निग्धं मसृणं त्वतिकोमलम् ।

पाषाणगैरिकं रुक्षं कठिनं नातिलोहितम् ॥

पाषाणगैरिकात् श्रेष्ठं कथितं स्वर्णगैरिकम् ।

अत: सर्वत्र मतिमान् योजयेत्स्वर्णगैरिकम् ॥

र.त.२२/१११,११३

सुवर्णगैरिकं स्निग्धं मधुरं शिशिरं परम् ।

तुवरं तापहरणं हिक्काविमिनिवारणम् ॥

रक्तपित्तप्रशमनं तथासृग्दरनाशनम् ।

विषापहं तथा बल्यं मतं लोचनयोर्हितम् ॥

उदर्दकण्डूशमनं तथैव व्रणरोपणम् ।

ज्वरघ्नं च विशेषेण वन्हिदाहनिबर्हणम् ॥

र.त.२२/११६–११८

GOGHRITA

- **Synonyms :** Abhanjyan, Ajya, Amrita, Abhidhar, Abhangya, Chaupar, Ghrita, Habi, Jivania, Mraksha, Nabanitak, Pabitra, Sarpi, Srankshan, Snehan, Sneha, Snigdhata, Taijas.
- **Vernacular names** : **English**: Clarified Butter; **Hindi**: Ghee; **Malayalam**: Ney;

  Telegu: Neyyi; **Tamil**: Ney; **Assamese**: Gheeo.

- **Position in Nighantus:**
  - ❖ Dhanwantari.Nighantu : Subarnadi varga 59/135-136, pp.203.
  - ❖ Madanpal Nighantu : Paniyadi varga -127, pp.178.
  - ❖ Kaiyadev Nighantu : Ghrita varga -271, pp.368.
  - ❖ Bhavaprakash Nighantu : Ghrita varga 4-6, pp. 758.
- **Properties :-**

Table 2.1.32 shows properties of Goghrita from Nighantus[65, 66, 67, 68]:-

Properties:-	Rasa	Guna	Veerya	Vipaka	Prabhava
K.N.	-	-	-	Madhur	Tridoshjeet, Balya, Vrishya
D.N.	-	-	Sheeta	Madhur	Vatapittavisha paham, Balya
M.P.N	Madhur	Guru	Sheeta		Tridoshsamak, rasayan
B.P.N.	Madhur	Guru	Sheeta	Madhur	Vatapittakapha paham, rasayan

Acaryas have mentioned that *Goghrita* is *Rasayana*, good for eyes, stimulant of digestive fire, supports glow and beauty, enhances memory, voice and stamina, promotes longevity and protects body from various diseases.

The melting point of ghee is 35℃ which is less than the normal human temperature of the body. Its digestibility coefficient or rate of absorption is 96 %, which is highest of all oils and fats.

- **Description:-**

Ghrita is obtained from the class Mammalia of the animal kingdom. Out of all the *ghritas Ayurved* recommends the *Goghrita* as best and *ghrita* of choice for both, food and medicinal purposes. If not specified, the epithet *ghrita* always applies to *Goghrita.*

- **CHEMICAL COMPOSITION:**

The composition of *Ghrita* residue obtained from Indian cow is as follows-

- Moisture : 14.4%
- Fat : 32.4%
- Protein : 36.0%
- Lactose : 12.0%
- Ash : 05.2%

- **Chemical Composition of cow milk *Ghrita*:**
  - Triglyceride : 97-98%
  - Diglycerides : 0.25-0.4%
  - Monoglycerides : 0.016-0.038%
  - Glycerylesters : 0.011-0.015%
  - Free fatty acids : 0.1-0.44%
  - Phospholipids : 0.2-1%
  - Sterols : 0.22-0.41%
  - Vitamin A : 2500IU per 100 gms.
  - Vitamin D : $8.5x10^{-7}$ gm. per 100 gms.
  - Vitamin E : $24x\ 10^{-3}$ gm. per 100 gms.
  - Vitain K : $1x\ 10^{-4}$ gm. per 100 gms.

GODUGDHA

- **Synonyms** **:** Dugdha, ksheera, paya, Balajeevan.
- **Vernacular Names** **: English**: Milk; **Hindi:** Dudh; **Rajasthani:** Doodh; **Tamil**:

Palu; **Telegu**: Palu; **Malayalam**: Musu; **Assamese:** Gakhir.

- **POISTION IN NIGHANTUS:**
  - Dhanwantari.Nighantu : Subarnadi varga 70/151-152, pp.206.
  - Madanpal Nighantu : Paniyadi varga 8/64, pp.168.
  - Kaiyadev Nighantu : Dugdha varga 3/120-129, pp.341.
  - Bhavaprakash Nighantu : Dugdha varga 7-8, pp. 742.

- **PROPERTIES:**

Table 2.1.33 shows properties of *Godugdha* from different Nighantus[69, 70, 71, 72]:-

Ref.	Rasa	Guna	Veerya	Vipaka	Prabhava
K.N.	Madhur	Guru, Snigdha, Bahal, Picchil, Mridu, Slaksna, Manda	Sheeta	Madhur	Rasayan, Ojavardhak
D.N.	Madhur	Snigdha	Sheeta	Madhur	Vatapittaghna, Rasayan
M.P.N	Madhur	Guru, Snigdha	Sheeta	-	Vatapittanut, Rasayan
B.P.N.	Madhur	Guru, Snigdha	Sheeta	Madhur	Vatapittahara

Milk subsides *Vata* and *Pitta Dosas* by the above said properties. The Cow milk having ten properties like as sweetness, coldness, softness, unctuousness, density, smoothness, sliminess, heaviness, slowness and clarity. These are also the properties of *ojas*. It acts as *Rasayana, Tarpaka, Jivaniya, Hrdya, Ahladakara* and *Buddhi prabodhaka*. The Cow's milk possesses qualities like *Madhura, Sheeta, Mrdu, Snigdha, Sandra, Slakshna*.

- **Characters:**

Cow's milk is an opaque, white or yellowish-white emulsive, faint alkaline fluid, little more viscous than water, taste is sweet etc. and odour is faint and characteristic. It kept for a long time it ferments; specific gravity is between 1.027-1.034 and the milk with a higher fat content having low specific gravity. The yellowish-white colour of the milk is due to suspended fat globules.

Cow's milk contains all the elements necessary for the growth and nutrition of bones, nerves, muscles and other tissues of the human body.

- **Composition**:

Per 100 ml. cow milk composition:

- Carbohydrates : 4.6 gm.
- Protein : 3.2 gm.
- Total fat : 3.0 gm.
- Energy K.cal : 58.0 gm.
- Saturated fat : 2.0 gm.
- MUFA : 0.80 gm.
- PUFA : 0.06 gm.
- Trans fat : 0.06 gm.

- Cholesterol : traces
- Phosphorus : 85 mg.
- Calium : 122 mg.
- Vitamin A : 54 IU
- Vitamin B : 0.05 mg.

Nutritional value of Cow's milk (whole) per 100 g (3.5 oz):

Table 2.1.34 shows nutritional value of Cows milk:-

Parameter	Quantity	Parameter	Quantity
Energy	252 kJ (60 kcal)	Valine	0.192 g
Carbohydrates	5.26 g	Arginine	0.075 g
Sugars	5.26 g	Histidine	0.075 g
Lactose	5.26 g	Alanine	0.103 g
Fat	3.25 g	Aspartic acid	0.237 g
saturated	1.865 g	Glutamic acid	0.648 g
monounsaturated	0.812 g	Glycine	0.075 g
polyunsaturated	0.195 g	Proline	0.342 g
Protein	3.22 g	Serine	0.107 g
Tryptophan	0.075 g	Water	88.32 g
Threonine	0.143 g	Vitamin A equiv.	28 µg (3%)
Isoleucine	0.165 g	Thiamine (Vit. B_1)	0.044 mg (3%)
Leucine	0.265 g	Riboflavin(Vit. B_2)	.183 mg (12%)
Lysine	0.140 g	Vitamin B_{12}	0.44 µg (18%)
Methionine	0.075 g	Vitamin D	40 IU (10%)
Cystine	0.017 g	Calcium	113 mg (11%)
Phenylalanine	0.147 g	Magnesium	10 mg (3%)
Tyrosine	0.152 g	Potassium	143 mg (3%)

Ref: Percentages are relative to US recommendations for adults.
Source: USDA Nutrient database

DISEASE REVIEW

PANDUROGA

- ***Panduroga Swaroopa-***

A straight meaning of the word *pandu* is faint, dry, lustureless skin, nails and eyes (conjunctiva). This condition is described by *acharyas* in another word ie; "*Bhekavarna*", means like the frog's skin which is very dry and lustureless[73].

Amarkosha gives the description of *pandu* as, "*Ketakidhulisannibha*", means yellowish white colour like the *ketaki* flower's pollen grains. *Mlana Varna* in *panduroga* is described by *Acharya Gangadha*[74].

- ***Hetu* of *Panduroga*[75]-**

Acharya charaka mentioned some etiological factors of *pandu* in *chikitsa sthan*

- ***Aharaj hetu-***

*Kshara (*alkalies*), lavana (*salty*), amla (*sour*), viruddha, vidagdha and asatmya bhojana, Nishpava, Masha, Pinyaka, Tilataila.*

- ***Viharaj hetu-***

Divaswapna even in *vidagdhanna* condition, *vyayama, maithuna, vegadharana,* improper conduction of *vamanadi panchakarma, rituvaishamya* (abnormal weather).

- ***Manas hetu-***

Kama, chinta, bhaya, krodha, shoka, upahata chetas (mental instability). *Acharya sushruta* mentioned some different causes in *uttarasthana* as, *Madya* (Alcoholism), *Mruda* (ingestion of soil/mud), *Teekshna* (spicy food) etc.

- ***Samprapti* (pathogenesis) of *Pandu-***

दोषाः पित्तप्रधानास्तु यस्य कुप्यन्ति धातुषु ।
शैथिल्यं तस्य धातूनां गौरवं चोपजायते ॥
ततो वर्णबलस्नेहा ये चान्येअप्योजसो गुणाः ।
व्रजन्ति क्षयमत्यर्थं दोषदूष्यप्रदूषणात् ॥
सोअल्परक्तोअल्पमेदस्को निःसारः शिथिलेन्द्रियः । –च.चि. १६/४–६
प्रदूष्य कफवातासृक् त्वक्मांसानि करोति तत् ।
पांडुहारिद्रहरितान् वर्णान् बहुविधांस्त्वचि ॥ –च.चि. १६/११

Samprapti is nothing but serial events associated with progression of disease pathology. In *panduroga*, above etiological factors repeatedly happens to aggravate the *pitta dosha. Sadhaka pittadushti* is special in *pandu*. By the force of *vayu, sadhaka pitta* in heart (*hridaya*) pulls out and saturate in the *tvacha* and *mamsa* via *dashadhamanis* which leads to vitiation of *kapha, vata, asruk* (*rakta*) doshas; and patient's *varna* becomes *pandu* (faint), *haridra* (yellow), *harita* (greenish).

Charakacharya further says, due to aggravated *pitta dosha*, *shariradhatu* and *indriya* becomes *nisara*, *shithila* (lose their tone & strength) and *gauravatva* (unable to do their normal functions) is acquired by them.

Among all *dosha dushyas*, *Rakta* & *meda* (*alparakto alpamedasko*) are affected more in *pandu*. There is severe deterioration of *varna* (complexion), *bala* (strength), *sneha* (moisture) and *oja* due to vitiated *dosha* and *dushyas*[76].

..... विदूष्य रक्तं कुर्वन्ति दोषास्त्वचि पाण्डुभावम् ।
–सु.उ.तं. ४४/३

According to *sushrutacharya*, there is a vitiation of *rakta dhatu* due to some etiological factors which reflects on *tvacha* (skin) as faint, lustureless, dry skin (*pandutva*) [77].

- ***Samprapti Ghataka*[78]-**
  - *Udbhavasthana- Hridaya (Raktavaha srotasa)*
  - *Sanchara-* In whole body through *rasavahini*
  - *Adhishthna- Tvacha* & *mamsa*
  - *Vyaktisthana- Tvacha, nakha, netra* etc.
  - *Dosha- pitta (*specially *sadhaka pitta)*
  - *Dushya- Rasa, rakta, meda, oja, sarvasharira dhatu* and *indriya.*

- ***Poorvaroopa*[79,80]-**

Acharya charaka mentioned *poorvaroopas* in *chikitsasthana* 16/12 as, *Hridayaspandana* (palpitations), *roukshya* (dryness), absence of sweating, *shrama* (general weakness).

In *sushruta uttarsthana* 44/5, *poorvaroopas* mentioned as follows-

Tvaksphutana (scaly, dry skin), *gatrasada* (heaviness of body), *shthivana*, *prekshanakuta shotha* (swelling around eyes), yellowish stool and urine, *avipaka* (indigestion). Desire to eat soil is the different *poorvaroopa* specially seen in *pandu*.

- ***Roopa* (General symptoms)-**

Karnakshweda (increased excretory substances like wax in ear), loss of appetite, general weakness, severe bodyache (like someone is beating), *bhrama* (giddiness), *jwara* (fever), *shwasa*, heaviness of body, swelling around eyes

(*shunakshikuto*), hairfall, intolerance of the cold (*shishirdveshi*), sleepiness, no desire to speak, pain and heaviness in calf musucles, west, thigh, legs, foot, breathlessness during stepping up/ during exersion, Palpitations (*hridayadravata*).

- **Types of *Panduroga*[81]-**

1) Vataja
2) Pittaja
3) Kaphaja
4) Sannipataja
5) Mritbhakshanajanya

Almost all acharyas mentioned these five types of *pandu*; only *sushrutacharya* said 4 types; he doesn't mentioned the *mritbhakshanjanya* type of *pandu*.

- **Symptoms suggesting bad prognosis of the disease (*Asadhya lakshana*)[82]-**
  - *Chirotpanna* (very chronic),
  - *Kharibhoota* (becomes worst due to severe blood loss),
  - Oedema all over body,
  - seeing all objects yellowish,
  - Patient passes stool in small quantity, *drava*, *harita*, *baddha* and *sakapha*,
  - Whitish faint skin due to blood loss,
  - *Chardi* (vomitings), *Murcha* (vertigo), *Trishna* (thurst).
  - Swelling on extrimities and thinning of middle part (trunk) or swelling on the trunk and thinning of extrimities.
  - Swelling on *guda* (anus), *medhra* (penis), *mushka* (scrotum) is also suggestive of bad prognosis of the patient of *panduroga*.
  - *Pandurogi* with *atisara* (diarrhoea) and *jwara* (fevere) are also not curable by any treatment.

- **Treatment of *panduroga*-**

तत्र पाण्ड्वामयी स्निग्धस्तीक्ष्णैरुर्ध्वानुलोमिकैः ।
– च.चि. १६/४०
साध्यं च पाण्ड्वामयिनं समीक्ष्य स्निग्धं घृतेनोर्ध्वमधश्च शुद्धम् ॥

– यो.र. पाण्डुरोगचिकित्सा

Firstly *snehana* is very essential in *pandu* because, there is aggravation of *vatadosha* due to *rakta* and *meda kshaya*. Panchagavya *ghrita,* Tiktaka & *mahatiktaka ghrita, kalyanaka ghrita*; these type of *Deepak* and *pachak siddha ghritas* should be used in *pandu*.

Ghrita is preferred *snehadravya* for *snehana* in *pandurogi* because of the predominance of *pitta dosha* with *rakta dushti* in *pandu vyadhi*[83].

Next step for management of *pandu* is ***shodhana.*** *Charakacharya* told *teekshna vamana* in *pandu* after proper *snehana*. *Acharya sushruta* refused to do *urdhva shodhana* in *pandu,* but *dalhanacharya* had mentioned *mruduvamana*.

As *virechana* is very effective due to involvement of *pitta* and *rakta* in *samprapti* of *panduroga*; various *virechaka yogas* are mentioned in the *panduroga chikitsa*. Some of the *virechak yogas* given in *pandu* after proper *snehana* are-

1) *Godugdha* (cow's milk) with *Gomutra* (cow's urine). C.Chi.16/64
2) Smashed fruits of *Gambhari* (fruit of gmelina arboria) or *Draksha* (raisins) are given with lukewarm decoction of *dantiphala*. C.Chi. 16
3) Decoction of *Nikumbha* (*Danti*) in *Mahisha mutra* (buffalo's urine) with *guda*. Su.S.U.44/16

- **Importance of *lauha kalpas* (iron containing formulations) in *panduroga*-**

Acharya vagbhat said in there *uttarasthan* 40th chapter/48 that, *lauha* is best drug to treat *panduroga*.

पाण्डौ श्रेष्ठमयो.... । – अ.हृ. उ. ४०/४८

Lauhahkalpas are most effective for *dhatushaithilya* and *rakta kshaya* in *pandu*. There are some iron containing drugs like *lauhabhasma, Mandurabhasma, Suvarna Gairika, suvarnamakshika bhasma, kasisa bhasma* which are used for treating *panduroga*.

Lauhabhasma mostly causes constipation in patients hence it should be used with *mruduvirechaka* (mild purgative) *dravya* like *haritaki*. *Mandurabhasma* should be used instead of *lauhabhasma* because it doesn't cause constipation, because of its *snigdha guna*.

Ghrita is the best *anupana* of *lauhabhasma* because, *lauhabhasma* easily get assimilated in the body in presence of *ghrita* due to its *deepana, pachana* property. It also prevents vitiation of *vata* caused due to *kashaya, ruksha* properties of *lauhabhasma*.

- **Some of the *lauha kalpas* in *charaka samhita*-**

1) Lauhabhasma which is triturated for 7 days in *Gomutra* should be taken with *godugdha.*

2) *Navayasa churna, Mandura vataka, Yogaraja kalpa, Shilajatu vataka, punarnava Mandura, gaudarishta* (contains *Lohachurna*), *dhatryavaleha, bijakarishta and dhatryarishta* are some *kalpas* in *pandu chikitsa*.

- ***Lauha* yogas in *sushruta samhita*-**

1) *Gomutra bhavita triphala* with *lauhabhasma*

2) *Pravala, mukta, rasanjana churna* should give with *Gomutra*

3) *Suvarnagairika churna* should be taken with *Gomutra*.

One should take these 3 yogas for a long period.

- ***Yogaratnakara* mentioned-**

सम्यादयेत् क्षौद्रघृतप्रगाढैः हरितकीलोहरजः प्रयोगैः । – यो.र. पाण्डुरोगचिकित्सा

After proper *snehana-shodhana, haritaki churna* and *Mandura bhasma* is taken with *madhu* & *ghrita*.

- ***Shamana* *chikitsa* in *pandu*-**

वातिके स्नेहभूयिष्ठं पैत्तिके तिक्तशीतलम् ।
श्लैष्मिके कटुतिक्तोष्णं विमिश्रं सान्निपातिके ॥ –
च. चि. १६/११६

According to types of *pandu, vataja pandu* treated with *snigdha dravya*s, in *pittaja* type, *tikta rasayukta, sheetal dravya*s should be used. *Katu, tikta rasapradhana* and *ushna dravya*s are used for treating *kaphaja pandu* and for *sannipatika pandu, tridosha shamaka dravya* should be taken in use.

- **Some of the *yogas* in *panduroga chikitsa*-**

- ***Ghritas-*** *Dadimadi ghrita, katukadi ghrita, Draksha ghrita, Pathya ghrita, Danti ghrita, Haridradi ghrita, Vyoshadi ghrita(Ch.Chi.16/119) , Duralabhadi ghrita, kesaradi ghrita(A.S.Chi/ 18/ 4)*
- ***Avalehas****- Darvyadi leha, Dhatryavleha (Ch.Chi.16/97-101), Draksha leha(A.S.Chi.18/11)*
- ***Aasava-arishtas:****Gaudarishta,Beejakarishta,Dhatryarishta(Ch.Chi.16/68-105) Manduradyarishta (Y.R.Panduroga chikitsa), Sararishta, Gandirarishta, Mastvarishta (A.S.Chi.18/14-15)*
- ***Vati/vataka:*** *Manduravajra vataka (Y.R.Panduroga chikitsa), Trikatukadi vataka, Vajrabhidha gulika(A.S.Chi.18/10)*
- ***Churnas****- Gomutraharitaki churna(Ch.Chi,16/68), Vatsakabeejadi churna(A.S.Chi.18/6)*
- **Other-** *Madhumandur,Manduralavana(Y.R. Panduroga Chikitsa)*

- ***Pathya Aahara vihara*** in *pandu*[84]-
  - *Pathya karma- Vamana, virechana.*
  - *Pathya ahara- Jeerna* (old) *yava, godhuma* (wheat), *shali* (rice), *Yusha* prepared of *mudga* (green gram)/ *aadhaki* (red gram)/ *masoora* (red lentil), *jangala mamsarasa.*
  - Vegetables & fruits- *Patola, vriddha kushmanda* (ripened fruit of Benincasa hispida), unripen banana, *jeevanti, guduchi, matsyakshi, tanduliya* (vegetable), *punarnava, dronapushpi, vartaku* (bringle), garlic, ripen mango, *haritaki, bimbiphala, aamalaki*.
  - Places of *agnikarma* in *panduroga*- Joints of legs, 2 *angula* below the umbilicus, forehead, *hastamoola*, in the middle of *stana* and *kaksha* (axilla).
  - *Laghupanchamula kwatha* should be used for food cooking & drinking purposes.

- ***Apathyas*** in *panduroga*[85]
  - Karmas- *Raktasruti* (bloodletting), *dhoomapana, swedana*.
  - *Aahara- Guru, vidahi* and *viruddha aahara* is like poison in *pandu*rogi. Food which aggravates *pitta dosha* in body should be avoided.
  - *Vihara- Divaswapa, maithuna*, forceful stopping of *vamanavegas, mrudbhakshan* (eating soil), drinking plenty of water, working in extensive

heat of sun or fire, heavy exertion, long distance walking (travelling), *krodha*(getting angry).

- Other substances- Vegetables in *Patrashaka varga*, *ramatha* (asafoetida), *masha* (black gram), *pinyaka*, *tambula*, *sarshapa*, *sura*, *teekshna* (spicy) and *lavana* (salty) *dravya*s, all sour substances (*amladravyas*)

IRON DEFICIENCY ANAEMIA:-

IRON

Iron is the basic functional element of each cell in the human body. Although iron is very important for body, free iron is very harmful because it forms free radicles like OH-. Hence, body reutilises the iron which is thrown out from the iron cycle; thus body not only conserves it by reutilisation but also prevents its toxic effects on body in free iron form[86].

Iron is present in two forms; Heme and Non-heme. Heme iron is readily absorbed in body as compare to non-heme iron. Non heme is present in ferric form and heme in ferrous form. Non heme iron must be converted into ferrous form for better absorption. Heme iron is present mostly in animal sources & non-heme present in vegetables, cereals etc[87].

Absorption of Non-heme iron in body is reduced by some substances like, Tea, Vegetable fibres, phytates & phosphates in food antibiotics like Tetracycline etc. But, Ascorbic acid increases its absorption. Iron absorption takes place in duodenum and upper part of jejunum[88].

- **Role of Iron -**

Iron is very much important for proper physiologic functioning in the body. In mammals, it plays the role of O2 transportation up to the each and every body tissue. It is the important element in the cytochrome system of mitochondria. Cells lose their electron transport capacity and their energy metabolism is also affected without iron[89].

- **Cyclic Metabolism of Iron in the body[90]:-**

  - Iron absorbed from diet or from iron stores bound to the Transferrin in plasma
  - This iron-transferrin complex bound to transferrin receptors on developing erythroblast

- Iron-transferrin complex combines with transferrin receptors and iron is allowed to convert into heme in low pH for synthesis of haemoglobin.
- Then Transferrin receptors again placed at cell surface and transferrin is released in circulation for recycling.
- Excess iron bound to apoferritin (storage protein) to form ferritin.
- As the lifespan of RBC is finished (120 days) it undergoes phagocytosis; Haemoglobin broken down, iron returned to the Erythroid cell surface and presented to transferrin for next cycle.

- **Transferrin-** An Iron transport protein present in two forms; monoferric (has 1 iron atom) & Diferric (have 2 iron atoms). **Normal Half** clearance time of the transferrin is very fast ie, 60-90 mins. (i.e; Time required for binding iron to transferrin)

This clearance time of transferrin depends on two factors-

1) Activity of erythroid marrow-if there is stimulation of erythropoiesis, half clearance time decreases and vice versa.

2) Level of plasma iron- if there is increase in plasma iron level, clearance time increases and in iron deficiency it decreases to 10-15 mins.

- Largest number of transferrin receptors is present on erythroid cells in the marrow as compared to other body cells.
- Average intake of iron in adult is 10–15mg per day of which 1–2mg is absorbed in intestine.
- Minimum need of iron per day for an adult male is 1 mg and for females in child bearing period is 1.4 mg/day.
- The iron requirement in last 2 trimesters in pregnancy goes up to 5-6 mg/day.
- Total quantity of body iron is about 3.5 gm in adult men & 2.5 gm in women.

The acidic media in proximal small intestine facilitates iron absorption by converting ferric iron into ferrous in presence of ferrireductase.

- Hepcidin is the principle iron regulatory hormone which becomes low in iron deficiency for increasing the absorption of iron.
- When quantity of plasma iron exceeds above transferrin binding capacity, then free iron is available which badly affects the vital organs.
- In case of excess iron intake, the iron absorption decreases to avoid iron toxicity due to the free iron. There is no excretory way for iron unless by

blood loss (by menses/ GIT blood loss/ accidental loss) or through epithelial cell loss.

- **Iron Deficiency Anaemia**

Iron deficiency anaemia is commonest nutritional deficiency contributing about 50% of all types of anaemia[91].

Stages of Iron Deficiency:-

1) Negative Iron balance-

This condition develops because; the loss of iron exceeds the iron absorption ability of the body. After this condition, demand of iron is fulfilled by using stored iron in the form of iron stores like ferritin or marrow iron.

As long as iron stores are not used, the levels of TIBC (Total iron binding capacity), serum iron, Red cell protoporphyrine remains within normal limits. And Red cells also remain morphologically unaffected.

2) Iron deficient erythropoiesis-

When iron stores depleted, serum iron begins to fall, TIBC and red cell protoporphyrine levels increases.

Haemoglobin synthesis remains unaffected till serum iron and transferrin saturation levels are within limits. As transferrin saturation falls to 15-20 % there is impaired haemoglobin synthesis. This is the stage of Iron Deficient Erythropoiesis. The microcytic & hypochromic appearance of reticulocytes is observed in this stage.

3) Stage of Iron Deficiency Anaemia-

Haemoglobin and haematocrit levels falls in this stage. And Transferrin saturation comes to 10-15 %. In moderate anaemia (Hb-10-13 g/dl), bone marrow remains hypo proliferative, but severe iron deficiency leads to erythroid hyperplasia.

- **Causes of Iron Deficiency[92]**

- **1) Increased iron demand-**

  - During growth period ie, Infancy and Adolescence
  - During Pregnancy & lactation
  - In erythropoietin therapy
  - Inadequate diet

2) Increased loss of iron-

- GIT Blood loss- eg; Peptic ulcers, Irritable Bowel Syndrome, Gastritis, Bleeding due to hookworm infection
- Acute blood loss- Menorrhagia, Menstrual blood loss, Epistaxis, Blood donation etc
- Chronic blood loss- Cancer, Intravascular haemolysis

3) Decreased or Mal-absorption of Iron-

- Decreased iron absorption in diseases like sprue, crohn's disease and after gastrostomy.
- In acute or chronic inflammation.

- **Clinical symptoms of Iron Deficiency Anaemia[93]**

In IDA also all common signs of anaemia are seen, like fatigue, syncope, pallor of skin-conjunctiva-nails, irritability, exertional dyspnoea, cardiac murmurs, tachycardia etc. Impact of IDA also seen on physical capacity leads to decreased productivity of work. It happens due to reduced oxygen transport.

In IDA, epithelial cells get rapidly affected causing symptoms like dryness and roughness in skin, hairs, koilonychias, alopecia, loss of tongue papillae.

In severe condition of iron deficiency, symptoms like Atrophic glossitis, cheilosis, plummer-vinson syndrome are seen; also some uncommon symptoms like craving to eat substances like soil, paint, dirt, ice etc are seen in severe cases.

Perinatal iron deficiency may cause psychiatric illness.

- **Laboratory Diagnosis of IDA[94]**

1) **Serum iron-**

It shows the quantity of iron which is bound to transferrin. Normal range is 50-150 µg/dL.

2) **Total iron binding capacity (TIBC)-**

It indirectly shows the total quantity of transferrin in the circulation. Its normal range is 300-360 µg/dL. Transferrin synthesis increases with iron deficiency & decreases with any chronic diseases.

3) **Transferrin saturation-**

Its normal range in body is 25-50% and can be derived by following formula- Serum iron × 100 ÷ TIBC. In the condition of iron deficiency, its level goes below 18%.

4) **Serum ferritin-**

As free iron produce toxic effects on body, body sets some protective mechanisms for binding this free iron. Free iron combines with proteins and stored in the cells in ferritin or hemosiderin form.

Serum ferritin levels show the total iron stores in the body. Normal serum ferritin values in adult male are 100 μg/L & in adult females it is 30 μg/L. In deficiency of iron, iron stores depleted and ferritin level goes down to <15 μg/L.

5) Red cell Protoporphyrin levels-

Protoporphyrine is intermediate media in heme synthesis. When there is hampered heme synthesis, there is saturation of protoporphyrine in the red cells. Increased value of protoporphyrine shows lack of heme for the haemoglobin synthesis.

Normal range is below 30 μg/dL and in iron deficiency it exceeds above 100 μg/dL. Values also get increased in lead poisoning.

6) Detection of iron stores in bone marrow-

Iron stain of bone marrow will give information about iron stores in RE cells and also shows the effective iron delivery up to the erythroblasts.

- **Treatment of IDA[95]**

1) Oral iron therapy-

Oral therapy is preferred in chronic iron deficiency with fewer symptoms. Usually in the treatment of iron deficiency, 200 mg elemental iron per day should be given. Out of the dose of 200 mg, 50 mg iron is absorbed in the body per day. The aim of therapy is not only cure the iron deficiency but also restoring the iron storage of the body up to 0.5-1g iron in whole body. To fulfil this aim, patient need to take oral iron supplements for 6-12 months also after correction of anaemia.

Ideally oral iron should be given on empty stomach because food may hamper its absorption. But, gastrointestinal distress is the major side effect of oral iron therapy which is seen in 15-20% patients.

Results of oral iron therapy depend on two factors, absorption of iron and rate of erythropoiesis. In case of positive response, reticulocyte count rises in 4-7 days of treatment and highest in 1 to 1.5 weeks. Absence of response may be due to mal-absorption of iron.

There are number of oral iron preparations up to sustained release tablet also. Some of are as following-

Various iron supplements Tablet (iron content) (in mg)

1) Ferrous fumarate

2) Ferrous sulphate

3) Ferrous gluconate

) Polysaccharide iron

2) Parenteral iron therapy-

Parenteral iron therapy is indicated in the patients which are not suitable for oral iron therapy, in acute need of iron and in chronic, persistent blood loss.

Iron complexes for Iron per Injunction

1) Ferrumoxytol - 510

2) Ferric gluconate - 125

3) Ferric carboxymaltose - 750

4) Iron sucrose - 200

There are two methods of giving parenteral iron, first is giving total quantity of iron to correct the iron deficiency in addition with minimum 500 mg of iron as a store. And second method is giving small doses of iron repeatedly.

Quantity of iron recommended for an individual is derived as follows- Wt of the body (kg) × 2.3 × (15- Hb in g/dL) + 500 or 1000 mg iron for storage.

3) Red cell transfusion-

Red cell transfusion therapy is useful in the worst cases like anaemia with cardiovascular instability; excessive and continuous blood loss etc. It not only helps in stabilizing the patient but also improve the iron stores in body.

PROCEDURE REVIEW

Some of the important basic concepts in *Rasashastra* should be overviewed before coming to the actual pharmaceutical procedures; it helps us for better understanding the importance of that particular procedure and principle behind it.

- ***SHODHANA-***

Shodhana is one of the important *sanskara* in *Rasashastra*. It has a special importance among all other *sanskaras*. *Shodhana* is nothing but simply purification of substance and making them suitable for body. Any substance, specially metals and minerals are present in the ore form, which are mixed with other metals or also with some toxic substances. With all these blemishes, one can't use that metal as a therapeutic drug. Hence process of *shodhana* is required to remove all impurities and make them therapeutically active.

- **Importance of *Shodhana-***

Each & every drug is not edible in its natural form. There is need to make them suitable for human body and should make easily digestible. Any drug which is given to any diseased person, that should be easily digestible, assimiable, totally detoxified and should be therapeutically effective for that particular disease. These conditions can be fulfilled by various processes which are included in the *shodhana*[96].

- **Definition [97]-**

The *sanskara* in which separation of impurities or unwanted products (*mala*/*doshas*) in metals or minerals is carried out by the process of *peshana* (trituration), *swedana* (hot fomentation), *kshalana* (Washing), *nirwapana* (quenching) etc. is called as *shodhana*.

- **Objectives of *Shodhana*[98]**

(1) To separate out the unwanted part-

Eg; *Shodhana* of *shilajatu, guggulu*, in which wastes like stones, soil etc is separated to obtain purified drug.

2) To reduce the unwanted properties of drug-

Eg; *Dhatturabeeja twak* is separated from *dhattura beeja* to reduce its '*madaka'* (sedative) property.

3) To increase the efficacy of drug-

Eg; *Hingula* is triturated with *ardraka swarasa* to increase its *deepanas* property and to increase its *pachaka guna*, it should be triturated with *nimbu* swa*rasa*.

4) To use any drug for a special therapeutic purpose-

Eg; Trituration of *naga* with *aphu* swa*rasa* for increasing its *shukrastambhak* property.

5) To facilitate the metal or mineral for further procedure-

In *Rasashastra*, any metal or mineral is subjected to *marana*, only when it is undergone through the process of *shodhana*. *Shodhana* facilitates the further *marana* process of the metal or mineral.

6) Detoxification of the substance is achieved.

- **Actual changes taken place during *shodhana*[99]**

1**) Physical modifications**-

- Physical impurities are separated like in *Guggulu* & *shilajatu shodhana*.
- Hardness or intactness of metal or mineral is decreased by repeated quenching of red hot metal in a particular liquid. Eg; *samanya shodhana* of *Dhatu*s.
- Particle size is reduced by repeated trituration in particular *shodhana dravya*. Thus, increases in *sookshmatva* of drug make it therapeutically more potent.

2**) Chemical modifications**-

- Acid soluble impurities are eliminated by *swedana* of any *dravya* in *nimbu swarasa* or if *kanji* is used, then alkali soluble impurities are eliminated.
- In case of *kankshi* or *tankana shodhana*, water content is totally removed by heating that substance.
- Arsenic like toxic substances are eliminated by giving heat to substance.

3) Biological modifications-

- Making the substance safe that means having no adverse effects on human body. Eg; *Ashuddha vatsanabha* is cardiac depressant which is converted as a cardiac stimulant after *shodhana*.

4) Detoxification of the substance-

Substances like *Haratal*, *Manashila*, *Somala*, *tamra* are very toxic in its original/*ashuddha* form. It must to use them only after proper *shodhana* process.

5) Making the substances *sharira satmya*-

Most of the metals & minerals are inorganic which are indigestible in our body, which may produce untoward effects. In *shodhana*, inorganic substances are continuously in contact with organic material like *kwatha*, *swarasa*, *godugdha* etc. hence repeatedly giving *Bhavana*, *pachana*, *nirvapana* etc. procedures to that inorganic substance make them *laghu* and *sharirasatmya* (easily assimiable in the body).

- **Types of *Shodhana*-**

Mainly *shodhana* is classified into two types-

1) *Samanya shodhana*- It is the common method which is applied to all *dravya*s in the particular group is called *samanya shodhana* of *dravya*s included in that group only. Eg; *Samanya shodhana* of *Dhatu*s- *Nirvapana*/*Dhalana* of *dhatu* in *kadalimula* swa*rasa* for 7 times. – *Ayurved Prakasha* 3/52

2) *Vishesha shodhana*- Instead of *samanya shodhana* of *dravya*, the method of *shodhana* which is only applicable for the specific drug is called *vishesha shodhana*. It is variable for each *dravya* in similar group also. Eg; *Vanga shodhana* is done by *Dhalana* in *haridrayukta nirgundi swarasa* for 3 times. – *Rasaratnasamuchaya* 5/156

There are various methods used during *shodhana*, to achieve desired property of drug; which are described as follows

1) *Twaknishkasana*-

- Peeling off the outer covering of fresh *dravya*s like ginger etc.

2) *Dhavana*-

-To remove the impurities like sand, mud, soil etc. by washing with water.

3) *Nimajjana*-

-Keeping *dravya* in a liquid (for a complete day) in which *shodhana* will be carried out. And liquid should be changed on next day. Eg; *shodhana* of *vatsanabha* in *Gomutra*.

4) *Nirvapana*-

-*Dravya* which is subjected to *shodhana*, is heated on *Agni* till it becomes red hot and then quenched in a liquid used for *shodhana*. Eg; *Lauha shodhana*, *Abhraka shodhana*.

5) *Dhalana*-

- *Dravya* melted on strong heat & then poured into the liquid used for *shodhana*. Eg; *Vanga shodhana*.

6) *Pachana-*

-Heating of *dravya* in a particular liquid, till all liquid get vaporised. Eg; *Pachana* of *Mandura* in *Gomutra siddha triphala kashaya*.

7) *Patana-*

- It is like a distillation process; substance is heated first and its vapours allowed to condense by maintaining cold surrounding. *Damaruyantra* is used for this process of *shodhana*. It has three types: *urdhva, adho* & *teeryak patana*. Eg; *Higulottha parada*.

8) *Bharjana-*

- Frying the substance on *mandagni*. It may be for vaporising water content, or for giving outer coat of *sneha dravya*. Eg; *Gairika shodhana, hingu shodhana*.

9) *Bhavan-*

- Trituration of substance in particular *Bhavana dravya*. Eg; Trituration of *hingula* in *ardraka swarasa* for *shodhana*.

10) *Vivechana-*

- Separating unwanted substances by some manual processes.

11) *Shoshana-*

- Unwanted water content in *dravya*, spoils it. Hence, by this process *dravya* subjected for drying. Eg; *shigru beej, aghada beej* etc.

12) *Sinchana-*

- When *nirvapana* is not possible, then *sinchana* should be done for the *shodhana*. In this method, firstly give *agni* to the metal/mineral till it becomes red hot and then sprinkle *shodhana dravya* on red hot part of *dravya*. Eg; *Tamra shodhana*.

13) *Sthapana-*

- Substance is kept in particular liquid for a particular period. It may be for easy removal of outer intact covering. Eg; *jaipal, kuchala.*

14) *Swedana-*

- It is the process of heating the substance in direct contact with liquid or in presence of liquid vapours. Eg; *Shodhana* of *Gunja*.

- **Drugs that facilitates *shodhana* of metals[100]**

  Kacha, *Tankana* and *Shipra* (*Navasgara*/ *mahishmutra*/ *muktashukti*) are the drugs used for reducing the impurities in metals (*Lohamala nashak*).

- ***BHAVANA:***

Due to *shodhana*, substance becomes pure and becomes ready for *marana*. *Marana* changes the physical properties of substance. Means particle becomes very fine lighter but can't assimilate in body easily. *Putana* brings the chemical changes, increase efficacy of the drug and it get easily assimilated in the body.

In above procedures own properties of the drug increased but to use in the diseased condition, some other properties also required to break the actual pathology. Hence for adding necessary properties of some *vanaspati* or *pranija dravya, Bhavana sanskara* is necessary.

- **Quantity of *Bhavana Dravya*-**
- **Definition[101]:-**

The process in which metallic powder etc. are subjected to soak in suitable liquid and pestle up to drying is known as *Bhavana.*

It also plays a valuable role in the incineration process. *Bhavana* takes place *Shodhana* and *Jarana*. *Bhavana* is well defined in the *Rasatarangini* 2/49 as follows.

The quantity of liquid for each *Bhavana* is generally suggested as sufficient quantity of liquid to immerse the powder in it. The decoction being prepared for *Bhavana* is to reduce up to 1/8th part of the liquid.

- **Objectives :**

  1) To bring minute particles of the material in contact with the liquid media.

  2) Impregnation of properties of the media to the material.

  3) Transformation of the coarse powder to finer state.

  4) To facilitate the material for further processing.

  5) Leads to unique and suitable physico-chemical changes.

- **Amount of Liquid Media :**

  1) Gravimetrically equal to the amount of material to be levigated.

  2) Volumetrically so much that the material can be immersed completely.

  3) Volumetrically so much that the material can be made into dough.

  4) Amount of liquid media should be taken so much, that it can make the material wet throughout the specific period of grinding.

- **Procedures[102] :**

  1) In case where the media is taken as decoction form, the amount of dry herb should be taken equal to the amount of material; eight times water should be added to it and should be reduced to 1/8th by boiling. Then the decoction is added to the material as much that the material remains wet for whole day. This process is continued for seven days.

  2) The material is mixed with liquid material and ground till the whole material becomes like dough.

  3) The material is mixed with particular liquid media and ground continuously for the specific period.

PHARMACEUTICAL STUDY

Pharmaceutical science is the science of drug preparation. In *Ayurveda* the branch related to *Rasashastra* and *Bhaishajya Kalpana*. From *Vedic* era drugs were prepared by *Vaidhyas* himself and treat various diseases. *Rasashastra* is the science of "*Rasa*" i.e. "Mercury". The detailed study of *Parada* i.e. its purification methods; various processing regarding "*Lohveda*" and "*Dehaveda*"was mentioned thoroughly. The study of herbal, mineral and animal origin drugs also done in *Rasashastra*.

Ancient *Acharyas* said that *Rasavaidhyas* are best physician among all. Good physician is one who diagnoses and treats the patient with effective medicine. In *Rasa shastra* it is described that *Rasa Shastri* must have the quality of '*Kushala Rasa Karmani' (R.R.S.6/4).* Thus the preparation of drugs is very skillful science. In *Rasashastra* various metals and Minerals have some toxic properties and will cause untoward effect on health. So before using in medicine these metals and minerals are purified and incinerated with the reference mentioned in classical texts. The treatment will be fruitful, if the preparation of drug was done properly. In nut shell it can be stated that pharmaceutics science is very important in manufacturing as well as drug dispensing**.**

In present research work the Pharmaceutical study of *Gairika* was done. The objective of this study was to Purify *Gairika* with two different methods from classical text reference. The study was carried out in following heads:-

A] Collection of Raw material

B] Authentication of Raw Material – *Gairika*.

C] Removal of Foreign material

D] *Shodhana* of *Gairika* By *Goghrita Bharjana* method.

E] *Shodhana* of *Gairika* by *Godugdha Bhavana* method.

- **Place of work**: - Pharmaceutical work was carried in the PG department of *Rasashastra* and *bhaishajya kalpana* laboratory, PMT's Ayurved College, Shevgaon.

[A] COLLECTION OF RAW DRUGS:

1) *Gairika*- The key raw material of this research work was *Gairika* and it was collected from S.G.Phytopharma, Kolhapur.

2) *Goghrita* – For purification of *Gairika Goghrita* was required. It was collected from local market having ISI certified brand –*Gowardhana* Company**.**

3) *Godugdha*- Fresh cow milk was collected daily from local cow bearing man.

[B] AUTHENTIFICATION OF RAW DRUG (*GAIRIKA)*

The authentication of raw *Gairika* was done with *Ayurvedic* as well as modern parameters.

Ayurvedic paramenter- The Selected sample of *Gairika* fulfil following parameters.

1) *Atyantashonita*(Dark brick red color)
2) *Snigdha* (Smooth)
3) *Masruna* (Soft in consistency)

The selected sample of *Gairika* has Fe content 26.353 %, when analysed with modern parameter i.e. ICP-AES, XRD.

[C] REMOVAL OF FOREIGN MATERIAL:-

The sample of *Gairika* was studied with visible signs of any stones, rodent excreta or any noxious foreign matter.

[D] PURIFICATION OF *GAIRIKA* WITH *GOGHRITA BHARJANA* METHOD[103]:-

1] Name of practical- *Shodhana of Gairika*

2] Date of starting: - 10/04/2017, Date of completion: - 10/04/2017

Total duration – 20 min.

3] Reference: - *Ayurved Prakash* 2/272

गैरिकं किन्चिदाज्येन भृष्टं शुद्धं प्रजायते ।

आ.प्र. २/२७२

4] Equipments used: - Weighing balance, Gas burner, iron vessel Pan, Spatula, *Khalvayantra*, Cotton cloth, Steel vessel and Steel plate.

- **Weighing balance-** It was used for measurement of weight of *Gairika* before and after purification and *Goghrita* weight.
- ***Khalvayantra*-** It was used for powdering the raw *Gairika*.
- **Cotton cloth: -** It was used for refining the powdered *Gairika*.
- **Gas Burner: -** It was used for roasting the *Gairika.*
- **Iron vessel: -** Used for frying of *Gairika* (purification purpose**).**
- **Spatula: -** Used to shake the *Gairika* during roasting.
- **Steel vessel(Small)** – used to store *Goghrita*
- **Steel plate:-** Used to store purified *Gairika*

5] Ingredients with quantity:-

Ashuddha Gairika- 100g

Goghrita – 22g

6] Procedure:-

To know the exact proportion of *Goghrita* two pilot samples were prepared with 50g *Gairika* and 11g *Goghrita* and one exact quantity for 100g *Gairika* was fixed i.e. 22g and then further procedure of *shodhana* was done.

- Now weight the *Gairika* (R) and *Goghrita* in the quantity as mentioned above.
- Weighted *Gairika* was taken in clean and dry *Khalvayantra* to make its fine powder.
- This powdered material was taken in clean cotton cloth and refining was done (*Vastragalana*) to obtain fine powder.
- Now weighted *Goghrita* was taken in iron vessel and subjected to mild heat (*mandagni*).
- When all *Goghrita* in iron vessel was melted, fine powder of *Gairika* poured in it and roasting started on mild heat.
- The roasting was continued till the following changes appears in *Gairika* –
    i. All the lumps appeared in material which were formed due to addition of *Goghrita* get disappeared completely.
    ii. All particles of *Gairika* get separated from each other.
    iii. The colour of *Gairika* changes from brick red colour to dark brown colour.

- When all above changes appears in *Gairika*, roasting stopped and it was taken in steel plate for cooling.
- After cooling the purified (*Shuddha*) *Gairika* was weighted and stored in clean and dry glass container lebbled as "Sample -1" and used for further work.
- The total time required for completion of *shodhana* process was recorded.

7] **Precautions**:-

i. For s*hodhana* process of *Gairika*, it should be taken after fine powdered only.

ii. The *khalvayantra* used for powdering of *Gairika* should be watched for any previous practical of Mercury, Arsenic etc. so it should be washed very cleanly, otherwise *shuddha Gairika* would show high level of heavy metals in analysis.

iii. The roasting of *Gairika* should be done on *Mandagni*, otherwise *Goghrita* will be burnt.

iv. Quantity of *Goghrita* should be fixed by doing pilot practical.

v. Roasting should be stopped after getting proper changes of Purification otherwise, after few days *Shuddha Gairika* spreads rancid smell, due to *Ghrita.*

[E] PURIFICATION OF *GAIRIKA* WITH *GODUGDHA BHAVANA* METHOD[104]:-

1] Name of practical- *Shodhana* of *Gairika*

2] Date of Starting- 11/04/201 Date of completion – 19/04/2017

Total duration- 9 days.

3] Reference- *Rasa Ratna Samucchaya* 3/49

गैरिकं तु गवां दुग्धैर्भावितं शुध्दिमृच्छति ।

र.र.स. ३/४९

4] **Equipments used**: - Weighing balance, *Khalva Yantra*, Measuring cylinder, Steel vessel, Steel plate, Knife.

- **Weighing machine**- Used to measure *Gairika* before and after *shodhana*.
- **Khalva yantra**- Used to triturate *Gairika* with milk
- **Measuring cylinder**- Used to measure quantity of milk

- **Steel vessel**- Used to store milk
- **Steel plate**- Used to collect *Gairika* after *shodhana*
- **Knife** – Used to recollect material which was lodged at the edges of *khalvayantra* during trituration with milk.

5] **Ingredients with proportion** –

Ashuddha Gairika- 100g

Cow milk- Q.S. (Quantity sufficient for 7 trituration)

6] **Procedure** –

- First of all *Khalvayantra* was clean with water and dried well.
- Now 100g of *Gairika* was taken in *khalvayantra* and powdered it in very fine form.
- Then fresh cow milk was added in quantity that fully soaks the powder in *khalvayantra.*
- Now trituration started with constant speed and pressure.
- The material which was lodged at upper edges of mortar and pestle, removed with help of knife and recollected in center part of *khalvayantra* and again trituration started.
- Trituration was continued till all mixture gets dried.
- For first *bhavana* total 130 ml milk required and total 3 hours require to dry.
- The material was taken out from *khalvayantra* in steel plate and dried in sunlight.
- After proper drying the material was weighted with help of balance and taken for second trituration.
- Same procedure as described above was applied to remaining 6 triturations.
- After completion of 7 trituration the mixture was stored in glass bottle with labeling as "Sample-2" and used for further procedure.

7] **Precaution:-**

i. Fresh cow milk was used for each trituration.

ii. Trituration should be done very carefully; otherwise material can be spread out.

iii. Trituration should be continued till mixture become uniform and soft.

iv. 2nd trituration should be given after proper drying of first one.

v. After completion of all *bhavana* the mixture should be dried well otherwise after some period it may give foetid smell due to milk.

8] **Observation***:-*

i. Colour of *Gairika* changes to dark red after adding cow milk.

ii. The quantity of milk and duration of trituration get reduced with descending order of trituration.

iii. Weight of *Shuddha Gairika* was increased after each trituration.

ANALYTICAL STUDY

Ayurveda is the most ancient science of life with holistic approach. The preparation of various herbal and herbomineral compounds is an integral part of this science. In ancient era the preparation of medicine was oriented to practicing physician only. Hence the preparation of medicine was limited, selective and at personal level only. And that's why methodology of preparation and quality was differ by one *vaidya* to another, resulting in difficulty to set standard manufacturing and operating procedure and production of quality drugs.

Due to rapid civilization, and higher growth rate of population, there is increased demand of *Ayurvedic* medicines for curing diseases. To overcome this huge demand, *vaidya* depends on manufacturing industries. Thus due to increased demand of these *Ayurvedic* Herbal and Herbomineral compounds all over the world, it has been mandatory to develop standards for raw material, in process material and finished product. At the same time, consumer wants to know the quality of drug in terms of measurable parameters. So to standardize the preparation is the need of hour.

Analytical chemistry is one of the most important disciplines of the science which deals with the qualitative and quantitative analysis of various substances. Each and every drug in universe has got its own specific physical and chemical characteristics, which helps to separate each drug from another closely related drug. Thus chemical analysis is most important tool to find out any kind of adulteration in drug. Thus Physico-chemical analysis of a particular sample using said specific parameters helps in authentication and standardizing the drug.

- **MATERIALS AND METHODS:-**

In the present study *Gairika* in raw form and purified form was analysed on the basis of following physical and chemical parameters. The analysis was done with the standards mentioned in *Ayurvedic Pharmacopeia of India.*

- **Place of work:** - All samples were analysed from IIT Mumbai, Aabasaheb Kakade B. Pharmay College, Bodhegaon, Ahmednagar.
- **Samples:-**

  Sample R: - Raw *Gairika*

  Sample 1:- *Shuddha Gairika* (*Goghrita Bharjita*)

  Sample 2:-*Shuddha Gairika* (*Godugdha Bhavita*)

- Physical properties :-
  - Nature
  - Color
  - Streak
  - Fracture
  - Lusture
  - Tenacity
  - Transparency
  - Hardness
  - Specific gravity
- Chemical properties –
  - Elemental assay (For Fe, Mg etc.)
  - Acid solubility
  - Heavy metal tests(For Hg, Pb, As and Cd)
  - XRD
  - SEM
- Gravimetric tests
  - Moisture content
  - Ash values (Total ash, Acid insoluble Ash, Water soluble Ash)

- **METHODOLOGY:-**

[1] Determination of Hardness[105]

Hardness of metals and alloys is a complex property and depends upon other properties such as grain size, yield strength, tensile strength, ductility, work-hardening coefficient, resistance to abrasion etc. Various methods are used for the measurement of hardness and each method is based on a different principle. In all these methods, hardness is reported by a certain characteristic number.

The hardness of a metal or an alloy may be defined in one or more of the following forms.

1. Indentation hardness: It is the resistance offered by metals to indentation, which is mainly a measure of plasticity and density.

2. Rebound hardness: It is the resistance offered by metals to strike and rebound, which is principally a measure of elastic properties.

Scratch hardness: it is the resistance offered by metals to scratching, which is principally a measure of strength and plastic properties.

4. Cutting hardness: It is the resistance of metals to various cutting operations.

5. Abrasive hardness: it is the resistance of metals to wear subjected to sliding or rotating motion.

Micro-hardness Testers:

Micro-hardness test was selected due to the soft nature of this mineral. Load applied for the test was 10 gm. These instruments are designed in such a way that as low as 1 gm and as high as 1000gm load can be applied. Due to less loads, the impressions are extremely small and also shallow. This feature makes them highly indispensable for the measurement of hardness of very thin sheet materials, plated layers, nitride surfaces and phases.

Tukon hardness testing instrument is one of the machines which is of the above type. The machine is completely automatic except for manipulations involved in measuring the dimensions of impression made by the indenter. The impressions are measured by a permanently attached metallurgical type microscope.

Two indenters are used for the Tukon hardness tester; one is the standard Vickers 136° Diamond pyramid and the other is the diamond Knoop indenter. The Knoop indenter consists of a pyramidal shaped diamond cut to an included transverse angle of 130° and an included longitudinal angle of 172° 30'.

The projected impression of the Knoop indenter is rhombic in shape with one diagonal perpendicular to the other. The longer diagonal is about 7 times the shorter diagonal. The depth of impression is about $1/30^{th}$ of the length of the longer diagonal. With the use of Vickers indenter, the procedure and the calculations of diamond pyramid hardness number are precisely the same as already described i.e. by using the following equation:

V.P.N. = $1.8544\ P/d^2$

Where applied load (P) is in kg and diagonal of square impression (d) is in mm.

[2] Determination of Specific gravity[106]:

Definition: - It is defined as, the ratio of weight of volume of given liquid to the weight of volume of water measured at same temperature.

Specific gravity of a liquid is the weight of a given volume of the liquid at a specific temperature compared with the weight of an equal volume of water at the same temperature , all weighing being taken in air.

Apparatus: - Pycnometer, Analytical balance

Method:

A clean and dry pycnometer was taken and calibrated with water at 25^0c temperature. Now the liquid whose specific gravity to be calculated was taken in dry pycnometer and weight was taken at 25^0c. Now specific gravity of a given sample was calculated by dividing the weight of sample liquid in pycnometer to the weight of water, both measured at 25^0c temperature.

[3] Determination of *p*H Values[107]:-

Definition:-

The pH of any fluid is defined as negative logarithm of H^+ ion concentration. It is also defined as measure of hydrogen ion concentration relative to that of standard solution. It measures acidity or alkalinity of given fluid.

The *p*H value of an aqueous liquid may be defined as the common logarithm of the reciprocal of the hydrogen ion concentration expressed in g per liter. Although this definition provides a useful practical means for the quantitative indication of the acidity or alkalinity of a solution, it is less satisfactory from a strictly theoretical point of view. No definition of *p*H as a measurable quantity can have a simple meaning, which is also fundamental and exact.

Apparatus: - Digital pH meter,

Method:-

The pH of any fluid can be estimated by using digital pH meter.

[4]Determination of Solubility in dilute HCL[108]: -

When a mixture of a specified amount of a given solute and a specified amount of a given solvent forms a homogeneous liquid, the former is said to be soluble in the later. The arbitrary standard employed in this book is 0.10 g of solid or 0.20 ml of liquid to 3.00 ml of solvent. The study of the solubility behaviour of an unknown substance in various liquids, viz. water, ether, 5% sodium hydroxide solution, 5 % sodium hydrogen carbonate solution, 5% hydrochloric acid and cold concentrated sulphuric acid, may provide useful preliminary information about the nature of the compound.

Solubility in dilute hydrochloric acid: - Most compounds that are soluble in dilute HCL contain a basic nitrogen atom (incorporating an unshared electron pair) in

the molucle.thus most aliphatic amines (primary, Secondary and tertiary) form salts (polar, water soluble compounds) with HCL. Alkalinity of nitrogen atoms was reduced by Aryl groups. (e.g. Diphenyl amine, carbozole and triphenylamine) the basic character of the nitrogen atom has been diminished to such an extent that they do not form salts with dilute HCL and consequently do not dissolve. Alkylarylamines (containing not more than one aryl group) and alicyclic amines, however, do dissolve. A few types of oxygen-contain compounds (such as the pyrones and the anthocyanidin pigments of certain flowers), which form oxonium salts, dissolve in dilute HCL. Amides which are insoluble in water are generally unaffected by 5 % HCL but may dissolve in higher concentrations (10-20 %) of acid. This emphasises the importance of employing the correct strength of acid in the solubility tests. Many distributed amides having high molecular weight and water insoluble but dissolve in diluted hydrochloric acid.

It may be noted that some aromatic amines react with 5 % HCL to form insoluble hydrochlorides; the latter sometimes dissolve upon warming and adding small amount of water. The solid formed may show changes in aryl amine by seeing its appearance. The melting point of separated solid should compare with original compound. For this a test was done using solution of ethanolic silver nitratrate would indicate the formation of a hydrochloride.

[5] Determination of Moisture content (LOD) [109]:

Definition: It is defined as loss of weight after heating of a sample at 105 ^{0} c temperature.

Apparatus: - Hot air oven, Evaporating Dishes, Desiccator

Method:

The powdered and accurately weighted (10g) sample was taken in evaporating dish which was tared. The sample containing dish was kept in oven at 105^{0}c temperature for five hours. The weight was measured after cooling in desiccator. The procedure was continued till constant weight (<0.01g difference) was obtained in consecutive weights after drying.

[6] Total Ash Estimation[110]:-

Apparatus: - Muffle furnace, Silica Crucible with lid, Tongs, Spatula, Desiccator, Analytical balance

Method: -

The powdered and accurately weighed (2-3g) of a sample was taken in tared silica crucible. Then the crucible was covered with lid and kept in muffle furnace with temperature not more than 450^0c, till the white (carbon free) ash was obtained. The sample containing crucible was cooled in desiccator with help of tongs and after cooling the weight was measured. The percentage of total ash was calculated in accordance with air dried drug.

[7] Acid – insoluble Ash Estimation[111]:-

Apparatus: - Muffle furnace, Silica Crucible with lid, Tongs, Spatula, Desiccator, Analytical balance.

Method:-

In a silica crucible, which contains total ash, 25ml of dil. HCL was added. The material was filtered with Whatman 41 filter paper and residue was collected. Insoluble matter was washed, with hot water, till filtrate get neutral. The filtrate with filter paper taken in silica dish and dried on hot plate. Then the crucible was kept in muffle furnace at 450^0c, to get constant weight. The residue was cooled in desiccator and weighed. Acid insoluble ash was calculated with reference of air dried drug.

[8] Water Soluble Ash – Estimation[112:] -

Apparatus: - Muffle furnace, Silica Crucible with lid, Tongs, Spatula, Desiccator, Analytical balance.

Method:-

In total ash 25ml water was added and boiled. Insoluble residue was collected in ash less filter paper and washed with help of hot water. The content was taken in crucible and ignited in muffle furnace at 450^0c temp for 15 minutes and cooled in desiccator. After cooling weight was taken. The difference in weight of total ash and insoluble ash gives the value of water soluble ash.

[8] Sulphated Ash – Estimation[113]:-

Apparatus: - Muffle furnace, Silica Crucible with lid, Tongs, Spatula, Desiccator, Analytical balance.

Method: -

1-2 g accurately weighed sample was taken in dry and clean crucible. The crucible was kept in muffle furnace and ignited till all material gets burnt. The crucible was kept in desiccator for cooling. After cooling 1ml of H2SO4 was added in charred material and heated over slight flame till white fumes get evaporated. The sample then ignited at 800^0c , cooled and few drops of H2SO4 were added and slight heat given. The same procedure was repeated till two consecutive readings should not show difference in weight more than 0.5 mg.

[9] Residue on Ignition[114]:-

The Residue on Ignition Test specified in General Tests, Japanese Pharmacopeia is a method to measure the weight of the residual substance not volatilized when the sample is ignited under a constant condition. Generally, this test is intended to determine the content of inorganic substances contained as impurities in an organic substance, and, occasionally, to determine the amount of inorganic substances contained as components in an organic substance. Our laboratories have adopted this test method for the above two purposes in the case of the quality control for drug substances, synthetic intermediates, starting materials in the course of drug development. Some validation studies have been conducted for this test in order to clarify the quantitation limit in the case of an application for the former purpose, and trueness and precision in the case of the latter purpose. Consequently, the quantitation limit was determined as around 0.50 mg. The amount of sample should be determined based on this quantitation limit (mg) and the level of quantitation limit (%) or that of specification limit (%) should be considered from the view point of each testing purpose. The test method was also confirmed to have a good trueness and precision as the determination method for an alkaline salt, such as sodium, potassium or calcium salt, of organic compounds, as long as the test is operated with great care not to scatter the content out of crucible during ignition to incineration.

[10] ICP-AES: - **Inductively Coupled Plasma—Atomic Emission Spectrometry[115]**

ICP- atomic emission spectroscopy is used in the analysis of chemicals or trace element. Flame technique was used for emission of electromagnetic radiation. These radiations have characteristic wavelengths as that of particular element. The concentration of elements presents in a sample is depends on intensity of emission.

ICP-AES also referred to as inductively coupled plasma optical emission spectrometry (ICP-OES), is an analytical technique used for the detection of chemical elements. It is a type of emission spectroscopy that uses the inductively coupled plasma to produce excited atoms and ions that emit electromagnetic radiation at wavelengths characteristic of a particular element. It is a flame technique with a flame temperature in a range from 6000 to 10,000 K. The intensity of this emission is indicative of the concentration of the element within the sample.

The ICP-AES is composed of two parts: the ICP and the optical spectrometer. The ICP torch consists of 3 concentric quartz glass tubes. Output or "work" coil of the radio frequency (RF) generator surrounds part of this quartz torch. Argon gas is typically used to create the plasma.

When the torch is turned on, an intense electromagnetic field is created within the coil by the high power radio frequency signal flowing in the coil. This RF signal is created by the RF generator which is, effectively, a high power radio transmitter driving the "work coil" the same way a typical radio transmitter drives a transmitting antenna. Typical instruments run at either 27 or 40 MHz The argon gas flowing through the torch is ignited with a Tesla unit that creates a brief discharge arc through the argon flow to initiate the ionization process. Once the plasma is "ignited", the Tesla unit is turned off.

The argon gas is ionized in the intense electromagnetic field and flows in a particular rotationally symmetrical pattern towards the magnetic field of the RF coil. A Stable, high temperature plasma of about 7000 K is then generated as the result of the inelastic collisions created between the neutral argon atoms and the charged particles .A peristaltic pump delivers an aqueous or organic sample into an analytical nebulizer where it is changed into mist and introduced directly inside the plasma flame. The sample immediately collides with the electrons and charged ions in the plasma and is itself broken down into charged ions. The various molecules break up into their respective atoms which then lose electrons and recombine repeatedly in the plasma, giving off radiation at the characteristic wavelengths of the elements involved.

In some designs, a shear gas, typically nitrogen or dry compressed air is used to 'cut' the plasma at a specific spot. One or two transfer lenses are then used to focus the

emitted light on a diffraction grating where it is separated into its component wavelengths in the optical spectrometer. In other designs, the plasma impinges directly upon an optical interface which consists of an orifice from which a constant flow of argon emerges, deflecting the plasma and providing cooling while allowing the emitted light from the plasma to enter the optical chamber. Still other designs use optical fibres to convey some of the light to separate optical chambers.

Within the optical chamber(s), after the light is separated into its different wavelengths (colours), the light intensity is measured with a photomultiplier tube or tubes physically positioned to "view" the specific wavelength(s) for each element line involved, or, in more modern units, the separated colors fall upon an array of semiconductor photo detectors such as charge coupled devices(CCDs). In units using these detector arrays, the intensities of all wavelengths (within the system's range) can be measured simultaneously, allowing the instrument to analyse for every element to which the unit is sensitive all at once. Thus, samples can be analysed very quickly. The intensity of each line is then compared to previously measured intensities of known concentrations of the elements, and their concentrations are then computed by interpolation along the calibration lines. In addition, special software generally corrects for interferences caused by the presence of different elements within a given sample matrix.

[11] X-ray Diffraction[116]:-

X-ray Diffraction is an analytical technique used in fingerprint characterization of crystalline material and for determination of their structure. Each substance has its specific characteristic X-ray powder pattern which can be used as “fingerprint” for its identification. When the material is identified, X-ray crystallography used to determine the structure of that material. X-ray diffraction is very important characterization tool used in the solid state chemistry.

Definition: X-ray powder diffraction is a rapid analytical technique primarily used for phase identification of a crystalline material and can provide information on unit cell dimensions. The analysed material is finely ground, homogenized and average bulk composition is determined.

Principle of Diffraction:-

Max von Laue, in 1912 discovered that crystalline substances act as three dimensional diffraction grating for X-rays wavelengths similar to the spacing of planes in a crystal lattice. X-ray diffraction is now a common technique for the study of crystal structures and atomic spacing.

X-ray diffraction is based on constructive interference of monochromatic X-rays and a crystalline sample. These X-rays are generated by a cathode ray tube, filtered to produce monochromatic radiation, collimated to concentrate and directed towards the sample. The interaction of the incident rays with the sample produces constructive interference (and a diffracted ray) when conditions satisfy Bragg's Law ($n\lambda=2d \sin\Theta$). This law relates the wavelength of electromagnetic radiation to the diffraction angle and the lattice spacing in a crystalline sample. These diffracted X-rays are then detected ,processed and counted.by scanning the sample through a range of 2Θ angles, all possible diffraction directions of the lattice should be attained due to the random orientation of the powdered material. Conversion of the diffraction peaks to d-spacing allows identification of the mineral because each mineral has a set of unique d-spacing. Typically, this is achieved by comparison of d-spacing with standard reference patterns.

All diffraction methods are based on generation of X-rays in an X-ray tube. These X-rays are directed at the sample and the diffracted rays are collected. A key component of all diffraction is the angle between the incident and diffracted rays. Powder and single crystal diffraction vary in instrumentation beyond this.

Instrumentation:-

X-ray diffract meters consist of three basic elements: an X-ray tube, a sample holder and X-ray detector. X-rays are generated in a cathode ray tube by heating a filament to produce electrons, accelerating the electrons toward a target by applying a voltage and bombarding the target material with electrons. When electrons have sufficient energy to dislodge inner shell electrons to the target material, characteristic X-ray spectra are produced. These spectra consist of several components, the most common being K_α and k_β. K_α consist, impart of $K_{\alpha 1}$ and $K_{\alpha 2}$. $K_{\alpha 1}$ has a slightly shorter wavelength and twice the intensity of as $K_{\alpha 2}$. the specific wavelengths are characteristic of the target material.. Copper is the most common target material for single crystal diffraction, with Cu K_α radiation= $1.5418A^0$. These X-rays are collimated and directed onto the sample. As the sample and detector are rotated, the

intensity of the reflected X-rays is recorded. When the geometry of the incident X-rays impinging the samples satisfies the Bragg equation, constructive interference occurs and a peak in intensity occurs. A detector records and processes this X-ray signal and converts the signal to a count rate which is then output to a device such as a printer or computer monitor.

[12] SEM: - **Scanning Electron Microscope[117]: -**

The SEM is an instrument that produces a largely magnified image by using electrons instead of light to form an image. A beam of electrons is produced at the top of the microscope by an electron gun. The electron beam follows a vertical path through the microscope, which is held within a vacuum. The beam travels through electromagnetic field and lenses, which focus the beam down towards the sample. Once the beam hits the sample, electrons and X-rays are ejected from the sample. Detectors collect these X-ray, backscattered electrons, and secondary electrons and convert them into a signal that is send to a screen similar to a television screen. This produces the final image.

Preparation of sample:-

Because the SEM utilizes vacuum condition and uses electrons to form an image, special preparations must be done to the sample. All water must be removed from the samples because the water would vaporize in the vacuum. All metals are conductive and required no preparation before being used. All non-metals need to be made conductive by covering the sample with a thin layer of conductive material. This is done by using a device called a "sputter coater". The sputter coater uses an electric field and argon gas. The sample is placed in a small chamber that is at a vacuum. Argon gas and an electric field cause an electron to be removed from the argon, making the atoms positively charged. The argon ions then become attracted to a negatively charged gold foil. The argon ions knock gold atoms from the surface of thegoldfoil.

EXPERIMENTAL STUDY

- **Introduction-**

Animal experimental studies are included under preclinical studies. These are the most accurate way of predicting not only the efficacy of compounds but also there adverse effects on the body. Experiments which can't be done on human bodies are performed on the animals by such type of studies. Thus, Animal experimentation has great importance in the world of research.

- **Selection of Animals:**

The Wistar rats of either sex, weighing between 150-180 g with 7-9 weeks age, of Sprague Dawley strain, were selected for present study. Six animals per group were tested for study. These rats were housed in polypropylene cages with stainless steel grill top, with facilities for food and water bottle and bedding of clean paddy husk. Three rats were housed in a single cage. Identification of animals were done by unique number marked by writing on cage tag and by corresponding colour body markings. In all cages room temperature was maintained between 22 ± 3^0C, relative humidity 50-60% and illumination cycle set to 12 hours light and 12 hours dark. In diet pelleted feed was supplied to all rats. Potable water passed through 'Aqua guard' water filter, was provided ad libitum in plastic bottles with stainless steel sipper tubes. The rats were acclimatized in their cages for five days prior to start of dosing in the experimental room after veterinary examination.

- **IAEC Approval** :-

IAEC protocol for this study was approved, the approval No. was APTRF/RP-03/1718 Dated: 07/04/2017.The study was carried out as per the protocol and guidelines of IAEC; by which, the duration of study was limited for 1 month because, long term animal handling may lead to animal mortality which not only affects the plan of study but also sounds unethical as per IAEC protocol.

- **Place of study-**

The study was performed at APT Research Foundation, Pune. The research laboratory was recognised by DSIR SIRO.

- **Date of Acclimatization**:- 20/09/2017
- **Date of completion of study** :- 27/10/2017

- **Objective of the study :-**

The objective of the present study was to evaluate effect of *Goghrita* and *Godugdha shodhita Gairika* on haematological parameters of wistar rats.

- **Inclusion criteria:-**

1. Adult, Healthy and active wistar rats were selected for study.
2. Wistar rats having approximately same weight (150-180 g) were selected for study.

- **Exclusion criteria:-**

1. Unhealthy and lethargic wistar rats, showing abnormal behavioral changes were excluded from the study.
2. The pregnant female wistar rats were excluded from the study.

- **Grading of animals:-**

For present study, 6 animals were taken in each group and such five groups were made, as follows.

Table 3.3.1- shows grouping of animals:-

Sr no	Group	Drug
1	Group I	Normal control, wistar rats with diluted honey
2	Group II	Disease control, (Wistar rats + PHZ)
3	Group III	Standard, (Wistar rats + PHZ + Syp. Vit B12)
4	Group IV	Sample 1 (Wistar rats +PHZ + Trial drug 1)
5	Group V	Sample 2 (Wistar rats +PHZ + Trial drug 2)

- **Group I**- Normal control group (NC)

Receive only diluted honey (3ml honey+4.5ml de-ionized water) 1ml for each individual animal[118].

- **Group II –** Disease control group (DC)

Receive only phenyl hydrazine phenyl hydrazine (60mg/kg), IP

- **Group III**- Standard control group (STD)

Receive standard drug i.e. syp.vit B12 (1ml/rat) in PHZ induced anaemic rats.

- **Group IV-** Trial drug one (T1) –

Receive trial drug 1 i.e. *Goghrita bharjita shuddha Gairika* 45mg /kg (mixed with diluted honey) in PHZ induced anaemic rats.

- **Group V**- Trial drug 2 (T2)-

Receive trial drug 2 i.e. *Godugdha shodhita Gairika* 45mg/kg (mixed with diluted honey) in PHZ induced anaemic rats.

- **Induction of anaemia**[119]:-

In all rats anaemia was induced with Inj. PHZ (Phenyl Hydrazine), in the dose of 60mg/kg for successive two days, given with IP (Intraperitoneal) route.

- **Dose determination**[120]**:-**

By using extrapolation factor the dose of study drug was calculated.

Subclinical dose= a × b

[a- clinical dose, b- constant =0.018, extrapolation factor]

Clinical dose administered to humans= 500mg/60kg for one day[121].

Subclinical dose= 500 × 0.018 = 9 mg/60kg

Animal dose per kg = 9 × 5 = 45 mg / kg

Thus total 45 mg/kg trial drug was administered to each rat per day.

- **Drug administration :-**

- **Normal control group-**

For control group diluted honey was given in the dose 1ml/ rat orally using rubber catheter for 30 days.

- **Trial group** -

Sample drugs (sample 1 & 2) were in the powder form so it was mixed with diluted honey (3 ml honey + 4.5 ml de-ionized water) and then given to animals in the dose of 45mg/kg orally with use of rubber catheter for thirty days.

- **Standard drug** [122]**-**

Vit.B12 syrup 1ml/ rat was given orally for 30 days.

- **Duration of study:** 30 days.

- **Route of drug administration :-**
  - Standard drug (Syp, Vit.B12), Control drug (diluted honey), Trial drug (Sample1 & 2) was given by oral route.
  - PHZ (Phenyl hydrazine) was given by IP (intraperitoneal) route.

- **Collection of blood sample[123] :**

In present study for estimation of haematological parameters retroorbital sinus of rats was punctured and blood was collected with the help of capillary tube**.** Blood was collected on 0, 14 and 28 day of study. The red blood corpuscular count, Haemoglobin percentage (Hb), Haematocrit value (HCT), mean corpuscular volume (MCV), mean corpuscular haemoglobin(MCH), mean corpuscular haemoglobin concentration (MCHC), Serum Iron level , serum ferritin level and TIBC were determined.

After 30 days trial animals was sacrificed and disposed as per standard protocol for animal ethics. (Co2 chamber or High dose general anaesthesia)

- **Study design:-**

After induction of anaemia, the rats having haemoglobin concentration less then 13g/dl were stipulated for present study.

The experimental animals were divided into following groups with 6 animals per group.

Table 3.3.2 – shows study design of research work:-

Group no	Group name	Group specification
I	NC	Diluted honey -1 ml/rat
II	DC	Phenyl hydrazine 60 mg/kg,i.p. for 2 days
III	STD	Phenyl hydrazine +Vitamin B_{12} syrup (1ml/rat)
IV	T1	Phenyl hydrazine +Goghritabharjita shuddha Gairika 45mg/kg (mixed with diluted honey)
V	T2	Phenyl hydrazine +Godugdha bhavita shuddha Gairika 45mg/kg (mixed with diluted honey)

*NC- Normal control, *DC- Disease control,

*STD- Standard, *T1- Trial group 1,

*T2- Trial group 2. *Diluted honey: - 3ml honey+4.5ml water.

- **Statistical analysis:-**

The results were analysed for statistical significance by one way ANOVA and were expressed as Mean ±SEM by using Graphpad prism 5 version (Bonferroni compare all pairs of column test).

OBSERVATIONS AND RESULTS OF PHARMACEUTICAL STUDY

Table 4.1.1 shows physical changes of *Gairika* after *Shodhana* (method 1)

Sr.no.	Parameters	*Ashuddha Gairika*	*Goghrita*	*Shuddha Gairika*
1	Appearance	Stony	Oily	Powder
2	Color	Brick red	Yellowish	Dark brick red
3	Touch	Rough , Dry	Snigdha	Very Smooth
4	Odour	Earthy	Specific	Earthy
5	Quantity	100g	22g	114g

Table 4.1.2 shows Yield of *Gairika* obtained after Purification (method 1)

Sr.no.	Sample 1	Quantity of Gairika	Yield Obtained	Net gain	% Gain
1	Ashuddha Gairika	100g	114g	14g	12.28

Pharmaceutical study aims to purification of *Gairika*, according to classical texts. In first method of purification, *Gairika* was roasted with *Goghrita*. After purification color of *gairika* changes from brick red to dark brick red.

After purification by first method, it was seen that weight of *Gairika* get increased. About 12.28% (14g) weight was gained by *Gairika* after purification.

Table 4.1.3 – Results of physical changes seen in *Gairika* after purification (method 2)

Sr.no.	Parameters	Ashuddha Gairika	Shuddha Gairika
1	Appearance	Stony	Powder
2	Color	Brick red	Red color
3	Touch	Rough , Dry	Smooth
4	Odour	Earthy	Specific
5	Quantity	100g	145g

Table 4.1.4 showing details of 7 triturations of *Gairika*

Sr .no.	Trituration	Quantity of milk (ml)	Duration (hrs)	Weight of Sample (g)
1	1st	130	3	122
2	2nd	80	3	124
3	3rd	50	2.30	130
4	4th	50	2	135
5	5th	45	1.45	138
6	6th	40	1.30	140
7	7th	40	1.30	145
8	Total	435	15.15	145

Table 4.1.5 showing results of final yield of *Gairika*

Sr. no.	Sample 2	Quantity of SG	Yield obtained	Net Gain	% Gain
1	Ashuddha Gairika	100g	145g	45g	31.03 %

In second method of Purification, *Gairika* was triturated with cow milk. In this method color of *Gairika* was not changed significantly. Red color was obtained to purified *Gairika.*

Due to trituration with cow milk consistency of *Gairika* changed from dry, rough to smooth.

In this method final 31.03 % weight gain was observed.

Table 4.1.6 showing comparative results of *Shodhana* of *Gairika* done by two methods

Sr . no.	Observations	Method 1 Ghritabharjana	Method 2 Godugdha bhavana
1	Ashuddha S.G.	100g	100g
2	Reference	Ayurved Prakash	Rasa ratna samucchaya
3	Ghruta / Cow milk	22g	435ml
4	Yield obtained	114g	145g
5	Net gain	14 g	45 g
6	% gain	12.28%	31.03%

7	Appearance	Powder	Powder
8	Colour	Dark brick red	Red
9	Consistency	Very smooth	Smooth
10	Odour	Earthy	Specific
11	Duration	20 min.	15 hrs 15 min.

In above table comparative readings of purification of *suvarnagairika*, done by two methods were documented.

OBSERVATIONS AND RESULTS OF ANALYTICAL STUDY

Table 4.2.1 showing results of physico-chemical analysis of three samples of *Gairika*

Sr. No.	Test name	Results Obtained		
		Sample R	**Sample 1**	**Sample 2**
1.	Nature	Massive clay	Massive clay	Massive clay
2	Colour	Brick red	Dark brick red	Brick red
3	Streak	Brick red	Brick red	Brick red
4	Fracture	Uneven	Uneven	Uneven
5	Lusture	Earthy	Earthy	Earthy
6	Tenacity	Brittle	Brittle	Brittle
7	Transparency	Opaque	Opaque	Opaque
8	Hardness	5.7	5.4	5.4
9	Specific gravity	2.76	2.71	2.71
10	pH 1%	5.98	5.80	5.12
11	Solubility (HCL)	87%	86 %	89 %
12	LOD	0.1 %	<0.1%	<0.1 %
13	Total Ash	99.07%	99.08%	99.34 %
14	Acid insoluble Ash	10.26%	10.29%	10.26 %
15	Water soluble Ash	98.73%	98.91%	98.87%
16	Sulphated Ash	73.88%	73.70%	69.72%
17	Residue on ignition	0.02%	0.02%	0.02%

*** Sample R- Raw *Gairika*, *Sample 1- *Goghrita Bharjita Gairika*, *Sample 2- *Godugdha bhavita Gairika***.

All three samples of *Gairika* have massive clay nature, brick red streak, uneven fracture, earthy lusture, brittle tenacity and opaque transparency. Samples 1 have dark brick red color while sample R and Sample 2 have brick red color.

Table 4.2.2-XRD- Peak list of Raw *Gairika*

Pos.[^{0}2θ]	Height [cts]	FWHM Left[^{0}2θ]	d-spacing [^{o}A]	Rel.Int.[%]
8.8288	237.82	0.3070	10.01610	3.72
12.3522	6399.84	0.0895	7.16589	100.00
19.8551	638.03	0.1279	4.47172	9.97
20.3224	647.26	0.1535	4.36393	10.11
21.3059	503.90	0.2047	4.17040	7.87
24.1439	591.94	0.2047	3.68623	9.25
24.8562	5535.06	0.0895	3.58219	86.49
26.7078	205.09	0.3070	3.33790	3.20
33.1622	1463.70	0.4605	2.70151	22.87
34.9186	488.59	0.1791	2.56955	7.63
35.6386	2825.40	0.0640	2.51927	44.15
37.6790	514.06	0.1535	2.38741	8.03
38.4246	873.26	0.2047	2.34278	13.65
39.2273	507.62	0.2047	2.29667	7.93
40.8179	524.28	0.2558	2.21077	8.19
45.4755	302.19	0.3070	1.99459	4.72
49.4293	715.60	0.4093	1.84391	11.18
51.0189	236.23	0.2047	1.79013	3.69
54.0573	653.52	0.6140	1.69643	10.21
55.1355	274.26	0.3070	1.66582	4.29
57.3827	72.35	0.8187	1.60551	1.13
60.0030	85.12	0.6140	1.54180	1.33
62.3219	881.30	0.4093	1.48989	13.77
63.9647	936.99	0.1791	1.45554	14.64
72.1414	211.47	0.4093	1.30937	3.30
75.4981	129.40	0.3070	1.285928	2.02

Table 4.2.3-XRD Pattern list of Raw *Gairika*

Visible	Ref. Code	Score	Compound name	Displ. .[^{0}2θ]s	Scale Fac.	Chem.Formula
*	98-018-4766	68	Hematite	0.000	0.368	Fe2o3
*	98-008-7771	47	Kaolinite	0.000	0.717	H4Al2O9Si2

Table 4.2.4-XRD Peak list of sample 1 (*Goghritabharjita Gairika*)

Pos.[^{0}2θ]	Height [cts]	FWHM Left[^{0}2θ]	d-spacing [^{o}A]	Rel.Int.[%]
12.3541	2898.17	0.1023	7.16474	82.10
19.8288	906.42	0.0768	4.47759	25.68
20.3239	1047.80	0.1279	4.36963	29.68
21.2232	831.97	0.3582	4.18645	23.57
23.1034	304.27	0.2047	3.84984	8.62
24.0978	483.43	0.1535	3.69318	13.69
24.8527	3530.17	0.1023	3.58269	100.00
26.6021	1195.18	0.0640	3.35091	33.86
33.1396	1080.79	0.4605	2.70330	30.62
34.9084	610.43	0.2047	2.57027	17.29
35.6194	2471.86	0.1151	2.52059	70.02
35.9874	817.81	0.1535	2 .49565	23.17
37.6661	389.02	0.1279	2.38820	11.02
38.4272	1066.68	0.2814	2.34263	30.22
39.2279	657.79	0.1535	2.29664	18.63

40.8794	418.31	0.5628	2.20759	11.85
45.4405	314.40	0.3582	1.99605	8.91
46.7506	102.16	0.3070	1.94312	2.89
49.4591	630.77	0.2558	1.84287	17.87
51.0121	181.22	0.1535	1.79035	5.13
54.1162	479.78	0.7164	1.69476	13.59
55.1399	341.59	0.3070	1.66570	9.68
56.7753	152.58	0.3070	1.62154	4.32
57.3797	74.33	0.8187	1.60589	2.11
59.9678	148.77	0.3070	1.54262	4.21
62.2784	894.87	0.3582	1.49083	25.35
63.9558	864.35	0.1791	1.45572	24.48
70.1336	146.19	0.5117	1.34185	4.14
71.9777	147.38	0.8187	1.31195	4.17
73.7727	81.67	0.6140	1.28440	2.31
75.3088	118.58	0.6140	1.2 6198	3.36

Table 4.2.5-XRD Pattern list of sample 1 (*Goghritabharjita Gairika*)

Visible	Ref. Code	Score	Compound name	Displ. .[^{0}2θ]s	Scale Fac.	Chem.Formula
*	98-016-8008	62	Hematite	0.000	0.657	Fe1.854O3Ti0.146
*	98-008-7771	49	Kaolinite	0.000	0.861	H4Al2O9Si2
*	98-020-0721	39	Quartz low	0.000	0.337	O2Si1

Table 4.2.6-XRD Peck list of Sample 2 (*Godugdha bhavita Gairika)*

Pos.[^{0}2θ]	Height [cts]	FWHM Left[^{0}2θ]	d-spacing [^{o}A]	Rel.Int.[%]
12.3598	2350.25	0.0768	7.16149	100.00
16.4016	396.89	0.0384	5.40467	16.89
19.1609	425.25	0.1023	4.63213	18.09
19.5520	624.96	0.0640	4.54035	26.59
19.9763	1603.19	0.0768	4.44487	68.21
20.8405	877.30	0.0895	4.26245	37.33
21.2285	894.03	0.1023	4.18542	38.04
22.9010	142.91	0.4093	3.88340	6.08
23.7762	459.47	0.1023	3.74240	19.55
24.8690	2260.64	0.1023	3.28037	96.19
26.6193	1272.79	0.0512	3.34879	54.16
27.4674	166.78	0.1535	3.24729	7.10
33.1589	986.00	0.3582	2.70177	41.95
34.9295	664.66	0.1279	2.56877	28.28
35.5509	2109.46	0.1023	2.52528	89.75
37.6842	317.15	0.2558	2.38709	13.49
38.4684	848.70	0.1791	2.34021	36.11
39.2210	518.01	0.1023	2.29703	22.04
40.7659	351.20	0.6140	2.21347	14.94
45.4616	233.95	0.5117	1.99517	9.95
49.4558	526.91	0.3070	1.84298	22.42
54.1563	457.25	0.4093	1.69360	19.46
55.0791	290.42	0.4093	1.66739	12.36
57.3941	73.75	0.8187	1.60552	3.14
59.9890	151.38	0.3070	1.54213	6.44
62.2997	830.55	0.4.93	1.49037	35.34
63.9767	855.78	0.2047	1.45529	36.41
72.1594	120.59	0.5117	1.30909	5.13

Table 4.2.7-XRD Pattern list of Sample 2 (*Godugdha bhavita Gairika*)

Visible	Ref. Code	Score	Compound name	Displ. .[^{0}2θ]s	Scale Fac.	Chem.Formula
*	98-008-7771	41	Kaolinite	0.000	1.034	H4Al2O9Si2
*	98-015-6196	44	Quartz	0.000	0.614	O2Si1
*	98-017-4468	55	Hematite	0.000	0.707	Fe1.9O3Sn0.1

Table 4.2.8 - XRD analysis of all samples of *Gairika* with its compound and Peak scores

Sr. No.	Sample	Compound name	Peak score	Chemical Formula
1	Raw Gairika	Hematite Kaolinite	68 47	Fe2o3 H4Al2O9Si2
2	Goghrita bharjita Gairika	Hematite Kaolinite Quartz low	62 49 39	Fe1.854O3Ti0.146 H4Al2O9Si2 O2Si1
3	Godugdha bhavita Gairika	Hematite Quartz Kaolinite	55 44 41	Fe1.9O3Sn0.1 O2Si1 H4Al2O9Si2

According to XRD pattern and pick value, *Raw Gairika* have a composition of Fe2O3 and H4Al2O9Si2 i.e. Hematite and Kaolinite with score 68 and 47 respectively. XRD pattern of sample 1 shows composition of Fe1.854O3Ti0.146, H4Al2O9Si2, and O2Si1 with compounds Hematite, Kaolinite and Quartz low with score 62, 49 and 39 respectively while XRD pattern of Sample 2 shows

Fe1.9O3Sn0.1, O2Si1,H4Al2O9Si2 composition with compound name Hematite, Quartz and Kaolinite respectively and score was 55,44 and 41.

Quartz was not found in raw *Gairika*. But after pufification in sample 1 and 2 XRD pattern shows peaks for Quartz in score (39, 44). Kaolinite score get reduced in sample 2 as compare to sample 1 and raw *Gairika.* Raw *Gairika* shows highest Hematite score than shodhita *Gairika*. It may be due to, during *shodhana* process some chemical changes occurred which alters Hematite concentration of *Gairika.*

Table 4.2.9 showing analysis of ICP-AES of three samples of *Gairika*

Sr .no.	Samples	Cd	Cu	Fe	Pb	As	Hg
		%	%	%	%	%	%
1	S1	ND	0.0023	23.303	0.0044	ND	ND
2	S2	ND	0.0020	17.201	0.0067	ND	0.0142
3	R	ND	0.0016	26.353	0.0049	ND	ND

ND- Means less than 0.01 ppm.

Table 4.2.10- showing readings of SEM-EDS of two samples of *Gairika*

Sr no.	Elements	Sample 1	Sample 2
1	**C**	**17.19**	**5.18**
2	**O**	**46.48**	**52.71**
3	**Mg**	**0.00**	**0.00**
4	**Al**	**14.88**	**13.18**
5	**Si**	**16.26**	**14.44**
6	**Ca**	**0.00**	**0.00**
7	**Fe**	**4.33**	**13.87**
8	**Cu**	**0.87**	**0.61**

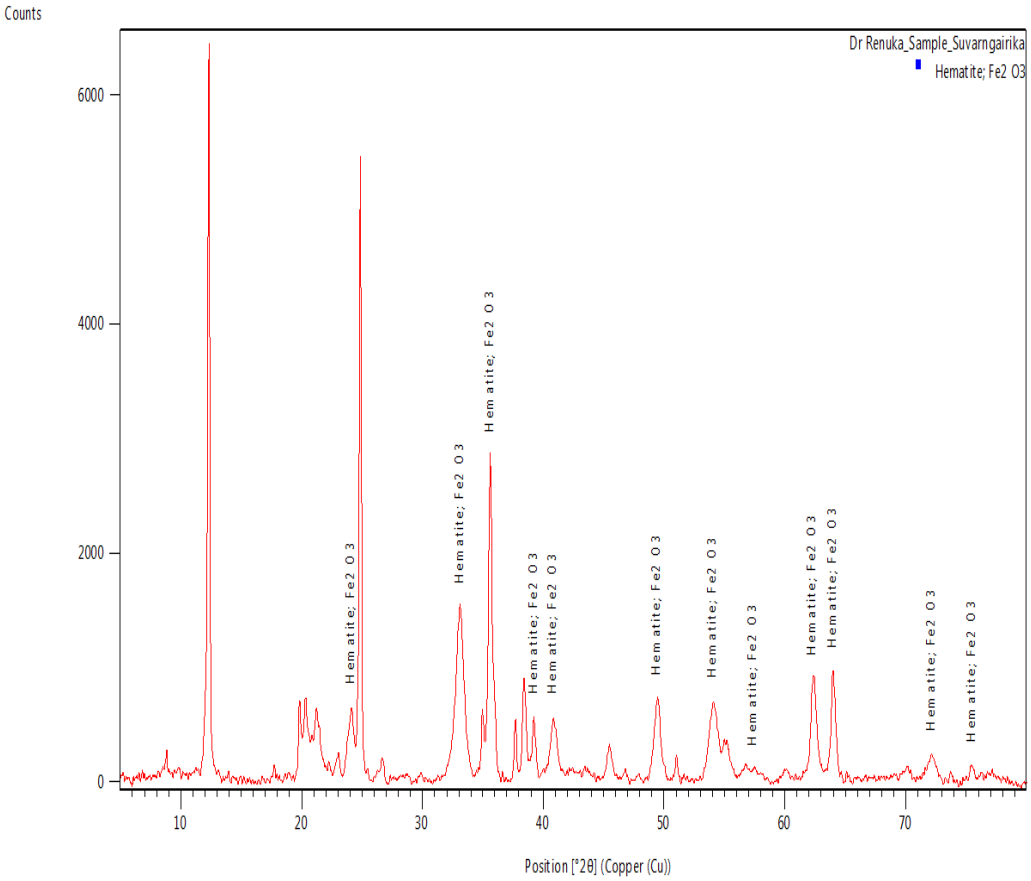
Table 4.2.11 showing readings of SEM-WDS of two samples of *Gairika*

Sr no.	Elements	Sample 1	Sample 2
1	**Cu**	**1.305**	**0.638**
2	**Fe**	**29.477**	**22.998**
3	**Ca**	**0.115**	**0.048**
4	**Al**	**30.045**	**23.390**
5	**Mg**	**0.050**	**0.076**
6	**O**	**39.007**	**52.850**

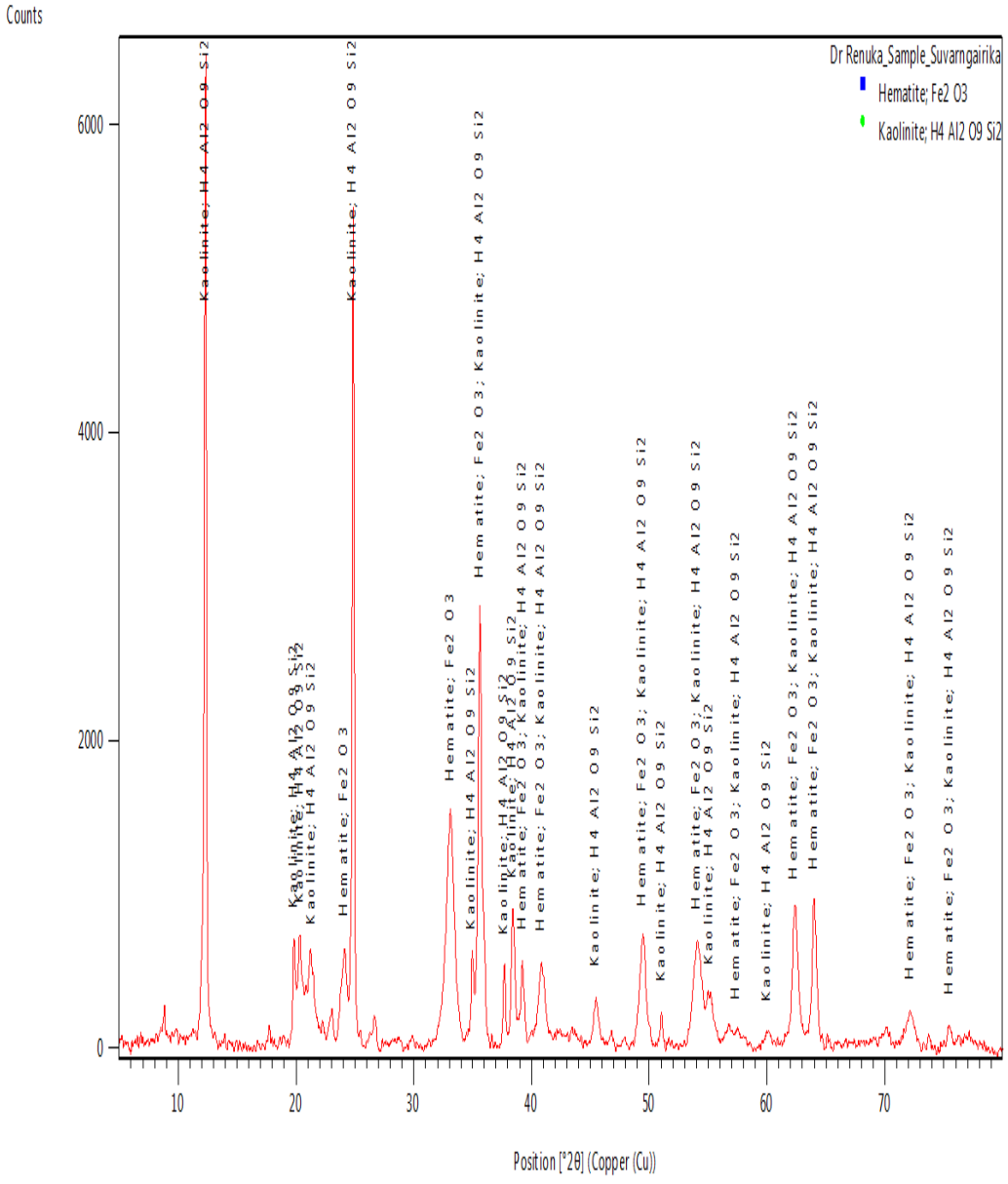
XRD- Pattern and Pick - Graphical Presentation of GAIRIKA

XRD- Pattern and Pick - Graphical Presentation of GAIRIKA

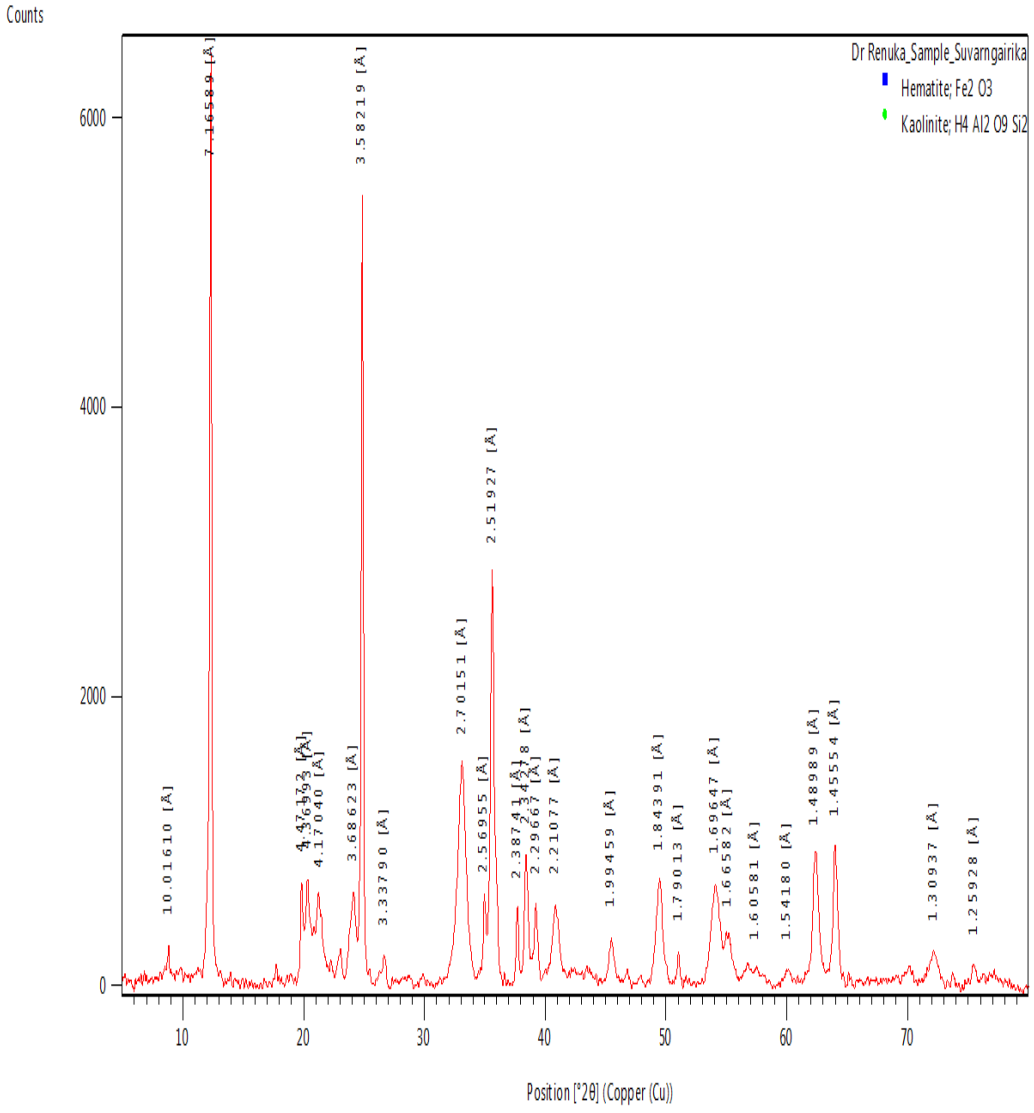
Graph 4.2.1- XRD Pattern of Raw Gairika



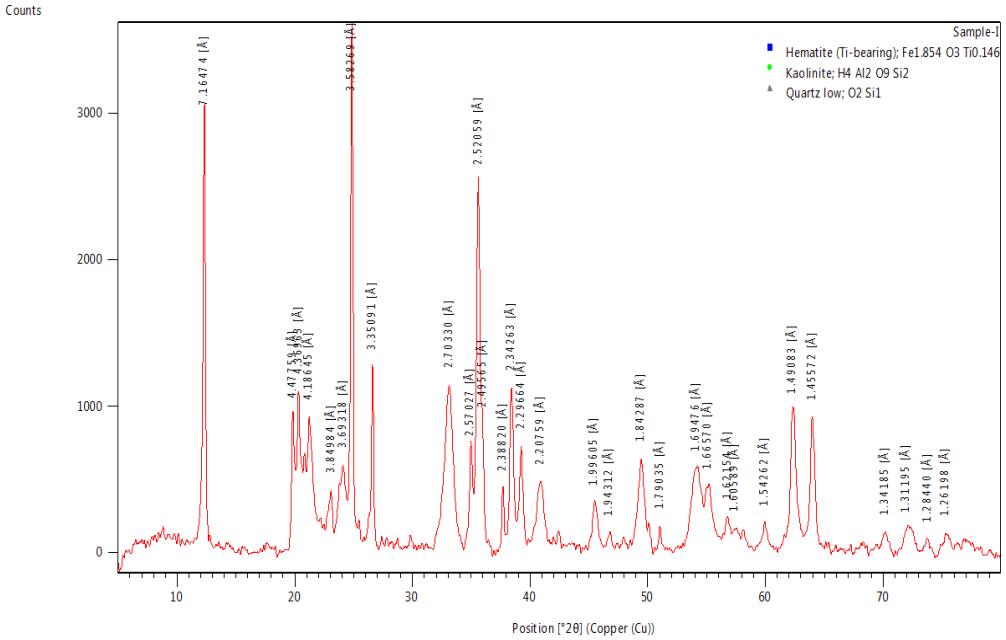
Graph 4.2.2- XRD Pattern of Raw Gairika



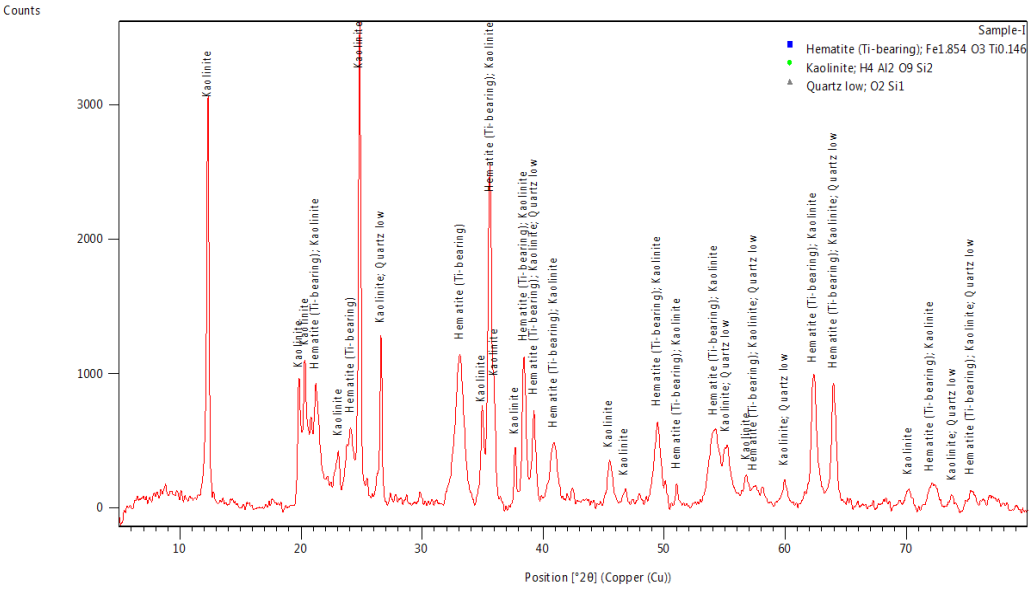
Graph 4.2.3- XRD Peak Pattern of Raw Gairika



Graph 4.2.4 and 4.5 – XRD Pattern of Sample 1



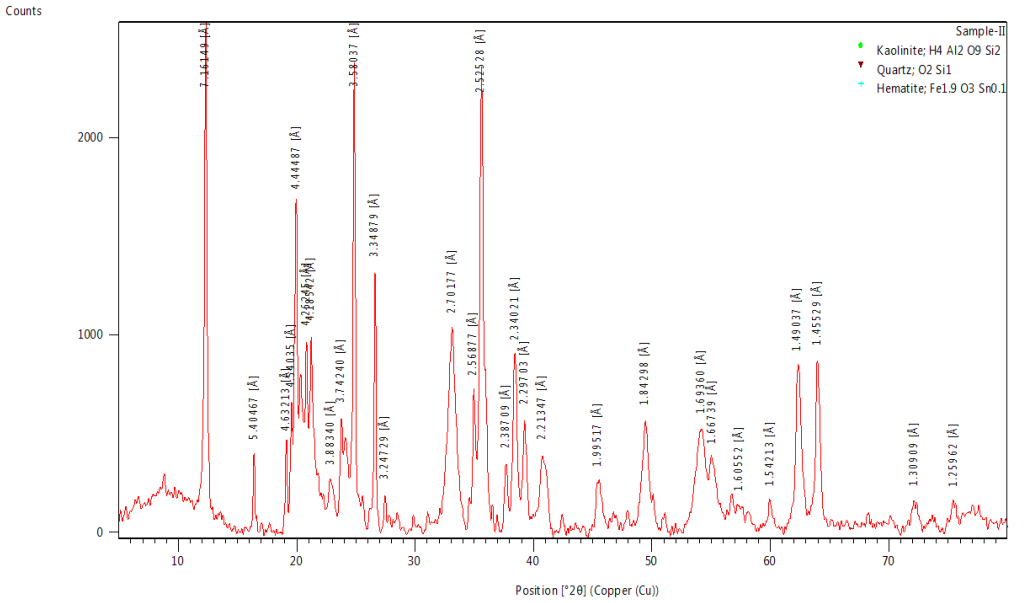
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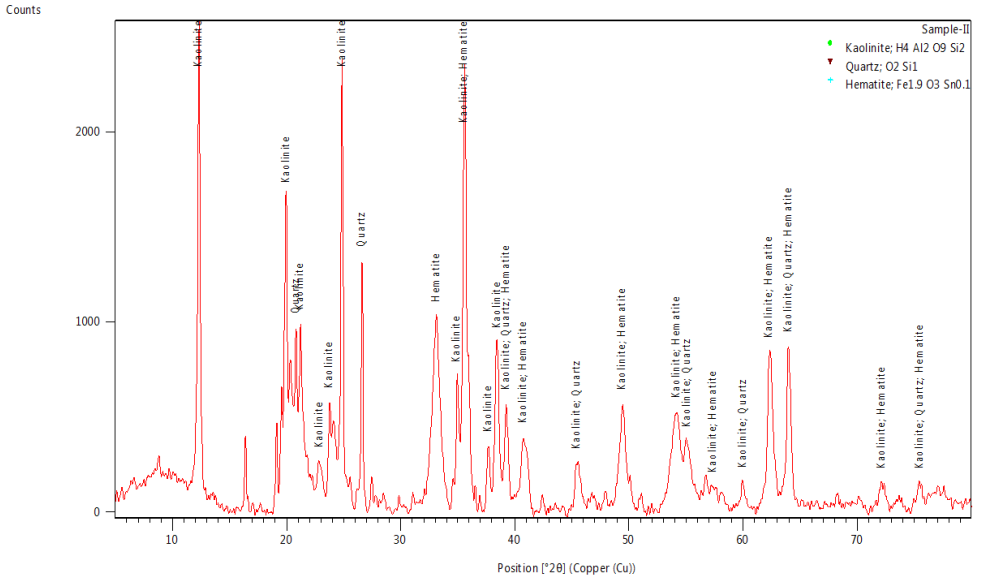
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Graph 4.2.5.

Graph 4.2.6 & 4.2.7- XRD Graphical Presentation of Sample 2



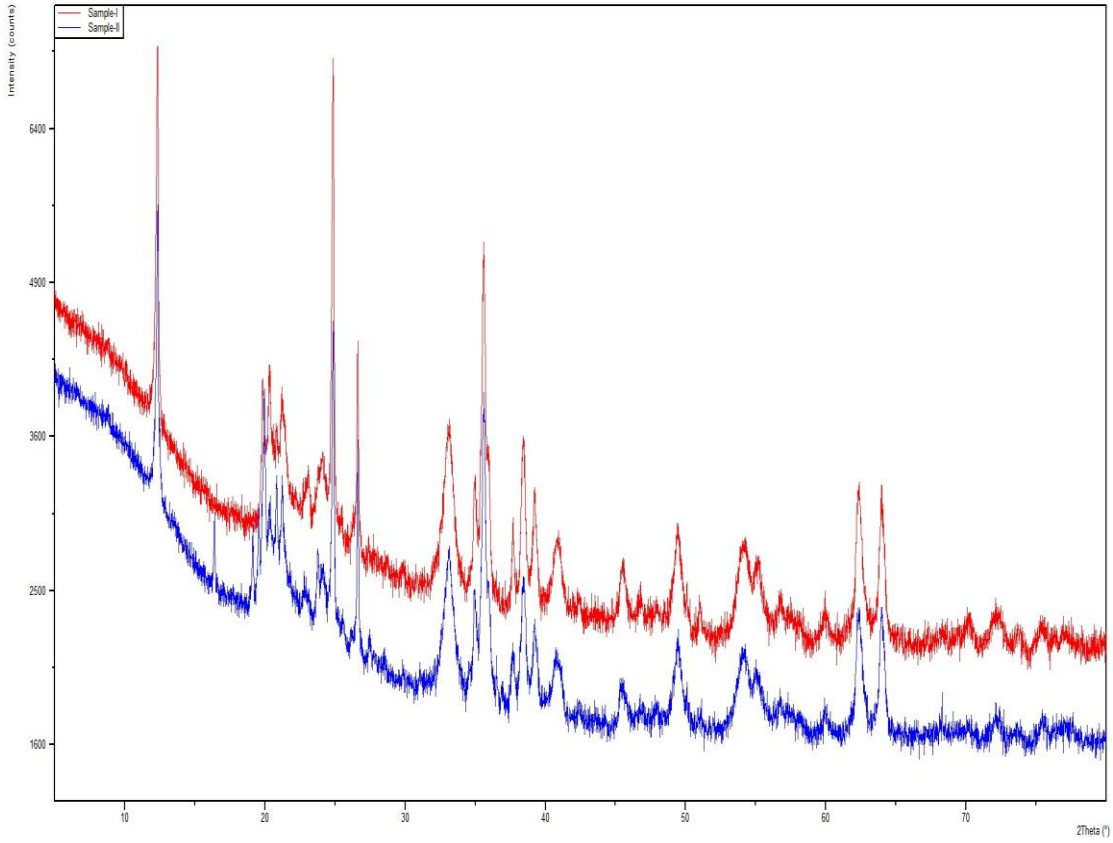
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Graph 4.2.7.

Graph- 4.2.8 Combined graphical presentation of Sample 1 and 2



SEM- Topographic images of Sample 1 and 2 at 10,000 X magnification.

Image of Sample 1 at 10,000 magnification

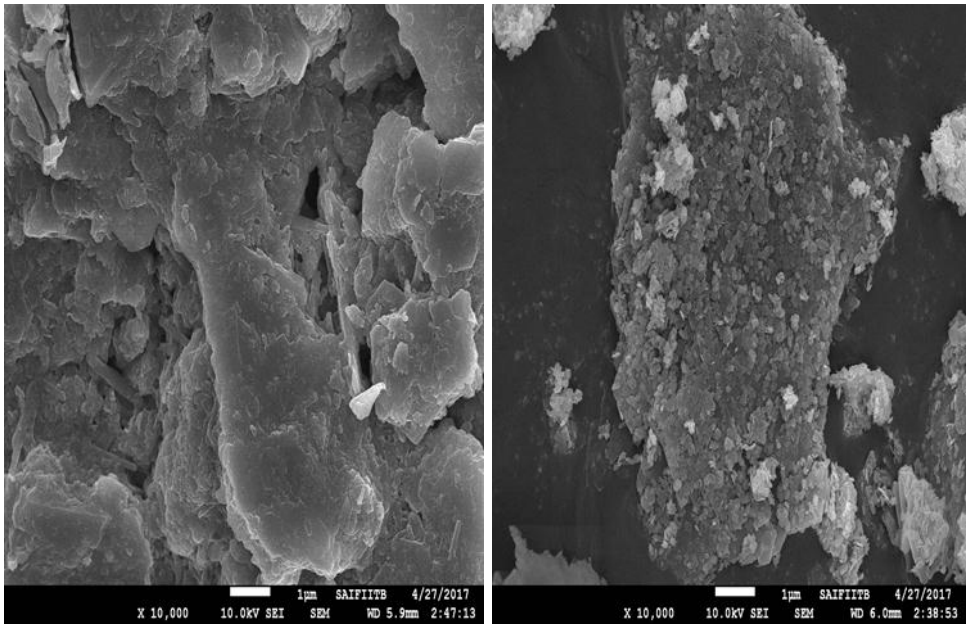
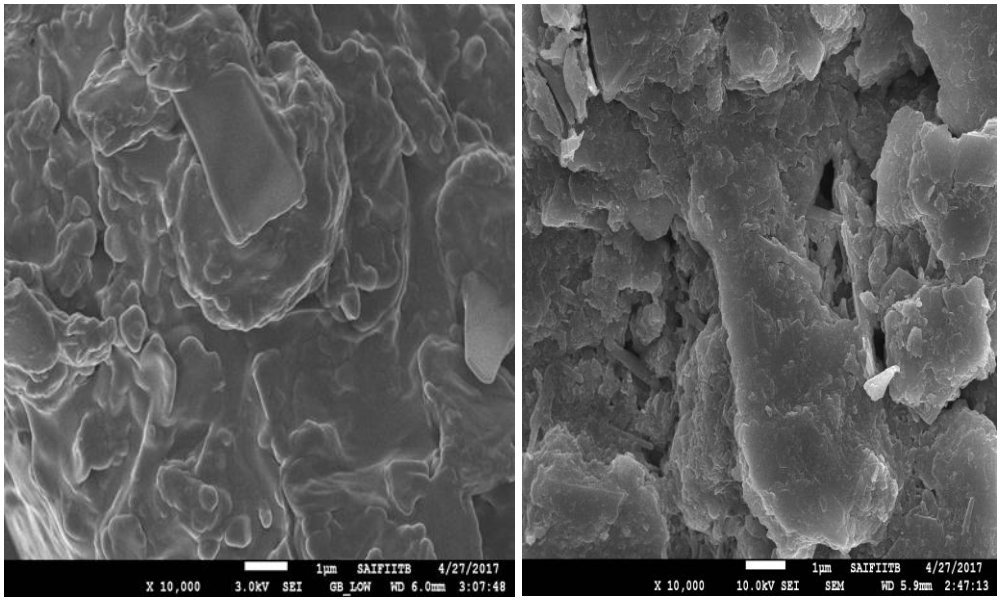
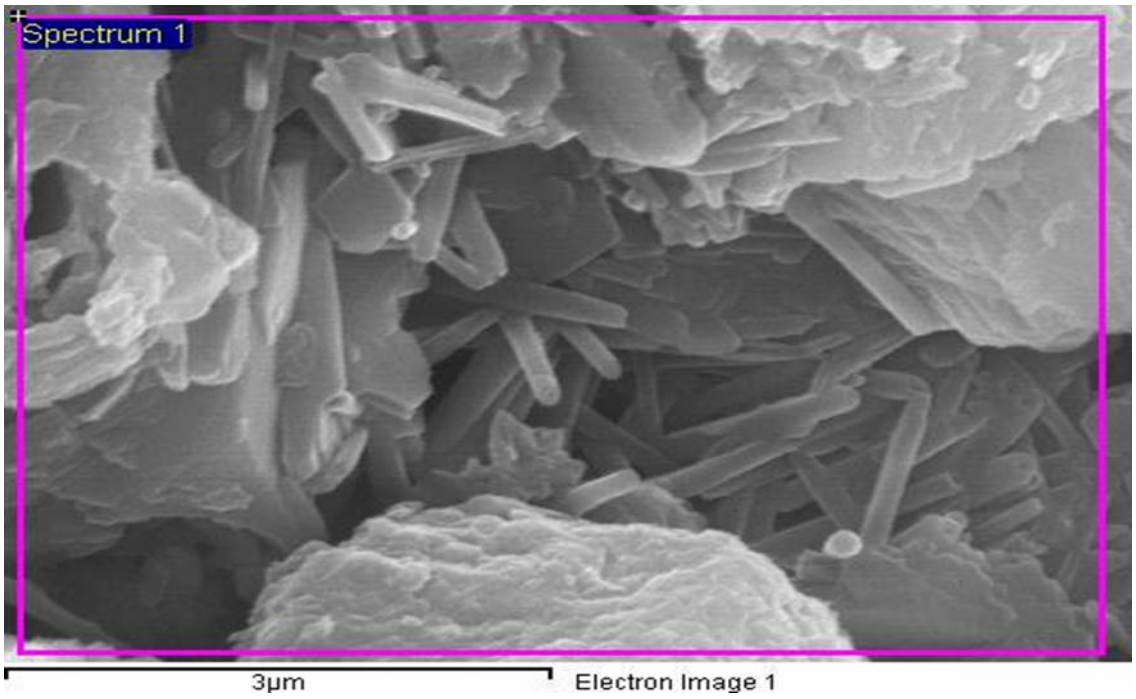
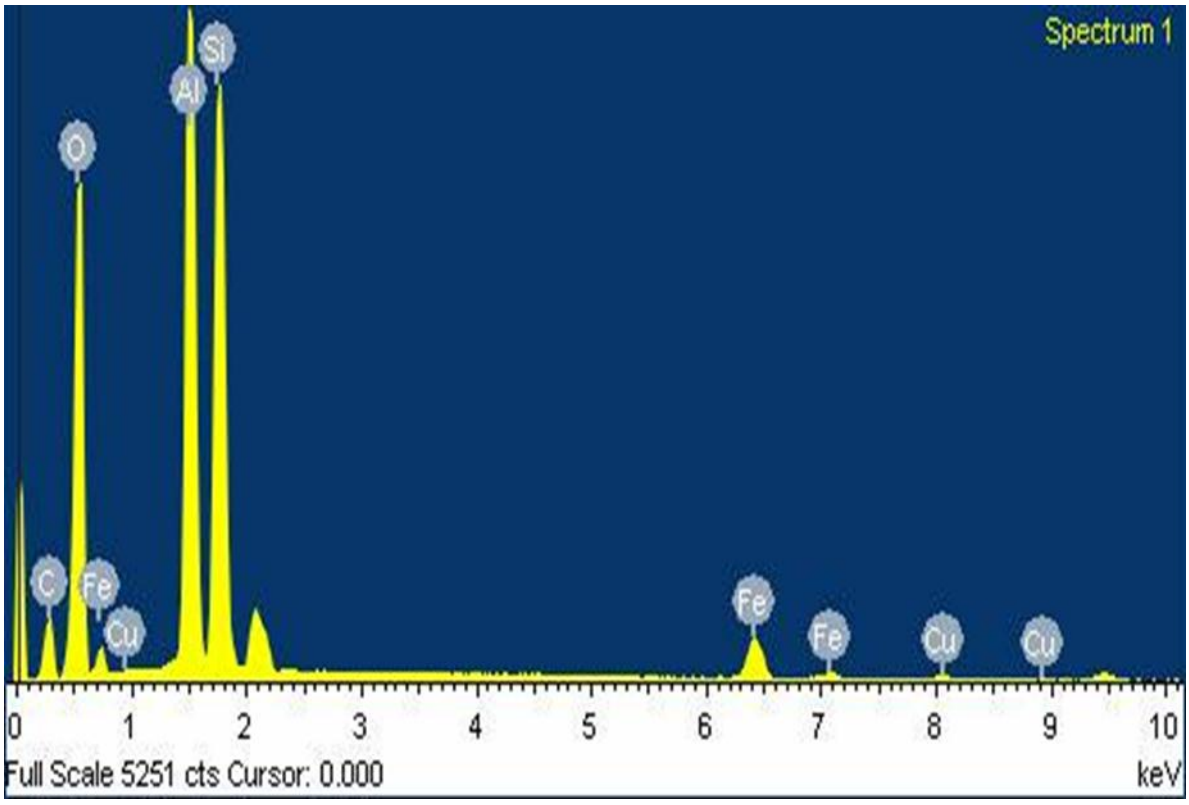


Image of Sample 2 at 10,000 magnifications

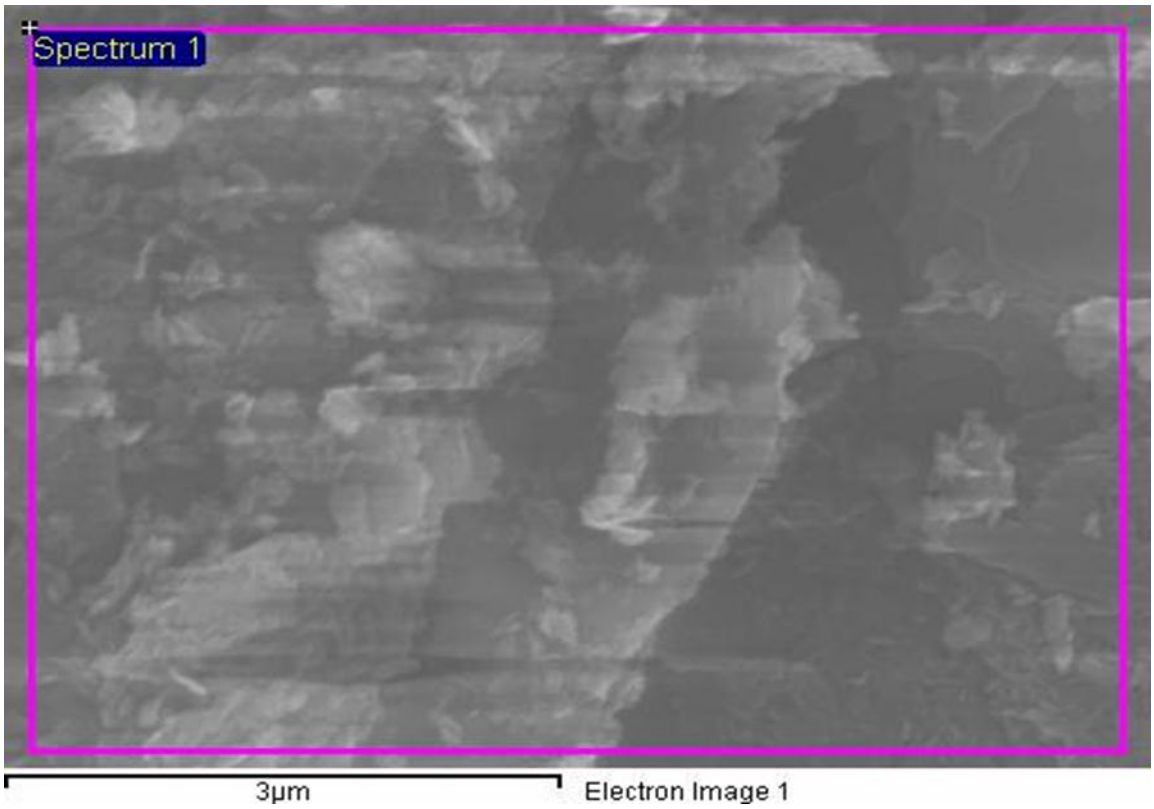


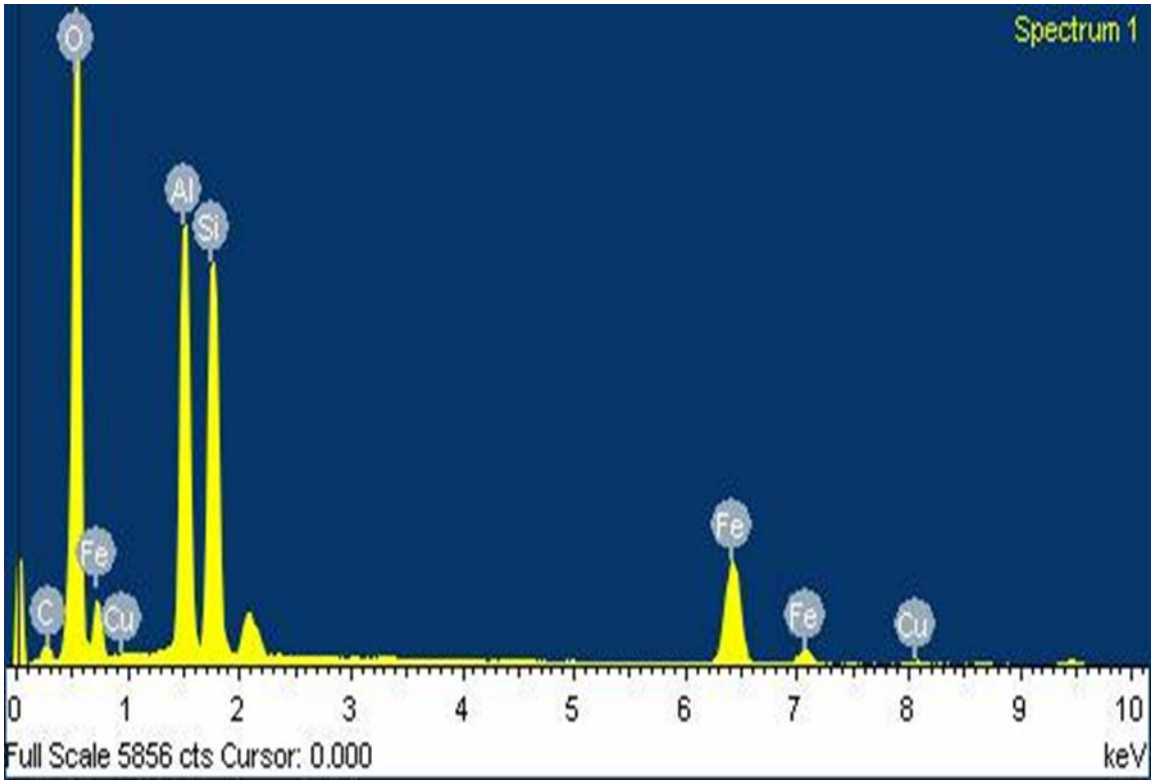
SEM- Topographic Electron image of Sample 1 (*Goghritabharjita Gairika*)





SEM-Topographic Electron image of Sample 2 (*Godugdha bhavita Gairika*)





OBSERVATIONS AND RESULTS OF EXPERIMENTAL STUDY

Table 4.3.1- Test system and management of Experimental Study:-

Species	Rats
Strain	Sprague Dawley
Source	APT Testing and Research Pvt. Ltd.
Age	7-9 week
Body weight range	150 to 180g
Identification	By unique identification number marked by writing on cage tag and by corresponding colour body markings.
No. of animals	Six animals were tested per group.(30)
Acclimatization	The rats were housed in their cages for five days prior to start of dosing in the experimental room after veterinary examination.
Environmental conditions	Room temperature maintained between 22 ± 3^0 C, relative humidity 50-60 % and illumination cycle set to 12 hours light and 12 hours dark
Accommodation	Three rats per cage housed in polypropylene cages with stainless steel grill top, facilities for food and water bottle, and bedding of clean paddy husk.
Diet	Pelleted feed supplied by Supplier.
Water	Potable water passed through 'Aquaguard' water filter was provided *ad libitum* in plastic bottles with stainless steel sipper tubes.

Table 4.3.2- showing mean body weight of all groups:-

Sr.no.	**Group**	**Body weight in gram**				
		0 day	**7 day**	**14 day**	**21day**	**28 day**
1	NC	152.0	159.3	166.7	173.0	182.5
2	DC	153.8	157.6	162.4	169.4	174.8
3	STD	155.8	162.0	168.2	172.3	178.7
4	T1	154.0	158.8	164.8	168.4	173.8
5	T2	156.7	167.8	174.2	180.8	185.8

Table 4.3.3- showing mean Haematology results of all groups at end of study:-

Group	RBC (10^6/µl)	HCB (gm/L)	HCT (%)	MCV (fl)	MCH (pg)	MCHC (gm/L)	Sr.Ferritin (ng/ml)	Sr.Iron (µg/dl)	TIBC (µg/dl)
NC	9.3	16.6	51.5	55.5	17.8	32.2	81.09	189.7	263.0
DC	4.4	7.9	24.0	56.3	18.7	33.1	64.66	114.2	185.6
STD	7.4	14.5	38.3	60.0	19.5	32.6	70.80	151.8	232.5
T1	7.8	15.3	48.8	62.6	19.4	31.0	58.09	154.4	248.6
T2	7.4	13.7	45.5	61.9	18.5	30.0	57.81	169.2	234.2

- **Statistical analysis by parametric ANOVA (one way)**
- **[A] Body Weight**

Table 4.3.4- Shows Statistical Analysis by Parametric ANOVA for Body Weight

Group	N	Mean	SD	F	P
DC	5	20.000	3.317	9.505	0.0001
NC	6	**30.667**	3.830		
STD	6	22.833	4.021		
T1	5	19.800	3.114		
T2	5	**28.200**	4.087		

As value of P is less than 0.05 (Table 4.3.4), variation among column means is significantly greater than expected by chance. Mean of NC group and T2 group were greater among all. It suggests NC group and T2 group have shown body weight gain significantly among all groups.

Table 4.3.5- shows Bonferroni Comparison test for Body Weight

Comparison	Mean Diff	t	P	Significance	Result
DC vs. NC	-10.667	4.714	**< 0.001**	**Significant**	**NC > DC**
DC vs. STD	-2.833	1.259	> 0.05	Not Significant	DC ≈ STD
DC vs. T1	0.200	0.0851	> 0.05	Not Significant	DC ≈ T1
DC vs. T2	-8.200	3.489	**< 0.01**	**Significant**	**T2 > DC**
NC vs. STD	7.833	3.651	**< 0.05**	**Significant**	**NC > STD**
NC vs. T1	10.867	4.829	**< 0.001**	**Significant**	**NC > T1**
NC vs. T2	2.467	1.096	> 0.05	Not Significant	NC ≈ T2
STD vs. T1	3.033	1.348	> 0.05	Not Significant	STD ≈ T1
STD vs. T2	-5.367	2.385	> 0.05	Not Significant	STD ≈ T2
T1 vs. T2	-8.400	3.547	**< 0.05**	**Significant**	**T2 > T1**

(≈ means difference is not significant)

Standard Control group has shown more weight gain than disease control group. T1 group has less weight gain than disease control group. T2 group has less weight gain than normal control group. T1 group have lesser weight gain standard control. T2 group have more weight gain than standard control. But value of P is greater than 0.05 (Table 4.3.5) hence above said differences not significantly greater than expected by chance.

Normal control group (P<0.001) and T2 group (P<0.01) shown to be increase weight significantly in comparison with disease control group. Standard control (P<0.05) and T1 group (P<0.001) shows significant decrease in weight when

compared with normal control group. Treatment group 2 (P<0.05) shows significant changes in weight gain in comparison with T1 group.

[B] RBC

Table 4.3.6- Shows Parametric ANOVA test for RBC count:-

Group	N	Mean	SD	F	P
DC	5	-0.2800	1.066	21.198	0.0001
NC	6	0.6833	0.8976		
STD	6	**3.833**	0.7916		
T1	5	**3.860**	1.148		
T2	5	3.220	0.9524		

As value of P is less than 0.05 (Table 4.3.6), variation among column means is significantly greater than expected by chance. Mean of T1, STD group, and T2 group were greater among all. It suggests standard control group, T1 and T2 group have shown increased RBC levels significantly among these groups.

Table 4.3.7 – Shows Bonferroni Comparison test for RBC count:-

Comparison	Mean Diff	t	P	Significance	Result
DC vs. NC	-0.9633	1.644	>0.05	Not Significant	NC ≈ DC
DC vs. STD	-4.113	7.018	**<0.001**	**Highly Significant**	**STD>DC**
DC vs. T1	-4.140	6.763	**<0.001**	**Highly Significant**	**T1>DC**
DC vs. T2	-3.500	5.718	**< 0.001**	**Highly Significant**	**T2 > DC**
NC vs. STD	-3.150	5.637	**< 0.001**	**Highly Significant**	**STD > NC**
NC vs. T1	-3.177	5.420	**< 0.001**	**Highly Significant**	**T1 > NC**
NC vs. T2	-2.537	4.328	**< 0.01**	**Significant**	**T2>NC**
STD vs. T1	-0.02667	0.04550	> 0.05	Not Significant	STD ≈ T1
STD vs. T2	0.6133	1.046	> 0.05	Not Significant	STD ≈ T2
T1 vs. T2	0.6400	1.046	> 0.05	Not Significant	T1≈T2

(≈ means difference is not significant)

Normal Control group has shown more RBC count than disease control group. T1 group have more RBC level than standard control group. T2 group have less RBC level than Standard control group. Test 2 group has shown less RBC count than T1

group. But value of P is greater than 0.05 (Table 4.3.7) hence above said difference not significantly greater than expected by chance.

While RBC levels were found to be increased significantly in Standard control (P<0.001), T1 (P<0.001) and T2 (P<0.001) group in comparison with disease control group animals. Also results show significant increase in STD (P<0.001), T1 (P<0.001) and T2 (P<0.01) group when compared with normal control group animals.

[C] Haemoglobin

Table 4.3.8- Shows Parametric ANOVA test for Hbgm/L:-

Group	N	Mean	SD	F	P
DC	5	-2.040	0.4775	8.306	0.0003
NC	6	1.367	2.013		
STD	6	**4.550**	0.9975		
T1	5	**5.200**	4.508		
T2	5	3.100	1.409		

As value of P is less than 0.05 (Table 4.3.8), variation among column means is significantly greater than expected by chance. Mean of T1 and STD group were greater among all. It suggests standard control group and T1 group have shown increased Haemoglobin levels significantly among these groups.

Table 4.3.9 – Shows Bonferroni Comparison test for Hb gm/L:-

Comparison	Mean Diff	t	P	Significance	Result
DC vs. NC	-3.407	2.457	>0.05	Not Significant	DC ≈ NC
DC vs. STD	-6.590	4.753	**<0.001**	**Highly Significant**	**STD>DC**
DC vs. T1	-7.240	4.999	**<0.001**	**Highly Significant**	**T1>DC**
DC vs. T2	-5.140	3.549	**< 0.05**	**Significant**	**T2 > DC**
NC vs. STD	-3.183	2.408	> 0.05	Not Significant	STD ≈ NC
NC vs. T1	-3.833	2.765	> 0.05	Not Significant	T1 ≈ NC
NC vs. T2	-1.733	1.250	> 0.05	Not Significant	T2 ≈ NC
STD vs. T1	-0.6500	0.4688	> 0.05	Not Significant	STD ≈ T1
STD vs. T2	1.450	1.046	> 0.05	Not Significant	STD ≈ T2
T1 vs. T2	2.100	1.450	> 0.05	Not Significant	T1 ≈ T2

(≈ means difference is not significant)

Normal Control group has shown more haemoglobin count than disease control group. Standard control group, T1 and T2 group have more Haemoglobin level than normal control group. Test 1 group shows more haemoglobin count than standard control group. Test 2 group has less haemoglobin level than standard control group. Also T2 group has less haemoglobin level than T1 group. But value of P is greater than 0.05 (Table 4.3.9) hence above said difference not significantly greater than expected by chance.

While haemoglobin level found to be significantly increased in Standard control (P<0.001), T1 (P<0.001) and T2 (P<0.05) group in comparison with disease control group animals.

[D] HCT

Table 4.3.10- Shows Parametric ANOVA test for HCT%:-

Group	N	Mean	SD	F	P
DC	5	2.020	4.420	8.208	0.0003
NC	6	5.367	5.385		
STD	6	19.150	15.838		
T1	5	**28.760**	8.599		
T2	5	**23.680**	5.369		

As value of P is less than 0.05 (Table 4.3.10), variation among column means is significantly greater than expected by chance. Mean of T1 and T2 group were greater among all. It suggests T1 and T2 group have shown increased Haematocrit levels significantly among these groups.

Table 4.3.11 – Shows Bonferroni Comparison test for HCT%:-

Comparison	Mean Diff	t	P	Significance	Result
DC vs. NC	-3.347	0.5965	>0.05	Not Significant	DC ≈ NC
DC vs. STD	-17.130	3.053	>0.05	Not Significant	STD ≈ DC
DC vs. T1	-26.740	4.563	**<0.01**	**Significant**	**T1>DC**
DC vs. T2	-21.660	3.696	**< 0.05**	**Significant**	**T2 > DC**
NC vs. STD	-13.783	2.577	> 0.05	Not Significant	STD ≈ NC
NC vs. T1	-23.393	4.170	**<0.01**	**Significant**	**T1 > NC**
NC vs. T2	-18.313	3.264	**< 0.05**	**Significant**	**T2 > NC**
STD vs. T1	-9.610	1.713	> 0.05	Not Significant	STD ≈ T1
STD vs. T2	-4.530	0.8075	> 0.05	Not Significant	STD ≈ T2
T1 vs. T2	5.080	0.8669	> 0.05	Not Significant	T1 ≈ T2

(≈ means difference is not significant)

Normal Control group and standard control group has shown more haematocrit level than disease control group. Standard control group also have more Haematocrit level than normal control group. Test 1 group and Test 2 group shows more haematocrit count than standard control group. Test 2 group has less haematocrit level than T1 group. But value of P is greater than 0.05 (Table 4.3.11) hence above said difference not significantly greater than expected by chance.

While haematocrit level found to be significantly increased in T1 ($P<0.01$) and T2 ($P<0.05$) group in comparison with disease control group animals. Also HCT level increased significantly in T1 group ($P<0.01$) and T2 group ($P<0.05$) when compared with normal control group.

[E] MCV

Table 4.3.12- Shows Parametric ANOVA test for MCV:-

Group	N	Mean	SD	F	P
DC	5	**9.120**	8.042	2.778	0.0523
NC	6	1.767	1.154		
STD	6	5.750	6.445		
T1	5	**11.580**	4.274		
T2	5	9.060	4.748		

As value of P is equal to 0.05 (Table 4.3.12), variation among column means is not significantly greater than expected by chance. It means that MCV level of all group were almost equal to each other.

Table 4.3.13– Shows Bonferroni Comparison test for MCV:-

Comparison	Mean Diff	t	P	Significance	Result
DC vs. NC	7.353	2.258	>0.05	Not Significant	DC ≈ NC
DC vs. STD	3.370	1.035	>0.05	Not Significant	STD ≈ DC
DC vs. T1	-2.460	0.7232	>0.05	Not Significant	T1 ≈ DC
DC vs. T2	0.0600	0.0176	>0.05	Not Significant	T2 ≈ DC
NC vs. STD	-3.983	1.283	>0.05	Not Significant	STD ≈ NC
NC vs. T1	-9.813	3.013	>0.05	Not Significant	T1 ≈ NC
NC vs. T2	-7.293	2.240	>0.05	Not Significant	T2 ≈ NC
STD vs. T1	-5.830	1.790	>0.05	Not Significant	STD ≈ T1
STD vs. T2	-3.310	1.016	>0.05	Not Significant	STD ≈ T2
T1 vs. T2	2.520	0.7409	>0.05	Not Significant	T1 ≈ T2

(≈ means difference is not significant)

Normal Control group, standard control group and T2 group has shown less MCV level than disease control group. T1 group shows more MCV level than disease control group. Standard control group, T1 and T2 group shows more MCV level in comparison with normal control group. T1 and T2 group have more MCV levels than standard control group. Test 2 group have less MCV level than Test 1 group. But value of P is greater than 0.05 (Table 4.3.13) hence above said difference not significantly greater than expected by chance. It means all groups shows equal results on MCV count.

[F] MCH

Table 4.3.14- Shows Parametric ANOVA test for MCH:-

Group	N	Mean	SD	F	P
DC	5	-2.920	5.798	3.600	0.0210
NC	6	0.1667	0.5955		
STD	6	**-9.367**	6.760		
T1	5	-6.400	4.913		
T2	5	-7.120	3.173		

As value of P is less than 0.05 (Table 4.3.14), variation among column means is significantly greater than expected by chance. Mean of standard control has greater among all. It suggests standard control group have shown increased MCH levels significantly in this group.

Table 4.3.15 – Shows Bonferroni Comparison test for MCH:-

Comparison	Mean Diff	t	P	Significance	Result
DC vs. NC	-3.087	1.068	>0.05	Not Significant	DC ≈ NC
DC vs. STD	6.447	2.230	>0.05	Not Significant	STD ≈ DC
DC vs. T1	3.480	1.152	>0.05	Not Significant	T1 ≈ DC
DC vs. T2	4.200	1.391	>0.05	Not Significant	T2 ≈ DC
NC vs. STD	9.533	3.458	<0.05	**Significant**	**NC >STD**
NC vs. T1	6.567	2.271	>0.05	Not Significant	T1 ≈ NC
NC vs. T2	7.287	2.520	>0.05	Not Significant	T2 ≈ NC
STD vs. T1	-2.967	1.026	>0.05	Not Significant	STD ≈ T1
STD vs. T2	-2.247	0.7771	>0.05	Not Significant	STD ≈ T2
T1 vs. T2	0.7200	0.2384	>0.05	Not Significant	T1 ≈ T2

(≈ means difference is not significant)

Normal Control group have more MCH level than disease control group. Standard control group, T1 and T2 group has shown less MCH level than disease

control group.T1 and T2 group shows less MCH level than normal control group.T1 and T2 group have more MCH levels than standard control group. Test 2 group have less MCH level than Test 1 group. But value of P is greater than 0.05 (Table 4.3.15) hence above said difference not significantly greater than expected by chance.

While standard control group shows less MCH level than normal control group. As P <0.05, it suggest there were significant increase in MCH level in normal control group.

[G] MCHC

Table 4.3.16- Shows Parametric ANOVA test for MCHC:-

Group	N	Mean	SD	F	P
DC	5	-13.780	10.971	6.857	0.0010
NC	6	-0.7667	1.294		
STD	6	**-20.333**	9.495		
T1	5	**-19.600**	8.177		
T2	5	**-18.480**	2.847		

As value of P is less than 0.05 (Table 4.3.16), variation among column means is significantly greater than expected by chance. Mean of standard control, T1 and T2 group has greater among all. It suggests standard control T1 and T2 group have shown increased MCHC levels significantly in these groups.

Table 4.3.17 – Shows Bonferroni Comparison test for MCHC:-

Comparison	Mean Diff	t	P	Significance	Result
DC vs. NC	-13.013	2.862	>0.05	Not Significant	DC ≈ NC
DC vs. STD	6.553	1.441	>0.05	Not Significant	STD ≈ DC
DC vs. T1	5.820	1.225	>0.05	Not Significant	T1 ≈ DC
DC vs. T2	4.700	0.9897	>0.05	Not Significant	T2 ≈ DC
NC vs. STD	19.567	4.513	**<0.01**	**Significant**	**NC> STD**
NC vs. T1	18.833	4.142	**<0.01**	**Significant**	**NC > T1**
NC vs. T2	17.713	3.896	**<0.01**	**Significant**	**NC>T2**
STD vs. T1	-0.7333	0.1613	>0.05	Not Significant	STD ≈ T1
STD vs. T2	-1.853	0.4076	>0.05	Not Significant	STD ≈ T2
T1 vs. T2	-1.120	0.2358	>0.05	Not Significant	T1 ≈ T2

(≈ means difference is not significant)

Normal Control group has more MCHC level than disease control group. Standard control group, T1 and T2 group shows less MCHC than disease control

group. Test 1 group and Test 2 group shows more MCHC level than standard control group. Test 2 group also has less MCHC level than T1 group. But value of P is greater than 0.05 (Table 4.3.17) hence above said difference not significantly greater than expected by chance.

Standard control, T1 and T2 group shows less MCHC levels than normal control group. But here P< 0.01, so it can be considered that MCHC levels increased significantly in normal control group animals.

[H] Ferritin

Table 4.3.18- Shows Parametric ANOVA test for Ferritin:-

Group	N	Mean	SD	F	P
DC	5	64.680	4.376	4.796	0.0062
NC	6	**81.087**	8.191		
STD	6	70.803	16.371		
T1	5	58.090	8.448		
T2	5	57.810	9.954		

As value of P is less than 0.05 (Table 4.3.18), variation among column means is significantly greater than expected by chance. Mean of normal control was greater among all. It suggests normal control group shows significant increased in Ferritin content.

Table 4.3.19 – Shows Bonferroni Comparison test for Ferritin:-

Comparison	Mean Diff	t	P	Significance	Result
DC vs. NC	-16.407	2.576	>0.05	Not Significant	DC ≈ NC
DC vs. STD	-6.123	0.9614	>0.05	Not Significant	STD ≈ DC
DC vs. T1	6.590	0.9906	>0.05	Not Significant	T1 ≈ DC
DC vs. T2	6.870	1.033	>0.05	Not Significant	T2 ≈ DC
NC vs. STD	10.283	1.693	>0.05	Not Significant	STD ≈ NC
NC vs. T1	22.997	3.611	**<0.05**	**Significant**	**NC > T1**
NC vs. T2	23.277	3.655	**<0.05**	**Significant**	**NC > T2**
STD vs. T1	12.713	1.996	>0.05	Not Significant	STD ≈ T1
STD vs. T2	12.993	2.040	>0.05	Not Significant	STD ≈ T2
T1 vs. T2	0.2800	0.0420	>0.05	Not Significant	T1 ≈ T2

(≈ means difference is not significant)

Normal Control and standard control group have more Ferritin level than disease control group. T1 and T2 group have less Ferritin content than disease control

group. Standard control group also have less Ferritin level than normal control group.T1 and T2 group shows less Ferritin level than standard control group. Test 2 group also has less Ferritin level than T1 group. But value of P is greater than 0.05 (Table 4.3.19) hence above said difference not significantly greater than expected by chance.

While Ferritin level found to be significantly increased in normal control (P<0.05) group, when compared with trial groups.

[I] Iron

Table 4.3.20- Shows Parametric ANOVA test for Iron:-

Group	N	Mean	SD	F	P
DC	5	114.20	15.057	15.363	<0.0001
NC	6	**189.67**	13.750		
STD	6	151.83	19.405		
T1	5	154.40	12.075		
T2	5	**169.20**	19.930		

As value of P is less than 0.05 (Table 4.3.20), variation among column means is significantly greater than expected by chance. Mean of normal control and T2 groups were greater among all. It suggests normal control and T2 group shows significant increased in iron level.

Table 4.3.21 – Shows Bonferroni Comparison test for Iron:-

Comparison	Mean Diff	t	P	Significance	Result
DC vs. NC	-75.467	7.606	**<0.001**	**Highly Significant**	**NC > DC**
DC vs. STD	-37.633	3.793	**<0.01**	**Significant**	**STD > DC**
DC vs. T1	-40.200	3.879	**<0.01**	**Significant**	**T1 > DC**
DC vs. T2	-55.000	5.307	**<0.001**	**Highly Significant**	**T2 > DC**
NC vs. STD	37.833	3.999	**<0.01**	**Significant**	**NC > STD**
NC vs. T1	35.267	3.554	**<0.05**	**Significant**	**NC > T1**
NC vs. T2	20.467	2.063	>0.05	Not Significant	T2≈NC
STD vs. T1	-2.567	0.2587	>0.05	Not Significant	STD ≈ T1
STD vs. T2	-17.367	1.750	>0.05	Not Significant	STD ≈ T2
T1 vs. T2	-14.800	1.428	>0.05	Not Significant	T1 ≈ T2

(≈ means difference is not significant)

Test 2 group shows less Iron level than normal control group. T1 and T2 group shows more Iron level than standard control group. T2 group have more iron level than T1 group. But value of P is greater than 0.05 (Table 4.3.21) hence above said difference not significantly greater than expected by chance.

Normal control (P<0.001), standard control (P<0.01), T1 (P<0.01) and T2 (P<0.001) groups were seen to be increased iron level significantly in comparison with disease control group. Also standard control (P<0.01) and T1 (P<0.05) group shows significantly decrease in iron level when compared with normal control group.

Table 4.3.22- Shows Parametric ANOVA test for TIBC:-

Group	N	Mean	SD	F	P
DC	5	185.60	14.188	4.776	0.0063
NC	6	**263.00**	37.208		
STD	6	232.50	30.892		
T1	5	**248.60**	24.694		
T2	5	234.20	37.426		

As value of P is less than 0.05 (Table 4.3.22), variation among column means is significantly greater than expected by chance. Mean of normal control and T1 groups were greater among all. It suggests normal control and T1 group shows significant increased in TIBC level.

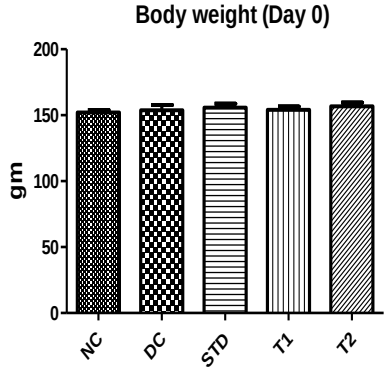
Table 4.3.23 – Shows Bonferroni Comparison test for TIBC:-

Comparison	Mean Diff	t	P	Significance	Result
DC vs. NC	-77.400	4.183	**<0.01**	**Significant**	**NC > DC**
DC vs. STD	-46.900	2.535	>0.05	Not Significant	STD ≈ DC
DC vs. T1	-63.000	3.260	<0.05	**Significant**	**T1 > DC**
DC vs. T2	-48.600	2.515	>0.05	Not Significant	T2 ≈ DC
NC vs. STD	30.500	1.729	>0.05	Not Significant	STD ≈ NC
NC vs. T1	14.400	0.7783	>0.05	Not Significant	T1≈ NC
NC vs. T2	28.800	1.557	>0.05	Not Significant	T2≈ NC
STD vs. T1	-16.100	0.8701	>0.05	Not Significant	STD ≈ T1
STD vs. T2	-1.700	0.0918	>0.05	Not Significant	STD ≈ T2
T1 vs. T2	14.400	0.7451	>0.05	Not Significant	T1 ≈ T2

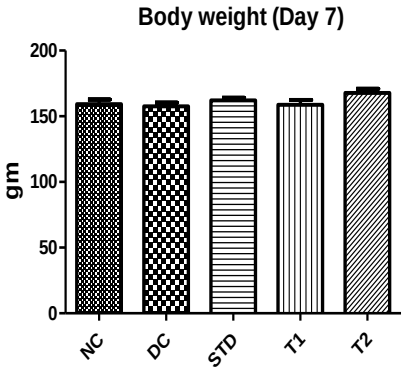
(≈ means difference is not significant)

Standard control group and T2 group have more TIBC level than disease control group. Standard control, T1 and T2 group have less TIBC level than normal control group. T1 and T2 group have more TIBC level than Standard control group. Test 2 group also has less TIBC level than T1 group. But value of P is greater than 0.05 (Table 4.3.23) hence above said difference was not significantly greater than expected by chance.

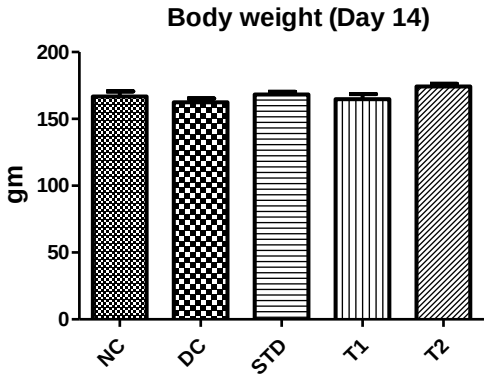
While TIBC level found to be significantly increased in normal control ($P<0.01$) and T1 group ($P<0.05$), in comparison with disease control group.



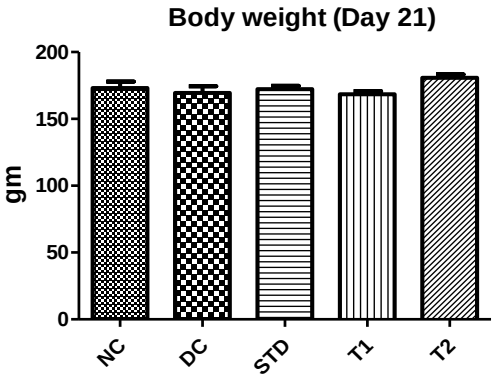
Graph 4.3.1



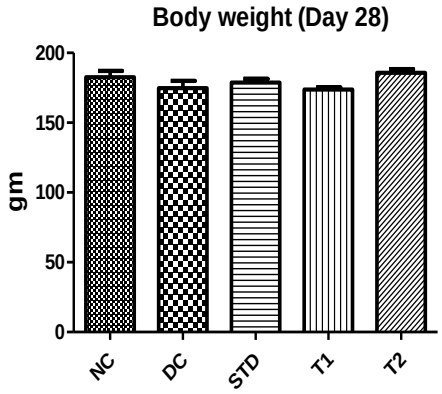
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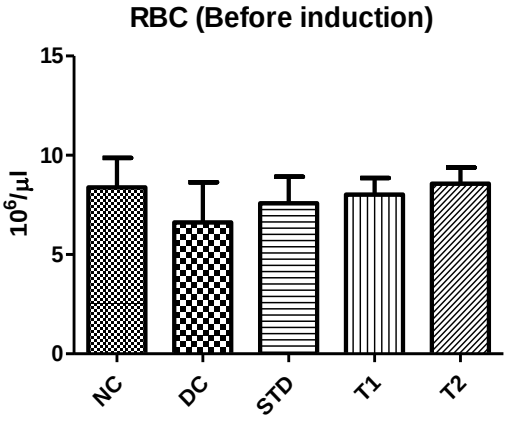
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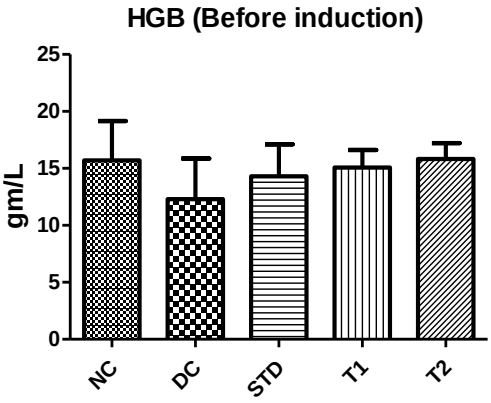
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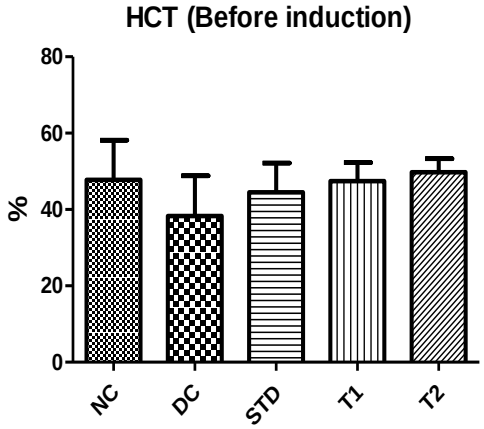
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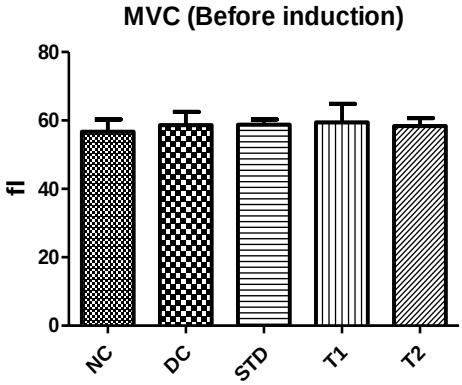
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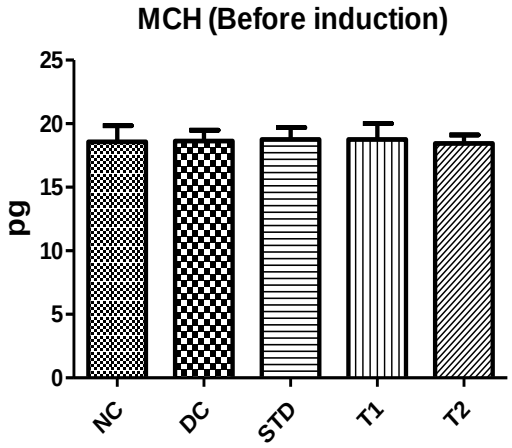
Graph 4.3.7



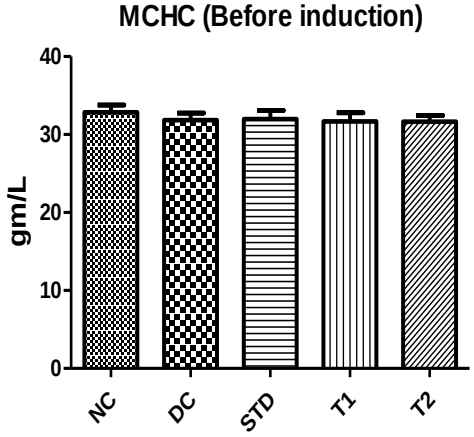
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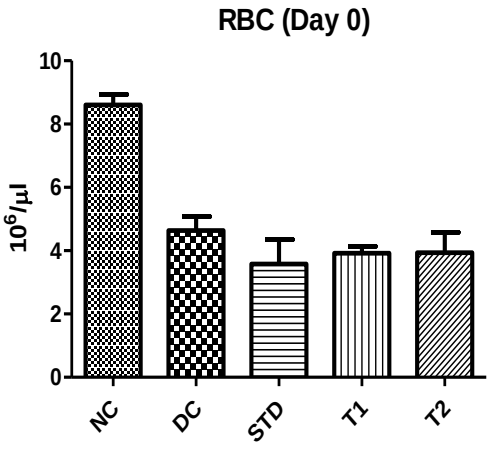
Graph 4.3.9



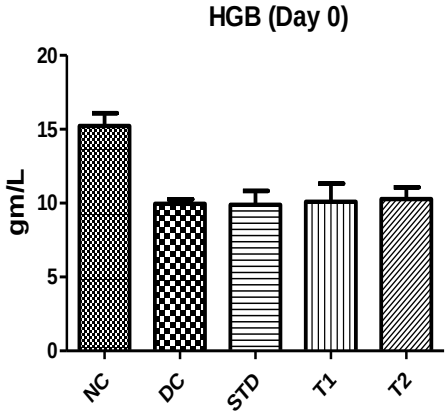
Graph 4.3.10



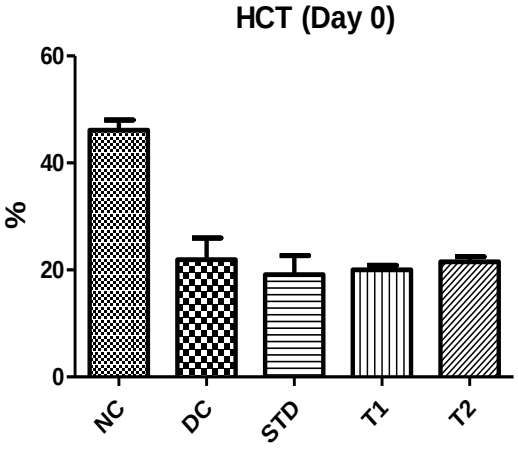
Graph 4.3.11



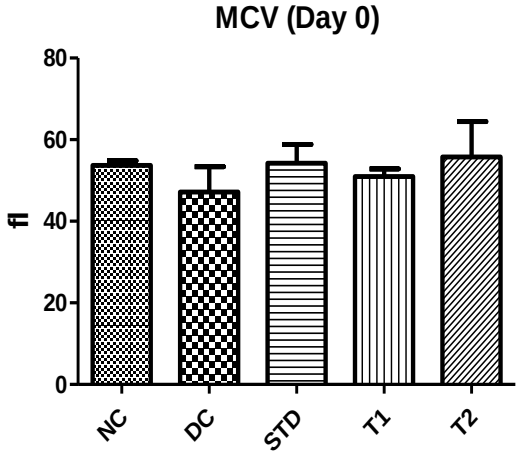
Graph 4.3.12



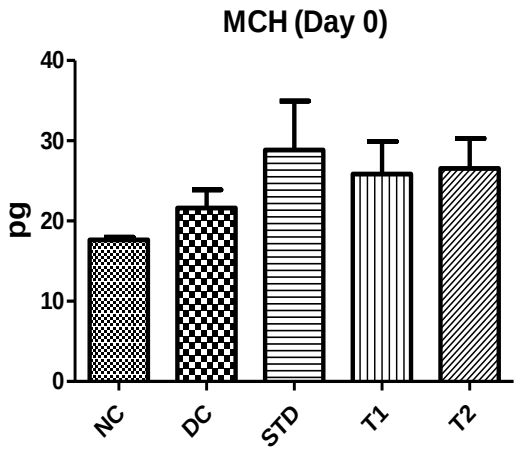
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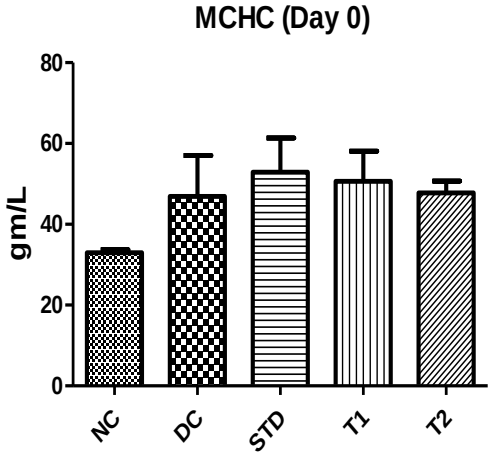


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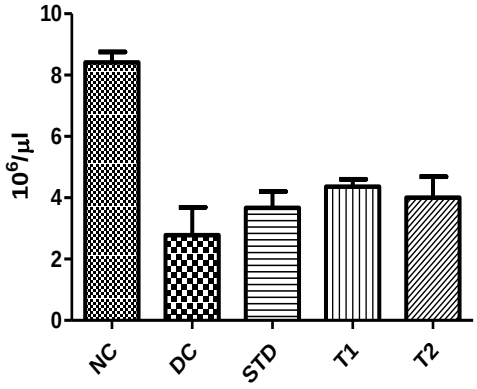


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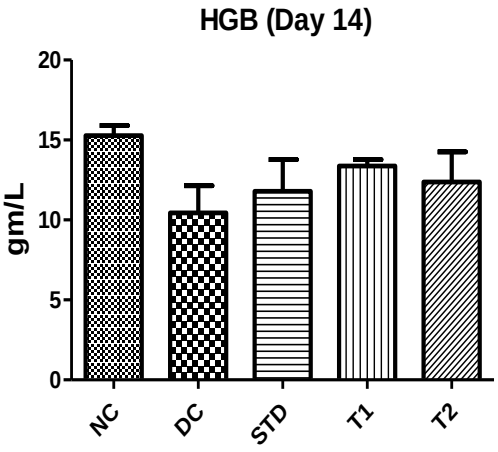




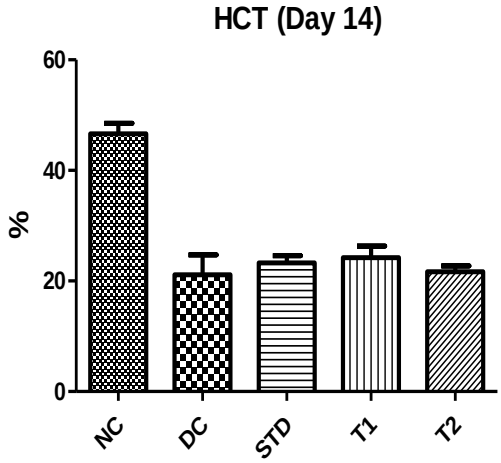
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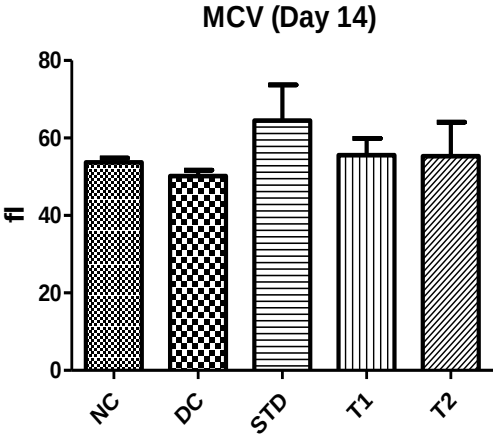
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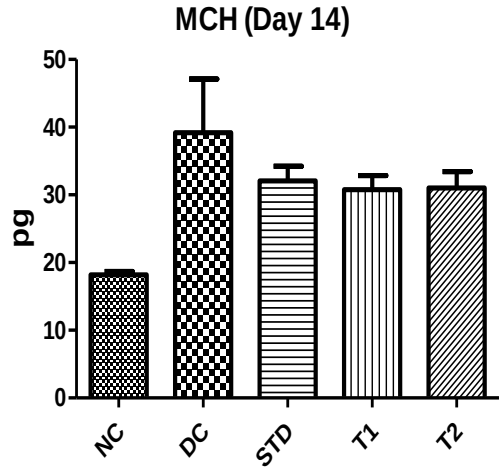
Graph 4.3.18



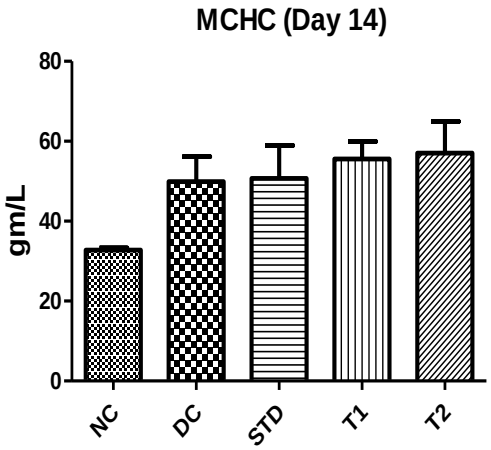
Graph 4.3.19



Graph 4.3.20

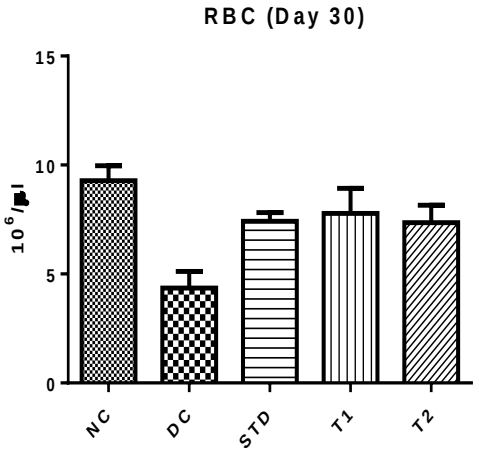


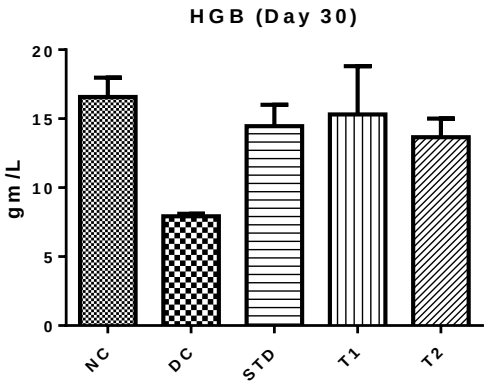
Graph 4.3.21



Graph 4.3.22

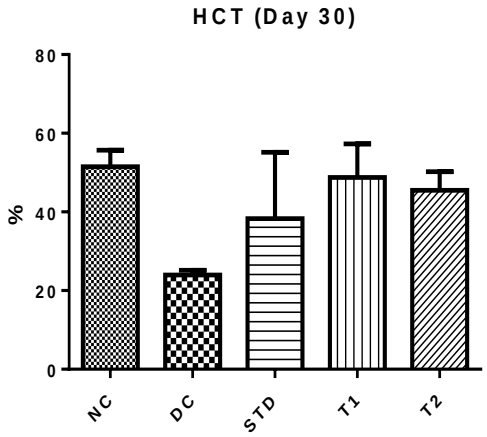
Graph 4.3.23

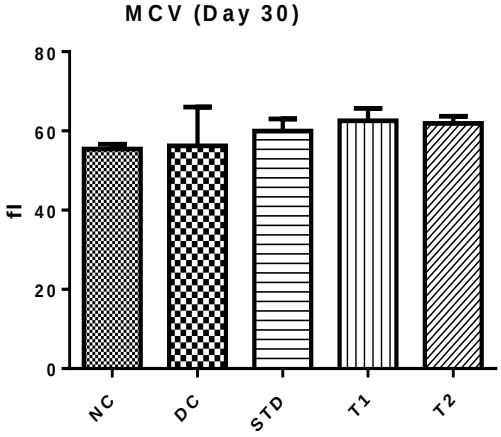




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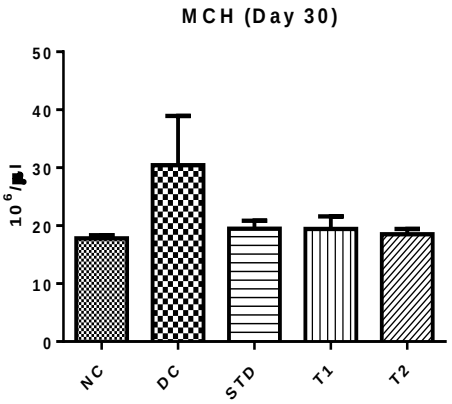
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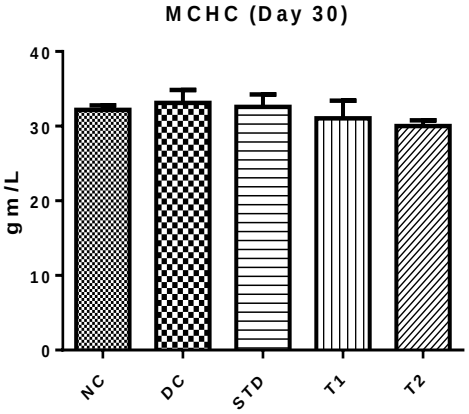




Graph 4.3.26

Graph 4.3.27

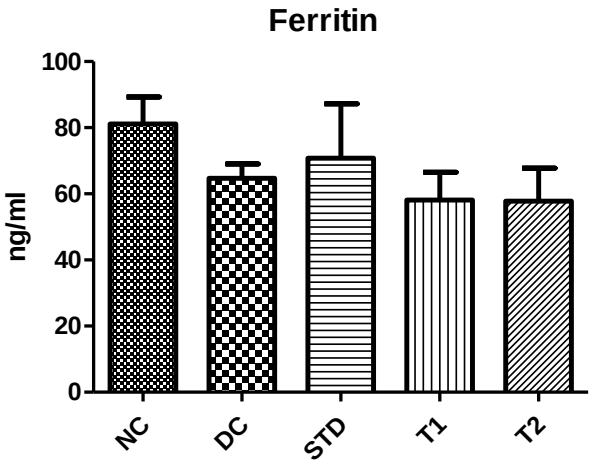




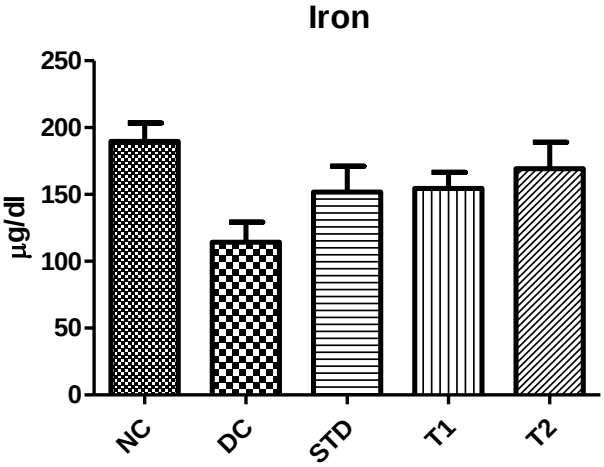
Graph 4.3.28

Graph 4.3.29

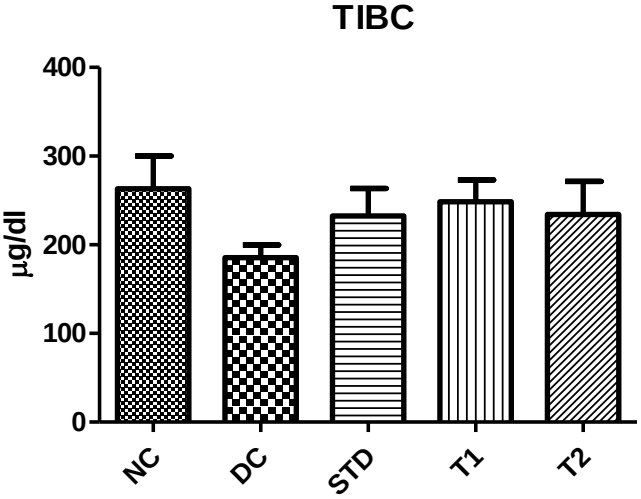
Biochemistry



Graph 4.3.30

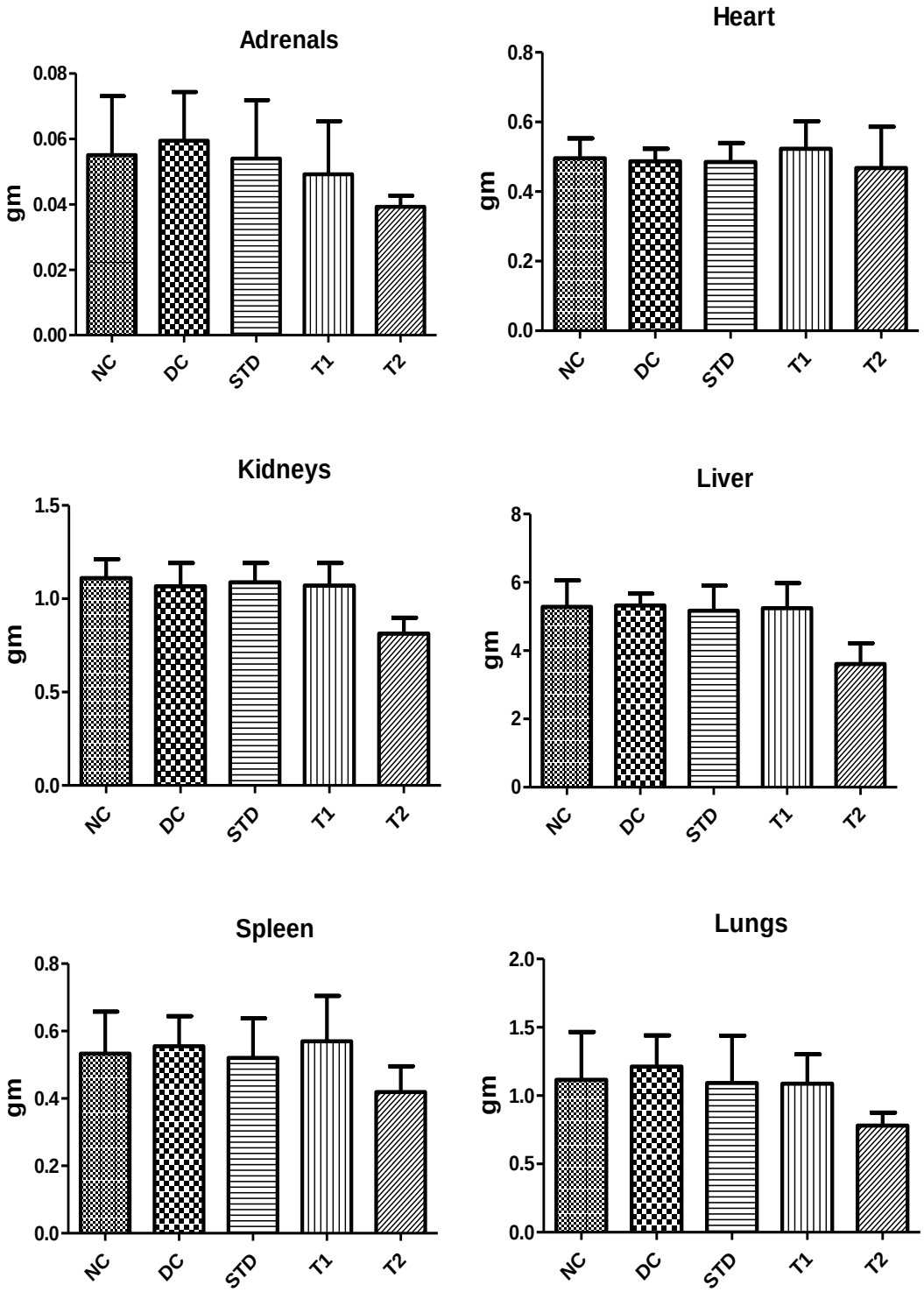


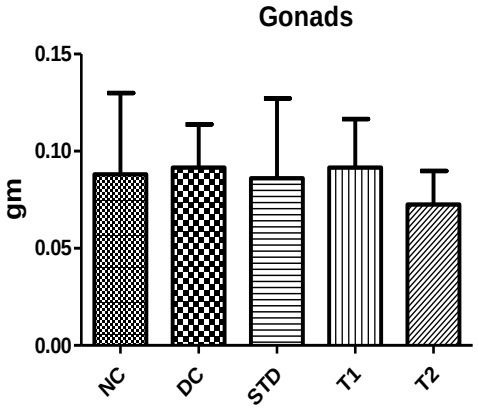
Graph 4.3.31

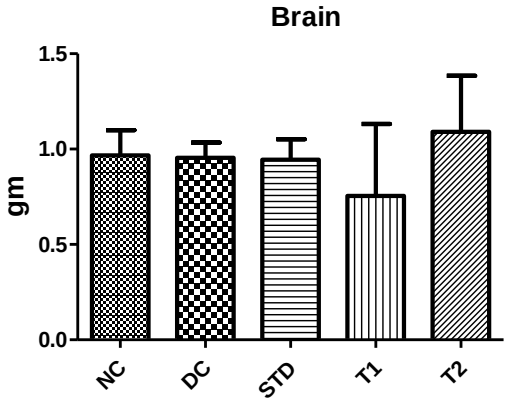


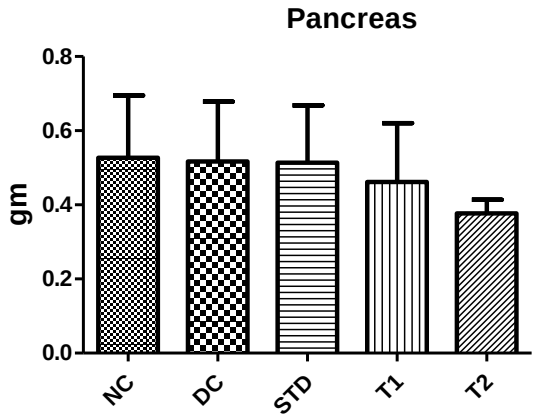
Graph 4.3.32

Relative organ weights




Gonads
gm
0.15
0.10
0.05
0.00
NC
DC
STD
T1
T2


Brain
gm
1.5
1.0
0.5
0.0
NC
DC
STD
T1
T2


Pancreas
gm
0.8
0.6
0.4
0.2
0.0
NC
DC
STD
T1
T2

DISCUSSION

Discussion is the main step in any research. It is the purpose of examining the facts through their merits and demerits to obtain proper knowledge about facts. To reach up to the depth of knowledge the discussion is the important step which helps in understanding the subject and guides to conclusive judgement. Before establishment of truth as conclusion, Discussion is mandatory. It is the process of re-examining the whole work. In spite of detailed classical study and experimentation, a theory can be accepted only after proper reasoning of observations. Hence the discussion is the very crucial part of scientific work. It can either support the hypothesis or it can help in amendment or it may revolutionize the concept totally.

- **Selection of Problem- Iron Deficiency Anaemia**

Iron deficiency anaemia is one among the major global health problems. It involves population of all age groups and sex, specially seen in adolescent age group and pregnant/ lactating mothers. Its wide prevalence in India indicates the poor nutritional status in our country.

Anaemia is the most prevalent nutritional deficiency disorder in the world. WHO defines anaemia, is the condition in which the haemoglobin content of blood is lower than normal as a result of deficiency of one or more essential nutrients. WHO has estimated that more than 2 billion people worldwide suffering from anaemia with 50 % attributed to iron deficiency.

Iron deficiency anaemia is common in our country, because most of the people in our country are suffered from under nutrition unknowingly. It occurs when the body does not have enough iron, leading to the decreased production of red blood cells.

There are much more hematinic iron products in market, but unable to cure the nutritional iron deficiency of such a large number of population; there are number of causes behind it such as high costs of iron products, effects seen only on longer consumption (about 3 months) of it, lack of supply up to the rural areas etc.

Adverse effect of hematinic drugs used in modern system is constipation, diarrhoea, metallic taste, abscess, anaphylatoid reaction, and increased viscosity and clot formation.

These disadvantages of allopathic drugs have turned the focus on the safe and effective medication. From ancient time, medicinal plants classified as *Rasayana* in *Ayurveda* are believed to be useful in strengthening the hematopoietic and immune system of an individual.

There is need of an effective, abundantly available and economic drug to cure the national calamity of iron deficiency anaemia in front of such a huge population.

- **Selection of the drug: *Gairika***

Ayurvedic physicians suggested various herbs for the treatment of haematological disorders as a source of iron and other minerals. Various researchers successfully evaluated the potential of several medicinal plants and some minerals in the treatment of anaemia using various experimental animal models. In *Rasashastra* there are various Iron containing compounds like *Suvarnamakshika, Kasisa, Loha, Gairika* found to be used in curing anaemia. Out of them *Gairika* was used as a Research drug, considering following significance.

- A drug which is routinely and widely used in *Ayurvedic* practices.
- Used in therapeutics externally e.g.*Gairikadya malahara* and internally e.g.*Kamdudha Rasa, Laghusutshekhars Rasa* etc.
- Easily available in large scale.
- Affordable to common people.
- Used in medicinal preparations by doing *shodhana* process only, no *marana* process/bhasma is indicated.

There were many research conducted on *Mandura*, *lauha,Kasisa*. But, *Gairika* is untouched by researchers which is more economic and abundantly available as compare to other *Lauha Kapla.* Hence, as per seeing the need of drug for iron deficiency anaemia, the study on *Gairika* was carried out and for seeing detailed effects on some biochemical parameters, animal experimental study was selected. Thus, study was carried out under the title, "Comparative study of effect of *Goghrita* and *Godugdha Shodhita Gairika* on haematological parameters of wistar rats."

- **Review of Literature:-**

In present study *Shodhana* of *Gairika* was done with different two methods. A thorough review of *Gairika, Goghrita a*nd *Godugdha* was done in section drug review. While the research topic i.e. most prevalent disease *Panduroga* (Iron deficiency anaemia) studied under disease review. Some procedures were followed during pharmaceutical preparation of trial drug, such as *Bharjana, Bhavana* and details of these terminologies compiled in section procedure review.

- **DRUG REVIEW:-**

For present study "*Gairika*" was studied as research drug. In *Rasashastra* classics *Gairik*a was included in "*Uparasa" varga*. Also it was one of the constituent of "*Panchmruttika*". In Samhita period only *Sushruta* mentioned the importance of *Gairika* in *Pandu*. There was no direct reference of *Gairika* found in various classics, which shows its efficacy in *Panduroga* (Iron deficiency anaemia). In *Charaka samhita* and *Vagbhata samhita*, *Gairika* was included in *Shonitasthapana gana* and *Kashaya skandha*. The pharmacology of *Shonitasthapana gana* is to restore blood components in various bleeding disorder. The drugs from this group do not increase blood level directly. In *Nighantu Gairika* was included under *Suvarnadi* and *Datwadi varga*. In *Bhavprakash samhita Gairika* was described under *Mishra prakarana* and mentioned as *Pratinidhi dravya* (substitute) of *Suvarnamakshika* i.e. if there is unavailability of *Suvarnamakshika* one should use *Suvarnagairika* as substitute.

In *Rasashastra* classics, most of *Acharyas* mentioned two types of *Gairika* i.e. *Suvarnagairika* and *Pashanagairika*. *Lohadhatu, Raktadhatu, Girija, Raktamruda, Lohitamruda* etc. are common synonym used for *Gairika* in various texts. *Gairika* was used internally after *shodhana* process only. No *Marana* process mentioned in classics. For *Shodhana* of *Gairika* various methods were described by different *Acharyas*, out of them *Godugdha bhavana* and *Goghrita bharjana* were much common. Most of *Rasacharya* used *Gairika* in *Rasaranjana karma*. *Acharya Nandi* said that *Gairika* itself is a *Satvarupa*, so there is no need to *do Satvapatana* of this mineral.

Hematite is a natural mineral pigment found with other iron-titanium oxide mineral in igneous and metamorphic rocks as accessory mineral. In was found in two forms, anhydrous iron oxide (red ochre) and hydrated iron oxide (yellow ochre). It is generally found mixed with clay and other impurities.

Table 5.1 shows *Rasapanchaka* of the drugs used in present study

Drug	Rasa	Guna	Virya	Vipaka	Karma
Gairika	Madhura, Kashaya	Snigdha, Masruna	Sheeta	Madhura	Pittashamaka, Raktavardhak
Goghruta	Madhur	Guru	Sheeta	Madhura	Tridoshsamak, rasayana
Godugdha	Madhur	Guru, Snigdha	Sheeta	Madhura	Vatapittanut, Rasayan

Goghrita and *Godugdha* used as a vehicle drug in present study. These were used for purification of *Gairika. Gairika* is one of the Iron containing mineral.

Panduroga (Anaemia) is a disease caused due to vitiation of *Pitta dosha* and this vitiated *pitta* affects *Rakta dhatu* resulting *Bhekavarna* to skin. *Gairika, Goghrita* and *Godugdha* have *Madhura rasa, Sheeta Virya , Madhura Vipaka, Snigdha guna* and *Pittashamaka* property. Thus resulting in pacifying the *Pitta dosha* in *Panduroga*.

Lauhakalpas are used in the treatment of *Panduroga*. As these drugs acts on *Dhatushaithilya* and *Raktakshaya* in *Pandu*. But there is one obstacle in using *Lauhakalpa*, i.e. these *Lauha kalpas* causes constipation and increases *Rukshata* in the body. So *Acharyas* mentioned *Shodhana, Marana* of *Lauhakalpa* using *Snehadravya* and *Virechaka dravya*.

Goghrita have *Deepan, Pachana, Yogvahi* and *Rasayana* property, *Godugdha* also works as *Pittashamaka, rasayana* and mild purgative to *pittaprakruti*. *Gairika* itself have *snigdha guna* and *Pittashamaka* property. In the *shodhana* process of *Gairika* we used *Goghrita* and *Godugdha,* resulting in *Raktavriddh*i. Also *Gairika* constitutes more than 16 % of Iron. Thus in *Panduroga, Gairika* will work an effective drug.

- **DISEASE REVIEW:-**

❖ **Panduroga and Iron deficiency anaemia :-**

In this study *Panduroga* has been selected for subclinical trial of *Goghrita bharjita* and *Godugdha bhavita Gairika* for evaluating better effectiveness. Because *Lauha* preparations are considered as best remedy for *Panduroga*. And *Gairika* is a one of the *Lauha* containing mineral.

Here *Panduroga* is co-related with iron deficiency anaemia for their etiological, symptomatic and management similarities.

1] Etiological similarity:

Excessive intake of *Kshara* and *Lavana* reduces absorption of iron by neutralizing gastric acidity. Excessive exercise may cause excessive demand of iron. Affliction of mind with *Shoka, Chinta, and Bhaya* may cause defective intake of iron due to anorexia.

2] Symptomatic similarities:

General symptoms like *Pandu*ta (pallor), *Daurbalya* (weakness), *Shrama* (fatigueness), *Shotha* (oedema), *Twaksphotana* (dry skin) etc.

Cardiovascular features like *Hridayaspandana* (palpitation), *Shwasa* (breathlessness).

G.I. symptoms like *Aruchi* (anorexia), Amlodgar (acidity).

Neurological features like *Bhrama* (giddiness), *Tama* (fainting

3] Management similarity:

*Rakta*janana (haematinic) regimens are prescribed for both *Panduroga* and iron deficiency anaemia.

- **PROCEDURE REVIEW:-**

In *Shodhana* of *Gairika* various procedures like *Bharjana, Bhavana, Swedana, Bhanupaka* etc. Mentioned for the purification of *Gairika.*

Shodhana aims not only the separation of impurities and detoxification but also there is improvement in efficacy of drug and incorporating the expected property in the drug.

Bharjana (Frying) - Continuous frying of fine powder of substance in any of the *sneha dravya* on mild heat is called *bharjana*.

Mild heating with continuous stirring allows evaporation of water part and separation of all particles from each other which allows the proper coating of *sneha dravya* (used for frying) to each and every particle of the substance.

Bhavana is a unique pharmaceutical process which includes trituration of a substance with various types of liquid media for achieving the desirable properties in the final drug.

In *Bhavana* process, there is continuous interaction between the particles of material itself and with the particles of liquid media which results in modification of properties (*gunantaradhana*) that means it may introduces new properties to the drug or enhances the original properties.

Thus, selection of *Bhavana dravya* can change therapeutic action of drug. *Bhavana dravya* impregnates its active principles into the material and convert into herbo-mineral form which increase bioavailability of the drug.

Bhavana should be done with uniform pressure and proper frequency for homogenization of mixture and to acquire soft, smooth and sticky consistency. Interaction of liquids of same drug or different drug in *Bhavana* may leads to development of newer pharmaco-kinetic-dynamic potent molecules.

- **PHARMACEUTICAL STUDY:-**

The pharmaceutical work designed with *Shodhana* of *Gairika.* As per API standard *Gairika* was collected and authentified with the Iron concentration not less than 16%. The raw *Gairika* tested on the *Ayurvedic* parameters of *Grahya-gyahyatva* also, and the *Gairika* having Brick red color, *Snigdha guna* were selected for further process.

Pharmaceutical study aims to purification of *Gairika*, according to classical texts. In first method of purification, *Gairika* was roasted with *Goghrita* (A.P. 2/272). After purification color of *Gairika* changes from brick red to dark brick red. It may be due to addition of *Goghrita* as *sneha dravya* and application of heat converts color of *Gairika* into dark. (Table -4.1.1)

Also rough and dry consistency of *Gairika* changed into smooth due to addition of *Ghrita*. *Gairika* was included in "*Panchmruttika*" by most of *Achryas.* As it is one type of *Mruttika,* it gives earthy odor before and after purification. (Table-4.1.1)

After purification by first method, it was seen that weights of *Gairika* get increased by 12.28% (14g). It may be due to, addition of *Goghrita*, Some quantity of *Ghrita* may remain in purified *Gairika* and resulted in yield gain. (Table-4.1.2)

In second method of Purification, *Gairika* was triturated with cow milk (R.R.S.3/49). In this method color of *Gairika* was not changed significantly. Red color was obtained to purified *Gairika.* Due to trituration with cow milk consistency of *Gairika* changed from dry, rough to smooth. In this method raw *Gairika* have

earthy odor and purified one have specific odor. Due to addition of cow milk, after completion of total trituration *Gairika* has somewhat milky odor. (Table-4.1.3)

Total 7 triturations were given to *Gairika* for purification. As number of trituration increased quantity of milk and required time for trituration was reduced, while final yield get increased from 1-7 trituration. For first trituration total 130 ml cow milk required, and total 3 hours time was needed to complete first trituration. For 7^{th} trituration 40ml cow milk and 1.30 hours required for completion of trituration. Lowering number of trituration takes minimum amount of milk to absorb and it becomes too soft to take less time to dry. That's why in last trituration quantity of milk and required time, both were reduced. (Table-4.1.4)

In second method of purification final 31.03 % weight gain was observed. It may be due to the addition of cow milk for trituration which adds extract of milk to final yield (Table-4.1.5).

In comparative studies of purification of *Gairika*, done by two methods, (Table-4.1.6) it seems that First method of purification (*Ghritabharjana)* was better than method 2 (*Godugdha bhavana*). As method first requires very little amount of *Ghrita* for roasting. Also it requires very little time to completion of *shodhana* process (20 min). While second method took much time duration for *Shodhana* process *(*15hrs 15 min). In first method labour works also less. So due to time saving, less labour work, less equipped, method one was cost effective also.

In method two yield obtained after purification was more than first method. As in second method total 7 trituration was given and after each trituration some amount of extract of milk was added to final yield. Thus in relation to yield obtained, method two was superior to method one (Table-4.1.6).

- **ANALYTICAL STUDY:-**

All three samples of *Gairika* were analyzed by using physicochemical and some advanced modern techniques. All these three samples of *Gairika* have massive clay nature, brick red streak, uneven fracture, earthy lusture, brittle tenacity and opaque transparency. Samples one has dark brick red color while sample R and Sample 2 have brick red color. Hardness of *Gairika* reduced after purification. Due to *Bharjana* and *Bhavana* hardness gets reduced resulting in increased absorption of drug. There was no difference found in Hardness of Sample 1 and 2. (Table-4.2.1)

Specific gravity: - Specific gravity of *Gairika* reduced after purification. This decrease in specific gravity may show that there must be separation of some unwanted substances or impurities after *Shodhana* process. (Table-4.2.1)

pH value: - pH of *ashuddha Gairika* was 5.98 and after *shodhana* 5.80 and 5.12 respectively in sample 1 and 2. (Table-4.2.1). pH value gets reduced after shodhana process. Sample 2 have less pH value than sample 1. This reduced pH of both samples helps in faster absorption of Iron.

LOD: - Loss on drying is a physical test to evaluate the percentage of moisture content of sample at 110^0c. It helps to determine the self-life of sample. Lesser the LOD better will be the drug. *Ashuddha Gairika* has LOD 0.1% and after purification it gets reduced to < 0.1%. It means that after purification *Gairika* have less chances of microbial contamination or any fungal growth resulting in better self-life and therapeutics. (Table-4.2.1)

Total Ash: - Ash value denotes the total percentage of inorganic matter present in sample. *Shuddha Gairika* has ash value for sample 1 and 2 as 99.08 &99.34% respectively. *Ashodhita Gairika* has 99.07% ash value. *Shodhita Gairika* shows increased ash value than *ashodhita* which was negligible. There was not much more difference found in Acid insoluble ash, water soluble extractive and residue on ignition of two samples of *Gairika*. (Table-4.2.1)

According to XRD pattern and pick value, *Raw Gairika* have a composition of Fe2O3 and H4Al2O9Si2 i.e. Hematite and Kaolinite with score 68 and 47 respectively. XRD pattern of sample 1 shows composition of Fe1.854O3Ti0.146, H4Al2O9Si2, and O2Si1 with compounds Hematite, Kaolinite and Quartz low with score 62, 49 and 39 respectively while XRD pattern of Sample 2 shows Fe1.9O3Sn0.1, O2Si1,H4Al2O9Si2 composition with compound name Hematite, Quartz and Kaolinite respectively and score was 55,44 and 41.(Table – 4.2.8)

Quartz was not found in raw *Gairika*. But after pufification in sample 1 and 2 XRD pattern shows peaks for Quartz in score (39, 44). Kaolinite score get reduced in sample 2 as compare to sample 1 and raw *Gairika.* Raw *Gairika* shows highest Hematite score than *shodhita Gairika*. It may be due to, during *shodhana* process some chemical changes occurred which alters Hematite concentration of *Gairika.* . (Table – 4.2.8)

From table 4.2.9, it can be said that, Raw *Gairika* have highest Fe content (26.35 %) than purified samples. Cd and As found <0.01 ppm in all three samples of *Gairika*. Pb and Hg also found in negligible amount.

With SEM technique we can closely study the surface topography of samples. From above images at 10,000X magnification level, it was seen that both samples of *Gairika* have soft, spongy surface with smooth borders without any angles. Particles of both samples have no uniform size and shape. (Image 1-4)

- **EXPERIMENTAL STUDY:-**

Experimental study was conducted on total 30 wistar rats, divided in five groups and 6 animals in each group. There were two trial groups, T1 and T2. In T1 group *Goghrita bharjita Gairika* was given in the dose 45mg/kg to PHZ induced anaemic rats for 28 days by oral route. In T2 group *Godugdha bhavita Gairika* in the dose 45mg/kg was given to PHZ induced anaemic rats for 28 days by oral route.

In normal control group (NC) the animals were not induced anemia and not any therapy was given. They were given only normal diet and diluted honey (3ml honey+4.5ml de-ionized water) in 1ml oral dose. As *Gairika* was given with Honey as an *Anupana*, so here honey works as vehicle. So to reduce the bias and get exact result of trial drug here is NC group which was given only vehicle drug. The group also compares the readings of diseased and trial groups.

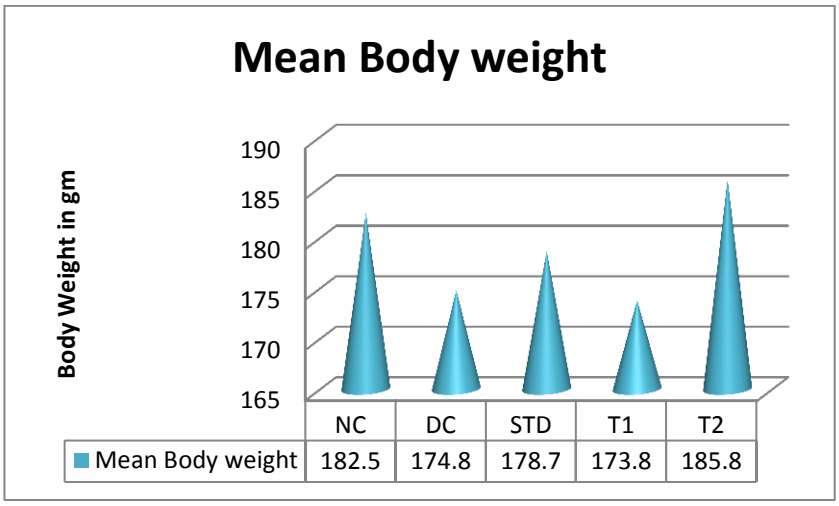
In standard control group (STD) the PHZ induced anemic animals were treated with standard control drug i.e. Syp. Vit B12 in the dose 1ml/rat for 28 days by oral route.

In disease control group (DC) the animals were injected with Inj. PHZ (60mg/kg) with intraperitoneal route to induce anemia and observed for 28 days. No any treatment was given to this group.

For the assessment of results total 9 biochemical parameters were tested, these were - RBC, HGB, HCT, MCV, MCH, MCHC, Sr. Ferritin, Sr. Iron and TIBC.

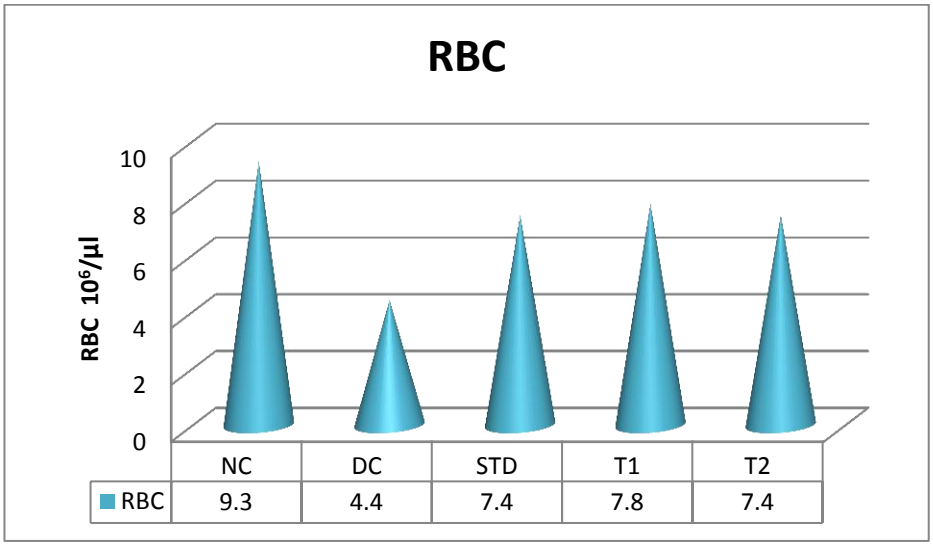
During study body weight and food consumption was measured weekly during the study period of 28 days. On Day 7, Day 14, Day 21 and Day 28, there was significant increase ($P<0.001$) in the body weight of T2 group animals as compared to Disease control animals.

Before induction of disease animals were evaluated for levels of Hemoglobin, RBC, HCT, MCV, MCH and MCHC. It was observed that there was no statistically significant difference in any of above parameters before induction of anemia.



Graph – 5.1 showing mean body weight

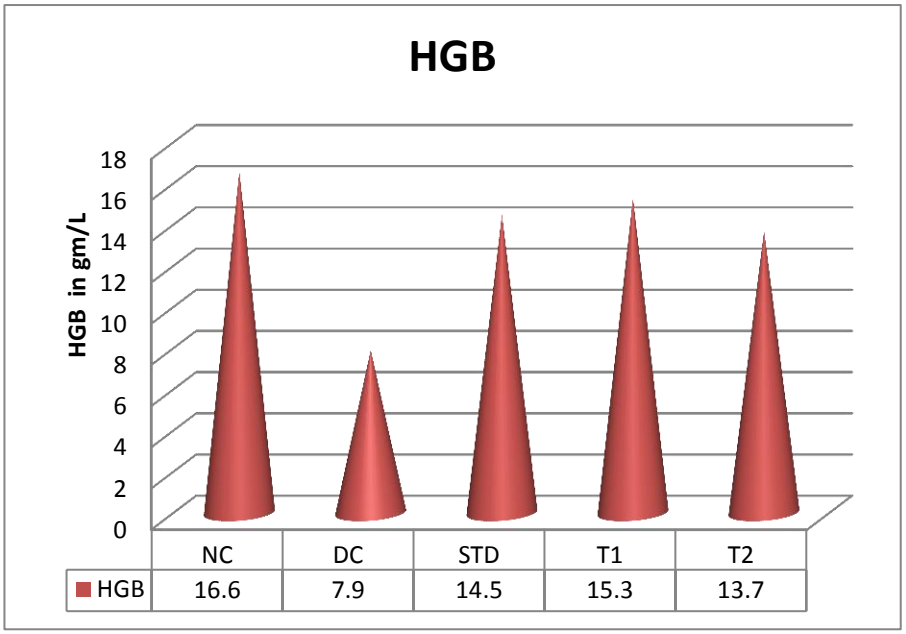
[1] Body weight:-From Table 4.3.5 and Graph 5.1, it can be said that trial group2 (*Godugdha bhavita Gairika*) shows significant weight gain when compared with disease control group. Also T2 group shows significant weight gain as compare to T1 (*Goghrita bharjita Gairika*) group. It may be due to *Godugdha* used for trituration in T2 group, shows *Balya* property of *Godugdha* and resulting in weight gain.



Graph – 5.2 showing mean RBC

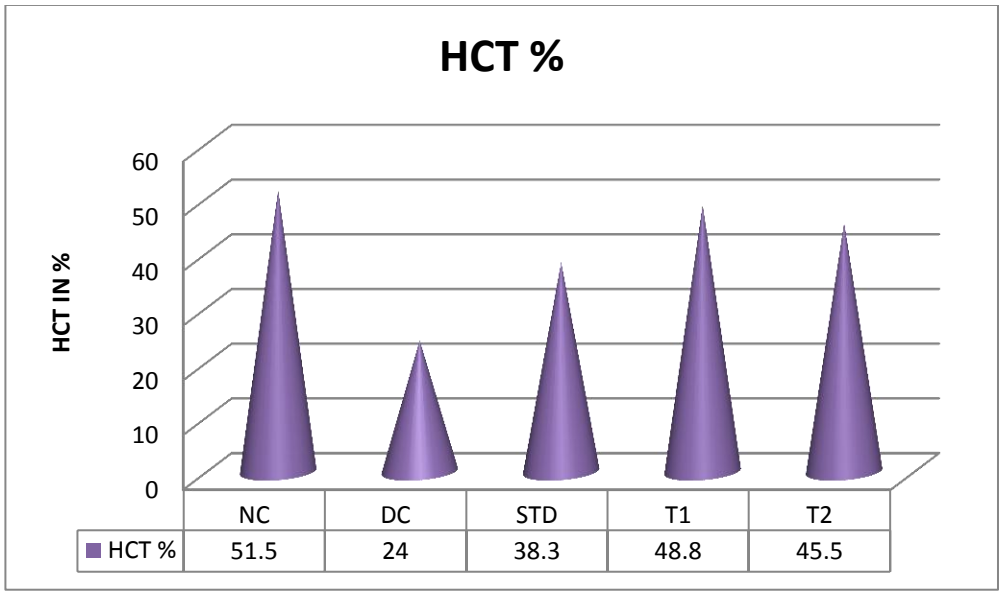
[2] RBC: - From Table 4.3.7 and Graph 5.2, it is seen that RBC count of T1 and T2 group shows significant results when compared with disease control group. Standard control group and both trial group shows similar results on RBC count. Both T1 and

T2 group shows similar results on RBC count. Thus it can be said that *Godudgha bhavita* and *Goghruta bharjita Gairika* not shows significant results on RBC count when compared with standard control group.



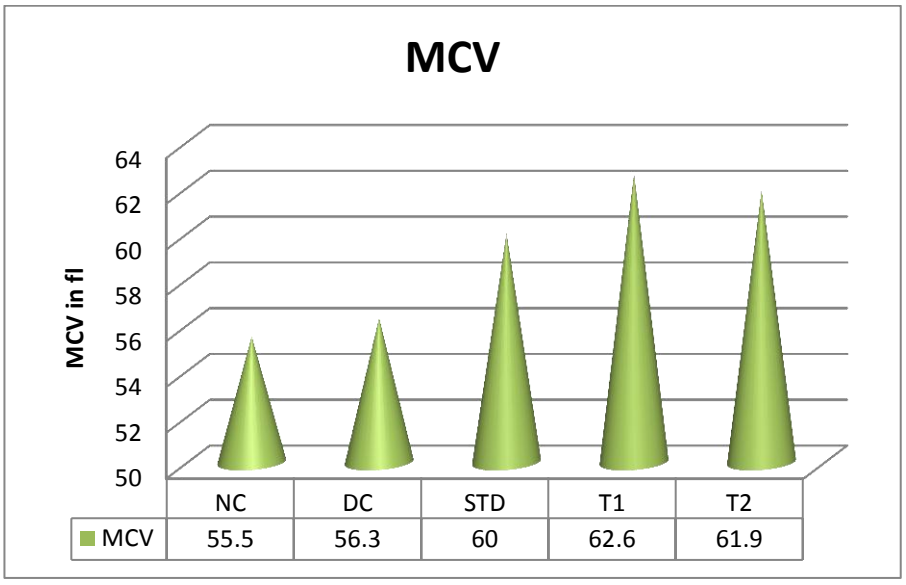
Graph – 5.3 Showing mean Haemoglobin count

[3] HGB:-From Table 4.3.9 and Graph 5.3, it can be said that both trial group and Standard control group shows significant results on Haemoglobin count when compared with disease control group. Both trial groups show insignificant results on Hb count when compared with each other. Thus it can be said that Trial group 1 and 2 have equal efficacy on Hb count.



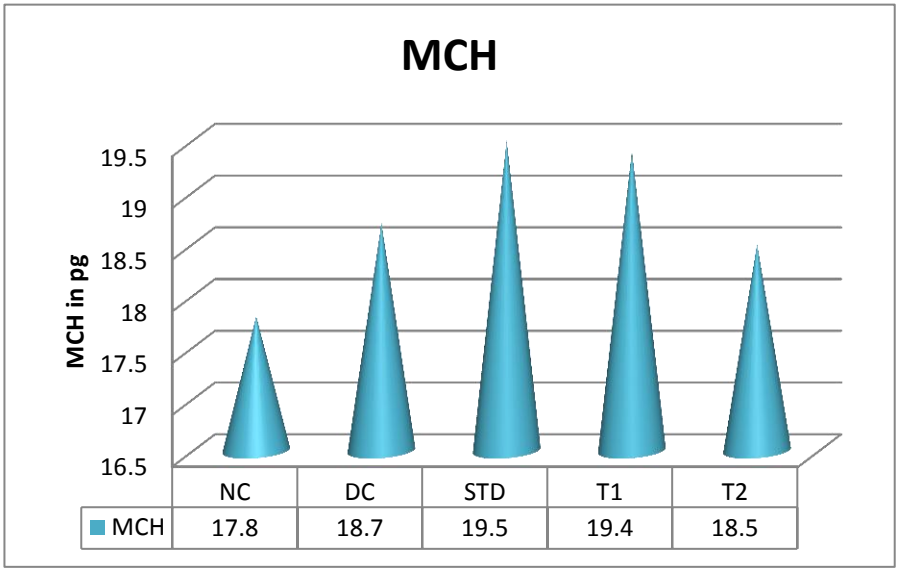
Graph – 5.4, showing results of mean HCT%

[4] HCT: - From Table 4.3.11 and Graph 5.4, it can be said that both trial groups shows significant results on HCT % when compared with disease control group. When T1 and T2 group compared with each other, the result is not significant i.e. both group shows equal increase in HCT %.



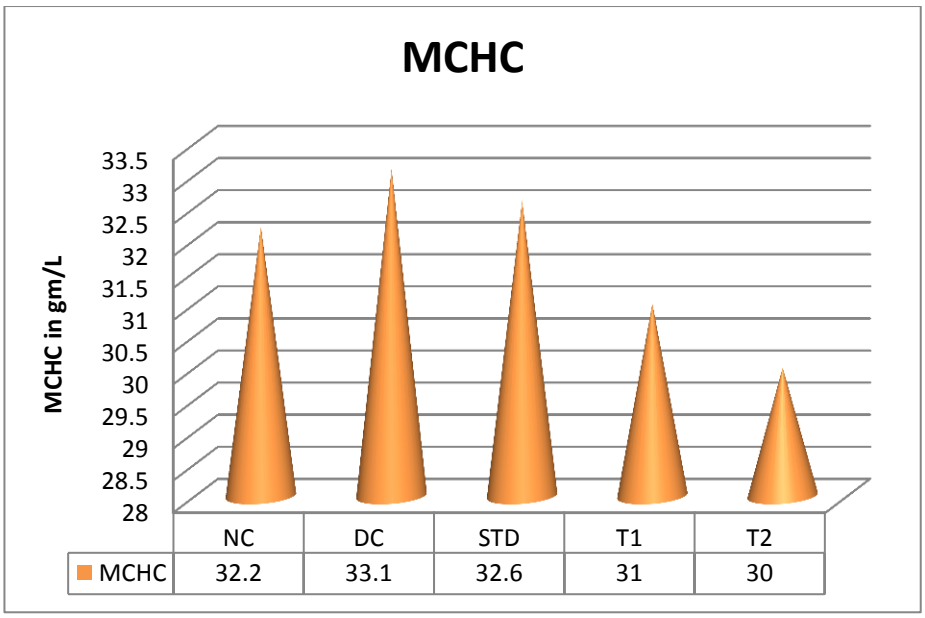
Graph - 5.5, Showing results of mean MCV

[5] MCV:-From Table 4.3.13 and Graph 5.5, it can he said that all groups have equal results on MCV. When T1 and T2 compared with disease control the results obtained shows the difference which was not significant.



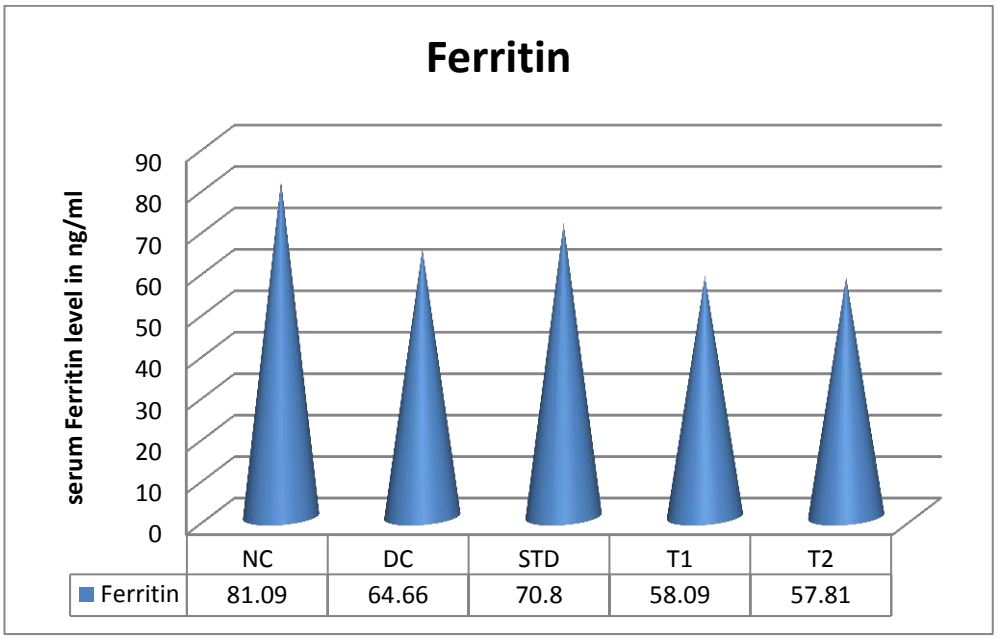
Graph – 5.6 Showing mean MCH

[6] MCH:-From Table 4.3.15 and Graph 5.6 it can be said that standard control group shows significant increase in MCH count when compared with normal control group. But T1 and T2 group does not show significant increase in MCH count when compared with disease control group.



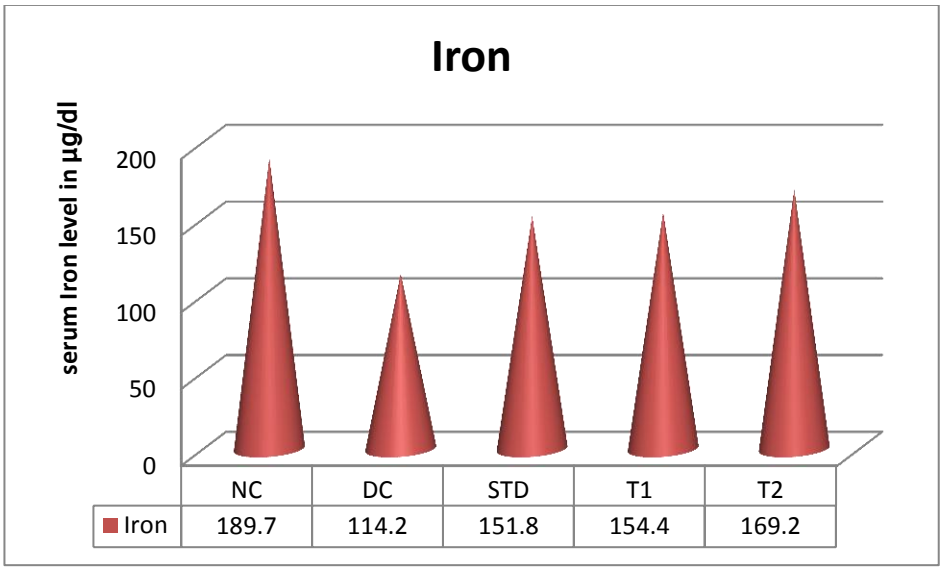
Graph – 5.7 Showing mean MCHC

[7] MCHC:-From Table 4.3.17 and Graph 5.7, it can be said that test group 1 and 2 shows less MCHC count than normal control group. Thus it can be said that normal control group shows significant increase in MCHC count.



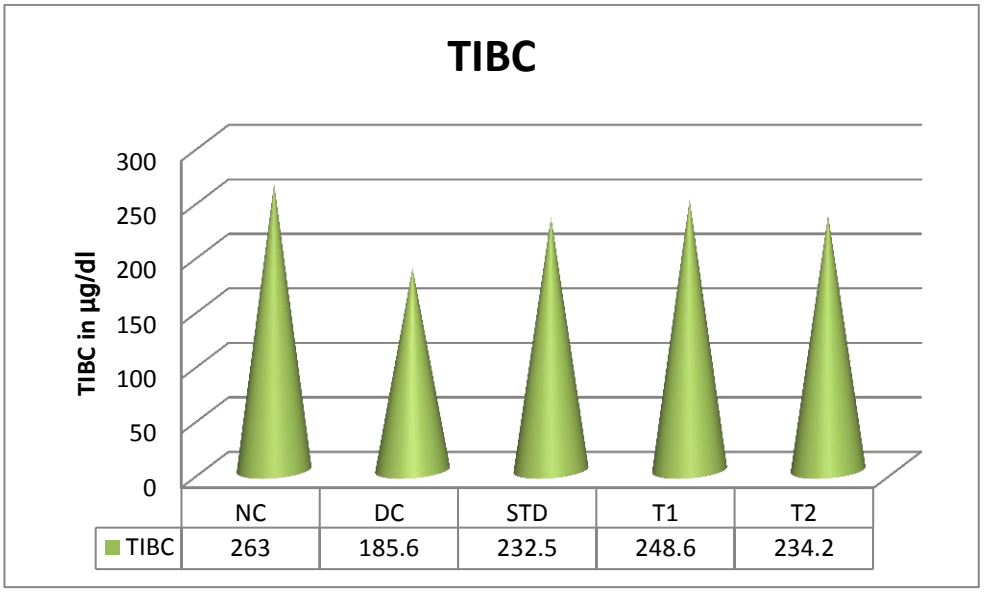
Graph- 5.8, Showing mean Ferritin

[8] Sr. FERRITIN:-From Table 4.3.19 and Graph 5.8, it can be said that normal control and standard control group shows more Ferritin level than disease control group. While T1 and T2 group shows less Ferritin content than disease control group. In both test groups increase in Ferritin level is not significant i.e. both test drugs have equal efficacy in Ferritin content.



Graph – 5.9 Showing mean Iron

[9] Sr. IRON:-From Table 4.3.21 and Graph 5.9 it can be said that both test groups shows significant increase in Iron level of anemic rats. Trial drug 2 shows increase in Iron level as compared with trial drug 1 and standard drug.



Graph – 5.10 Showing mean TIBC

[10] TIBC:-From Table 4.3.23 and Graph 5.10, it can be said that both test groups and standard control group shows increased in TIBC. When both test groups were compared, increased in TIBC was not significant i.e. both groups have equal results on TIBC. Trial drug 1 shows significant increase in TIBC count when compared with disease control.

In nut shell, at the end of study the, RBCs were found to be increased in all groups but the difference was statistically significant in STD ($P<0.001$), T1 ($P<0.001$) and T2 ($P<0.01$) groups in comparison with disease control animals.

Haemoglobin levels were significantly increased in both treatment groups T1 ($P<0.001$), T2 ($P<0.05$).

There were no significant changes in levels of MCV in all groups. Also, MCH levels were attenuated in NC ($P<0.05$). While, MCHC levels found to be elevated in NC ($P<0.05$).

There was no significant difference in Ferritin content of all groups in comparison with Disease control animals. But in NC ($P<0.05$) there was significant increase in Ferritin level.

Iron levels of STD ($P<0.01$), T1 ($P<0.01$) and T2 ($P<0.001$) were found to be elevated in comparison with Disease control animals. But STD ($P<0.01$) and T1 ($P<0.05$) group shows significantly decrease in iron level when compared with normal control group.

The TIBC was found to be significantly increased in T1 ($P<0.05$).

There were no significant changes observed in relative organ weights of animals in all groups.

Trial drug 1(*Goghrita bharjita Gairika*) – works comparatively better than trial drug 2(*Godugdha bhavita Gairika*) in increasing Haemoglobin (HGB) and TIBC in Iron deficiency anaemic rats.

Trial drug 2 works comparatively better than trial drug 1 in increasing Sr. Iron level and Total body weight of Iron deficiency anaemic rats.

Both trial drugs increase RBC and HCT concentration significantly in iron deficiency anaemic rats.

Above results pointed towards that test samples *Goghrita* and *Godugdha shodhita Gairika* may be useful in treatment of anemia. Further, it may be said that both of test substances have equivalent efficacy in treatment of anemia.

Conclusion

The present study had been taken out to see the effect of *Goghrita* and *Godugdha shodhita Gairika* in anaemic wistar rats. The following conclusion can be drawn from it.

- *Gairika i*s a mineral, occurring very easily and cost effective also.
- *Gairika* is a potent source of Iron.(>16 % , Fe)
- In *samhita* literature *Gairika* was used in bleeding disorders like *Raktapitta, Pradara* along with *panduroga.*
- There were various methods of *Shodhana* of *Gairika*, mentioned by various *Rasashastri*, But *Goghrita bharjana* method by *Ayurved Prakash* and *Godugdha bhavana* method by *Rasaratna Samucchaya* were considered as easy, convenient and standard methods of Purification.
- *Ghritabharjana* method was found to be better than *Godugdha bhavana* method, in accordance with time and procedure. But in obtaining yield, method 2 was superior to method 1.
- There was not much more difference found in physico-chemical parameters like Ash value, LOD, Specific gravity etc. of Sample 1(*Goghritabharjita Gairika*) and Sample 2(Godugdha *bhavita Gairika*).
- In elemental assay sample 1 have 23.30% Fe and Sample 2, 17.20%. In XRD analysis Sample 1 shows Haematite score 62 while sample 2 shows 55 score.
- In experimental analysis, trial drug 1(*Goghrita bharjita Gairika*) shows statistically significant result in Hb% and TIBC. While Trial drug 2 (*Godugdha bhavita*) increases body weight and Sr.Iron level significantly.
- Both trial groups show better results in increasing RBC and HCT with improving anaemia.
- Both groups have non-significant results in MCV, MCH, MCHC and Ferritin levels.
- Both trial drugs considered as effective haematinic in anaemic experimental animals.

Suggestions

- For process validation *Gairika* should be purified with other different methods.
- *Gairika* should be studied in other types of anaemia too.
- For proper analysis of results of *Gairika* on anaemia clinical trial should be done.

SUMMARY

The thesis entitled “Comparactive studty of effect of *Goghrita* and *Godugdha* shodhita *Gairika* on haematological parameters of wistar rats” comprises of following chapters.

A] Introduction: - The chapter explain details of need of present research work, rationale of the study. The chapter also enclosed previous work done regarding Iron deficiency anaemia and *Gairika*. Then enlists aims and objectives of the study. The chapter also states the research question and hypothesis.

B] Review of Literature: - The chapter divided into following three sections

- **Drug Review**: - In this section detailed detailed review of Gairika, Goghrita and Godugdha was done. References of Gairika from Samhita as well as Rasashastra classics were compiled together.
- **Disease Review**: - In this section the review of Panduroga and Iron deficiency anaemia was given.
- **Procedure Review**:- In this review of concepts like Shodhana, Bharjana and Bhavana were discussed in details

C] **Research Methodology:-**

Deals with Pharmaceutical study, Analytical study and Experimental study.

- Pharmaceutical study: - The study deals with purification of *Gairika* using *Goghrita* and *Godugdha* as media. Details of procedure, Precaution and observations were noted while doing actual practical of *shodhana*.
- Analytical study: - Analysis of two samples of purified *Gairika* was done from authorized research laboratory. Physic-chemical analysis, Elemental essay, XRD, ICP-AES and SEM of two samples of *Gairika* was done.
- Experimental study: - It deals with IAEC approval, Study mechanism, inclusion-exclusion criteria, study design and duration of study.

D] Analysis and Interpritation:-

The section deals with observations and results of Pharmaceutical study, Analytical study and Experimental study. The observations obtained in above studies were documented in tabular form and analysis was done.

The interpretation of all facts observed during whole study was discussed under the heading ‘Discussion’. In this section detail discussion on Literature review, Pharmaceutical, analytical, Experimental study and reasoning of obtained obesrvations, was done.

E] Conclusion: - In this section conclusion was enlisted, drawn from obtained findings. The section was terminated with possible suggestions.

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Body weight

Group	Marking	0 Day	7 Day	14 Day	21 Day	28 Day
NC	H	150.0	161.0	168.0	174.0	182.0
	B	154.0	162.0	171.0	175.0	183.0
	T	154.0	153.0	167.0	172.0	182.0
	HB	150.0	159.0	163.0	168.0	175.0
	HT	151.0	159.0	161.0	168.0	184.0
	W	153.0	162.0	170.0	181.0	189.0
MEAN		**152.0**	**159.3**	**166.7**	**173.0**	**182.5**
SD		**1.9**	**3.4**	**3.9**	**4.9**	**4.5**
DC	HBT	153.0	155.0	162.0	175.0	176.0
	B	159.0	160.0	165.0	173.0	182.0
	W	152.0	155.0	158.0	162.0	168.0
	FLS	149.0	Dead	Dead	Dead	Dead
	HLS	152.0	157.0	162.0	168.0	173.0
	T	158.0	161.0	165.0	169.0	175.0
MEAN		**153.8**	**157.6**	**162.4**	**169.4**	**174.8**
SD		**3.9**	**2.8**	**2.9**	**5.0**	**5.1**
STD	H	155.0	161.0	169.0	175.0	179.0
	B	159.0	162.0	168.0	171.0	181.0
	T	153.0	159.0	164.0	169.0	175.0
	HB	152.0	163.0	169.0	172.0	182.0
	HT	158.0	165.0	169.0	172.0	176.0
	W	158.0	162.0	170.0	175.0	179.0
MEAN		**155.8**	**162.0**	**168.2**	**172.3**	**178.7**
SD		**2.9**	**2.0**	**2.1**	**2.3**	**2.7**
T-1	RF	151.0	153.0	159.0	165.0	174.0
	RH	153.0	159.0	168.0	171.0	176.0
	RLS	154.0	160.0	167.0	169.0	173.0
	LF	Dead	Dead	Dead	Dead	Dead
	LH	158.0	163.0	167.0	170.0	174.0
	LLS	154.0	159.0	163.0	167.0	172.0
MEAN		**154.0**	**158.8**	**164.8**	**168.4**	**173.8**
SD		**2.5**	**3.6**	**3.8**	**2.4**	**1.5**
T-2	H-RLS	158.0	163.0	172.0	179.0	185.0
	H-RH	159.0	168.0	175.0	180.0	186.0
	H-RF	160.0	167.0	172.0	179.0	183.0
	B-LH	152.0	Dead	Dead	Dead	Dead
	B-LF	156.0	170.0	176.0	185.0	190.0
	W	155.0	171.0	176.0	181.0	185.0
MEAN		**156.7**	**167.8**	**174.2**	**180.8**	**185.8**
SD		**2.9**	**3.1**	**2.0**	**2.5**	**2.6**

Food consumption

Group	Cage	Day 0			Day 7			Day 14			Day 21			Day 28		
		R	C	C/A	R	C	C/A	R	C	C/A	R	C	C/A	R	C	C/A
NC	1	59.0	41.0	13.7	40.0	60.0	20.0	61.0	39.0	13.0	50.0	50.0	16.7	81.0	19.0	6.3
	2	63.0	37.0	12.3	39.0	61.0	20.3	69.0	31.0	10.3	49.0	51.0	17.0	79.0	21.0	7.0
Mean		**61.0**	**39.0**	**13.0**	**39.5**	**60.5**	**20.2**	**65.0**	**35.0**	**11.7**	**49.5**	**50.5**	**16.8**	**80.0**	**20.0**	**6.7**
SD		**2.8**	**2.8**	**0.9**	**0.7**	**0.7**	**0.2**	**5.7**	**5.7**	**1.9**	**0.7**	**0.7**	**0.2**	**1.4**	**1.4**	**0.5**
DC	3	57.0	43.0	14.3	35.0	65.0	21.7	70.0	30.0	10.0	44.0	56.0	18.7	65.0	35.0	11.7
	4	51.0	49.0	16.3	39.0	61.0	30.5	65.0	35.0	17.5	39.0	61.0	30.5	82.0	18.0	9.0
Mean		**54.0**	**46.0**	**15.3**	**37.0**	**63.0**	**26.1**	**67.5**	**32.5**	**13.8**	**41.5**	**58.5**	**24.6**	**73.5**	**26.5**	**10.3**
SD		**4.2**	**4.2**	**1.4**	**2.8**	**2.8**	**6.2**	**3.5**	**3.5**	**5.3**	**3.5**	**3.5**	**8.4**	**12.0**	**12.0**	**1.9**
STD	5	47.0	53.0	17.7	41.0	59.0	19.7	69.0	31.0	10.3	55.0	45.0	15.0	67.0	33.0	11.0
	6	59.0	41.0	13.7	51.0	49.0	16.3	78.0	22.0	7.3	39.0	61.0	20.3	59.0	41.0	13.7
Mean		**53.0**	**47.0**	**15.7**	**46.0**	**54.0**	**18.0**	**73.5**	**26.5**	**8.8**	**47.0**	**53.0**	**17.7**	**63.0**	**37.0**	**12.3**
SD		**8.5**	**8.5**	**2.8**	**7.1**	**7.1**	**2.4**	**6.4**	**6.4**	**2.1**	**11.3**	**11.3**	**3.8**	**5.7**	**5.7**	**1.9**
T-1	7	61.0	39.0	13.0	31.0	69.0	23.0	68.0	32.0	10.7	31.0	69.0	23.0	69.0	31.0	10.3
	8	57.0	43.0	21.5	35.0	65.0	32.5	76.0	24.0	12.0	33.0	67.0	33.5	79.0	21.0	10.5
Mean		**59.0**	**41.0**	**17.3**	**33.0**	**67.0**	**27.8**	**72.0**	**28.0**	**11.3**	**32.0**	**68.0**	**28.3**	**74.0**	**26.0**	**10.4**
SD		**2.8**	**2.8**	**6.0**	**2.8**	**2.8**	**6.7**	**5.7**	**5.7**	**0.9**	**1.4**	**1.4**	**7.4**	**7.1**	**7.1**	**0.1**
T-2	9	44.0	56.0	18.7	39.0	61.0	20.3	51.0	49.0	16.3	35.0	65.0	21.7	70.0	30.0	10.0
	10	49.0	51.0	17.0	41.0	59.0	29.5	59.0	41.0	20.5	41.0	59.0	29.5	65.0	35.0	17.5
Mean		**46.5**	**53.5**	**17.8**	**40.0**	**60.0**	**24.9**	**55.0**	**45.0**	**18.4**	**38.0**	**62.0**	**25.6**	**67.5**	**32.5**	**13.8**
SD		**3.5**	**3.5**	**1.2**	**1.4**	**1.4**	**6.5**	**5.7**	**5.7**	**2.9**	**4.2**	**4.2**	**5.5**	**3.5**	**3.5**	**5.3**

R:Remaining Food, C: Consumed Food, A: Animals present in cage

Hematology (Before induction)

Group	Marking	RBC (10^6/µl)	HGB (gm/L)	HCT (%)	MVC (fl)	MCH (pg)	MCHC (gm/L)
NC	H	9.1	18.4	53.1	58.2	20.1	34.6
	B	8.4	16.0	49.5	59.0	19.0	32.3
	T	10.2	19.3	59.2	58.2	18.9	32.6
	HB	8.5	16.5	51.2	60.3	19.4	32.2
	HT	5.7	9.6	28.9	51.1	16.9	33.2
	W	8.4	14.4	44.7	53.3	17.1	32.2
MEAN		**8.4**	**15.7**	**47.8**	**56.7**	**18.6**	**32.9**
SD		**1.5**	**3.5**	**10.4**	**3.6**	**1.3**	**0.9**
DC	HBT	6.6	13.1	41.2	62.7	19.9	31.7
	B	6.7	12.8	39.8	59.9	19.2	32.1
	W	2.8	5.4	17.9	63.4	19.0	30.1
	FLS	8.4	15.1	46.2	55.1	17.9	32.6
	HLS	8.3	15.0	46.3	55.6	18.0	32.3
	T	6.9	12.4	38.3	55.2	17.8	32.3
MEAN		**6.6**	**12.3**	**38.3**	**58.7**	**18.6**	**31.9**
SD		**2.0**	**3.6**	**10.5**	**3.9**	**0.9**	**0.9**
STD	H	7.2	14.4	43.7	61.0	20.0	32.9
	B	7.9	14.2	44.2	56.3	18.0	32.1
	T	5.1	9.1	30.1	58.7	17.7	30.2
	HB	8.1	14.8	47.4	58.5	18.2	31.2
	HT	8.3	15.9	49.1	59.4	19.2	32.3
	W	8.9	17.4	52.3	58.7	19.5	33.2
MEAN		**7.6**	**14.3**	**44.5**	**58.8**	**18.8**	**32.0**
SD		**1.3**	**2.8**	**7.7**	**1.5**	**0.9**	**1.1**
T-1	RF	9.0	17.3	55.2	61.2	19.1	31.3
	RH	8.5	14.7	44.4	52.1	17.2	33.1
	RLS	8.5	14.8	45.3	53.7	17.5	32.6
	LF	8.1	16.5	51.5	63.8	20.4	32.0
	LH	7.0	13.3	42.2	60.4	18.7	31.0
	LLS	7.0	13.8	45.8	65.5	19.7	30.1
MEAN		**8.0**	**15.1**	**47.4**	**59.5**	**18.8**	**31.7**
SD		**0.8**	**1.5**	**4.9**	**5.4**	**1.2**	**1.1**
T-2	H-RLS	8.5	14.8	47.9	56.2	17.3	30.8
	H-RH	8.8	16.2	49.7	56.8	18.4	32.5
	H-RF	9.7	17.9	54.7	56.7	18.5	32.7
	B-LH	7.8	15.1	48.2	61.9	19.3	31.3
	B-LF	9.1	16.8	53.0	58.1	18.4	31.6
	W	7.5	14.1	45.2	60.5	18.8	31.1
MEAN		**8.6**	**15.8**	**49.8**	**58.4**	**18.5**	**31.7**
SD		**0.8**	**1.4**	**3.5**	**2.3**	**0.7**	**0.8**

Hematology (Day 0)

Group	Marking	RBC (10^6/µl)	HGB (gm/L)	HCT (%)	MVC (fl)	MCH (pg)	MCHC (gm/L)
NC	H	8.3	14.6	44.4	53.7	17.6	32.8
	B	9.1	16.7	49.4	54.1	18.2	33.8
	T	8.4	14.8	46.3	55.5	17.7	31.9
	HB	8.6	15.2	45.2	52.4	17.6	33.6
	HT	8.9	15.7	46.9	52.6	17.6	33.4
	W	8.3	14.3	44.4	53.8	17.2	32.2
MEAN		**8.6**	**15.2**	**46.1**	**53.7**	**17.7**	**33.0**
SD		**0.4**	**0.9**	**1.9**	**1.1**	**0.3**	**0.8**
DC	HBT	4.1	10.1	21.1	51.0	24.4	47.9
	B	4.8	10.4	23.9	49.9	21.7	43.5
	W	5.2	9.6	26.4	51.0	18.5	36.4
	FLS	Dead	Dead	Dead	Dead	Dead	Dead
	HLS	4.8	9.8	22.7	47.5	20.5	43.2
	T	4.3	9.9	15.6	36.3	23.0	63.5
MEAN		**4.6**	**10.0**	**21.9**	**47.1**	**21.6**	**46.9**
SD		**0.4**	**0.3**	**4.0**	**6.2**	**2.3**	**10.1**
STD	H	2.7	9.5	16.1	60.3	35.6	59.0
	B	2.8	9.0	14.5	52.3	32.5	62.1
	T	3.4	11.6	20.0	59.5	34.5	58.0
	HB	4.7	9.9	24.5	52.4	21.2	40.4
	HT	3.9	9.3	20.4	52.0	23.7	45.6
	W	4.0	10.1	19.3	48.9	25.6	52.3
MEAN		**3.6**	**9.9**	**19.1**	**54.2**	**28.8**	**52.9**
SD		**0.8**	**0.9**	**3.5**	**4.6**	**6.1**	**8.5**
T-1	RF	4.1	8.4	20.2	49.6	20.6	41.6
	RH	4.0	9.2	20.6	51.0	22.8	44.7
	RLS	3.6	10.8	19.5	54.0	29.9	55.4
	LF	Dead	Dead	Dead	Dead	Dead	Dead
	LH	3.8	11.2	18.8	49.3	29.4	59.6
	LLS	4.1	10.9	21.0	51.0	26.5	51.9
MEAN		**3.9**	**10.1**	**20.0**	**51.0**	**25.8**	**50.6**
SD		**0.2**	**1.2**	**0.9**	**1.9**	**4.1**	**7.4**
T-2	H-RLS	4.1	9.9	22.0	53.7	24.1	45.0
	H-RH	4.7	10.8	21.8	46.1	22.8	49.5
	H-RF	4.0	10.4	20.8	51.7	25.9	50.0
	B-LH	2.9	8.9	20.2	70.4	31.0	44.1
	B-LF	3.5	11.1	21.6	61.0	31.4	51.4
	W	4.4	10.6	22.8	51.8	24.1	46.5
MEAN		**3.9**	**10.3**	**21.5**	**55.8**	**26.6**	**47.7**
SD		**0.7**	**0.8**	**0.9**	**8.6**	**3.7**	**3.0**

Hematology (Day 14)

Group	Marking	RBC (10^6/µl)	HGB (gm/L)	HCT (%)	MVC (fl)	MCH (pg)	MCHC (gm/L)
NC	H	8.4	14.7	45.0	53.7	17.5	32.7
	B	9.0	16.5	50.0	54.1	18.3	33.0
	T	8.4	15.0	47.0	55.5	17.9	31.9
	HB	8.5	15.2	46.0	52.4	17.9	33.0
	HT	8.2	15.3	46.9	52.6	18.7	32.6
	W	8.0	15.0	44.9	53.8	18.8	33.4
MEAN		**8.4**	**15.3**	**46.6**	**53.7**	**18.2**	**32.8**
SD		**0.3**	**0.6**	**1.9**	**1.1**	**0.5**	**0.5**
DC	HBT	2.0	9.4	20.0	51.1	47.0	47.0
	B	2.4	11.5	21.9	50.0	47.7	52.5
	W	2.9	10.2	25.3	51.0	35.2	40.3
	FLS	Dead	Dead	Dead	Dead	Dead	Dead
	HLS	4.3	12.7	22.7	47.5	29.5	55.9
	T	2.3	8.4	15.6	51.2	36.5	53.8
MEAN		**2.8**	**10.4**	**21.1**	**50.2**	**39.2**	**49.9**
SD		**0.9**	**1.7**	**3.6**	**1.6**	**7.9**	**6.3**
STD	H	2.9	9.6	21.1	72.8	33.1	45.5
	B	3.2	9.1	24.5	76.6	28.4	37.1
	T	3.6	12.0	24.0	66.7	33.3	50.0
	HB	4.1	13.9	24.5	59.8	33.9	56.7
	HT	3.9	13.0	23.0	59.0	33.3	56.5
	W	4.3	13.1	22.4	52.1	30.5	58.5
MEAN		**3.7**	**11.8**	**23.3**	**64.5**	**32.1**	**50.7**
SD		**0.5**	**2.0**	**1.3**	**9.2**	**2.2**	**8.3**
T-1	RF	4.2	13.0	22.5	53.6	31.0	57.8
	RH	4.3	13.2	25.6	59.5	30.7	51.6
	RLS	4.1	14.0	24.0	58.5	34.1	58.3
	LF	Dead	Dead	Dead	Dead	Dead	Dead
	LH	4.5	13.2	22.0	48.9	29.3	60.0
	LLS	4.7	13.5	27.0	57.4	28.7	50.0
MEAN		**4.4**	**13.4**	**24.2**	**55.6**	**30.8**	**55.5**
SD		**0.2**	**0.4**	**2.1**	**4.4**	**2.1**	**4.5**
T-2	H-RLS	4.5	12.7	22.8	50.7	28.2	55.7
	H-RH	4.7	14.5	21.8	46.1	30.7	66.5
	H-RF	4.0	13.4	20.8	51.7	33.3	64.4
	B-LH	2.9	8.9	20.2	70.4	31.0	44.1
	B-LF	3.5	12.1	21.6	61.0	34.2	56.0
	W	4.4	12.6	22.8	51.8	28.6	55.3
MEAN		**4.0**	**12.4**	**21.7**	**55.3**	**31.0**	**57.0**
SD		**0.7**	**1.9**	**1.0**	**8.8**	**2.4**	**8.0**

Hematology (Day 30)

Group	Marking	RBC (10^6/µl)	HGB (gm/L)	HCT (%)	MVC (fl)	MCH (pg)	MCHC (gm/L)
NC	H	10.3	18.4	57.6	55.9	17.8	31.9
	B	8.5	15.1	46.7	55.1	17.8	32.3
	T	9.7	18.2	55.4	57.0	18.7	32.8
	HB	8.8	15.6	49.7	56.3	17.6	31.3
	HT	9.6	16.4	51.4	53.8	17.1	31.9
	W	8.8	15.8	48.0	54.6	17.9	32.9
MEAN		**9.3**	**16.6**	**51.5**	**55.5**	**17.8**	**32.2**
SD		**0.7**	**1.4**	**4.3**	**1.2**	**0.5**	**0.6**
DC	HBT	4.2	7.7	22.2	52.9	18.3	34.7
	B	4.3	7.8	24.8	57.7	18.1	31.5
	W	3.2	8.2	23.2	72.5	25.6	35.3
	FLS	Dead	Dead	Dead	Dead	Dead	Dead
	HLS	5.0	8.0	25.0	50.0	16.0	32.0
	T	5.1	7.9	24.6	48.2	15.5	32.1
MEAN		**4.4**	**7.9**	**24.0**	**56.3**	**18.7**	**33.1**
SD		**0.8**	**0.2**	**1.2**	**9.8**	**4.1**	**1.8**
STD	H	6.8	12.5	4.4	59.2	18.3	30.9
	B	7.4	13.2	42.4	57.7	17.9	31.1
	T	8.0	16.3	47.6	59.8	20.4	34.2
	HB	7.2	14.5	41.4	58.0	20.2	35.0
	HT	7.5	14.0	44.1	59.2	18.7	31.7
	W	7.6	16.2	49.8	66.0	21.4	32.5
MEAN		**7.4**	**14.5**	**38.3**	**60.0**	**19.5**	**32.6**
SD		**0.4**	**1.6**	**16.9**	**3.1**	**1.4**	**1.7**
T-1	RF	9.0	18.1	56.0	62.1	20.0	32.3
	RH	8.8	18.7	58.1	65.9	21.2	32.1
	RLS	7.8	15.3	47.1	60.6	19.6	32.4
	LF	Dead	Dead	Dead	Dead	Dead	Dead
	LH	7.0	14.5	45.8	65.5	20.7	31.6
	LLS	6.3	9.9	36.9	58.7	15.7	26.8
MEAN		**7.8**	**15.3**	**48.8**	**62.6**	**19.4**	**31.0**
SD		**1.2**	**3.5**	**8.5**	**3.1**	**2.2**	**2.4**
T-2	H-RLS	7.1	13.8	45.7	64.5	19.4	30.1
	H-RH	8.1	13.8	48.2	59.6	17.0	28.6
	H-RF	7.9	14.9	48.9	62.3	18.9	30.4
	B-LH	Dead	Dead	Dead	Dead	Dead	Dead
	B-LF	7.6	14.4	47.3	62.0	18.8	30.4
	W	6.1	11.4	37.3	61.2	18.6	30.5
MEAN		**7.4**	**13.7**	**45.5**	**61.9**	**18.5**	**30.0**
SD		**0.8**	**1.3**	**4.7**	**1.8**	**0.9**	**0.8**

Biochemistry

Group	Marking	Ferritin (ng/ml)	Iron (µg/dl)	Total iron binding capacity (TIBC) (µg/dl)
NC	H	89.96	198.0	209.0
	B	88.54	213.0	267.0
	T	85.50	188.0	321.0
	HB	70.19	178.0	247.0
	HT	73.47	184.0	254.0
	W	78.86	177.0	280.0
MEAN		**81.09**	**189.7**	**263.0**
SD		**8.19**	**13.8**	**37.2**
DC	HBT	65.9	103.0	190.0
	B	60.8	105.0	184.0
	W	71.7	136.0	206.0
	FLS	Dead	Dead	Dead
	HLS	61.7	103.0	181.0
	T	63.3	124.0	167.0
MEAN		**64.66**	**114.2**	**185.6**
SD		**4.40**	**15.1**	**14.2**
STD	H	42.07	160.0	200.0
	B	69.53	123.0	216.0
	T	91.99	132.0	276.0
	HB	72.38	160.0	264.0
	HT	70.23	167.0	209.0
	W	78.62	169.0	230.0
MEAN		**70.80**	**151.8**	**232.5**
SD		**16.37**	**19.4**	**30.9**
T-1	RF	48.15	136.0	258.0
	RH	50.49	155.0	271.0
	RLS	62.58	167.0	262.0
	LF	Dead	Dead	Dead
	LH	61.18	151.0	244.0
	LLS	68.05	163.0	208.0
MEAN		**58.09**	**154.4**	**248.6**
SD		**8.45**	**12.1**	**24.7**
T-2	H-RLS	67.25	161.0	247.0
	H-RH	43.17	197.0	248.0
	H-RF	62.90	177.0	283.0
	B-LH	Dead	Dead	Dead
	B-LF	52.08	168.0	200.0
	W	63.65	143.0	193.0
MEAN		**57.81**	**169.2**	**234.2**
SD		**9.95**	**19.9**	**37.4**

Relative Organ weight (gm)

Group	Marking	Adrenals	Heart	Kidneys	Liver	Spleen	Lungs	Gonads	Brain	Pancreas
NC	H	0.051	0.477	0.943	4.921	0.640	0.948	0.060	0.848	0.622
	B	0.088	0.591	1.227	6.560	0.631	1.810	0.169	1.036	0.275
	T	0.058	0.532	1.086	5.482	0.576	0.973	0.091	1.110	0.576
	HB	0.047	0.425	1.107	4.373	0.320	0.839	0.054	0.763	0.433
	HT	0.034	0.476	1.203	5.577	0.582	1.086	0.080	1.025	0.493
	W	0.052	0.471	1.101	4.796	0.451	1.041	0.074	1.019	0.763
MEAN		**0.055**	**0.495**	**1.111**	**5.285**	**0.533**	**1.116**	**0.088**	**0.967**	**0.527**
SD		**0.018**	**0.058**	**0.101**	**0.769**	**0.124**	**0.350**	**0.042**	**0.132**	**0.168**
DC	HBT	0.043	0.487	1.036	5.380	0.580	1.154	0.083	0.865	0.538
	B	0.079	0.492	1.100	5.545	0.691	1.252	0.131	1.081	0.312
	W	0.064	0.536	1.267	4.841	0.542	1.282	0.085	0.928	0.679
	FLS	Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead
	HLS	0.065	0.434	0.964	5.728	0.453	0.874	0.082	0.925	0.660
	T	0.046	0.485	0.969	5.108	0.509	1.501	0.077	0.973	0.396
MEAN		**0.059**	**0.487**	**1.067**	**5.320**	**0.555**	**1.212**	**0.092**	**0.955**	**0.517**
SD		**0.015**	**0.036**	**0.125**	**0.352**	**0.089**	**0.228**	**0.022**	**0.081**	**0.161**
STD	H	0.050	0.469	0.928	4.840	0.629	0.932	0.059	0.834	0.612
	B	0.087	0.585	1.213	6.488	0.624	1.791	0.167	1.025	0.272
	T	0.055	0.511	1.044	5.271	0.554	0.936	0.087	1.067	0.554
	HB	0.049	0.442	1.151	4.548	0.333	0.873	0.057	0.793	0.450
	HT	0.033	0.455	1.151	5.335	0.556	1.039	0.076	0.980	0.472
	W	0.050	0.446	1.042	4.542	0.427	0.986	0.070	0.965	0.723
MEAN		**0.054**	**0.485**	**1.088**	**5.171**	**0.520**	**1.093**	**0.086**	**0.944**	**0.514**
SD		**0.018**	**0.055**	**0.103**	**0.730**	**0.117**	**0.346**	**0.041**	**0.108**	**0.155**

T-1	**RF**	0.036	0.659	1.098	4.771	0.425	1.075	0.097	0.105	0.704
	RH	0.070	0.514	1.205	6.245	0.589	1.347	0.095	1.019	0.469
	RLS	0.054	0.458	1.141	5.804	0.625	1.255	0.127	0.764	0.347
	LF	Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead
	LH	0.056	0.477	1.017	4.679	0.453	0.925	0.059	0.895	0.295
	LLS	0.030	0.506	0.893	4.717	0.756	0.833	0.080	0.991	0.494
MEAN		**0.049**	**0.523**	**1.071**	**5.243**	**0.569**	**1.087**	**0.267**	**0.755**	**0.462**
SD		**0.016**	**0.079**	**0.121**	**0.731**	**0.135**	**0.216**	**0.396**	**0.377**	**0.159**
T-2	**H-RLS**	0.041	0.364	0.959	5.002	0.418	0.661	0.075	1.612	0.334
	H-RH	0.040	0.590	1.247	6.668	0.414	0.909	0.055	0.951	0.380
	H-RF	0.038	0.587	1.092	5.512	0.374	0.807	0.056	0.923	0.424
	B-LH	Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead
	B-LF	0.034	0.339	1.243	5.759	0.545	0.808	0.082	0.941	0.398
	W	0.043	0.457	1.077	4.695	0.343	0.717	0.095	1.024	0.349
MEAN		**0.039**	**0.467**	**1.124**	**5.527**	**0.419**	**0.780**	**0.073**	**1.090**	**0.377**
SD		**0.003**	**0.119**	**0.122**	**0.762**	**0.077**	**0.095**	**0.017**	**0.294**	**0.036**

CIN. NO.:U24239PN2000PTC015557

SG Phyto Pharma Pvt ltd

Factory :
B-53/D - 21 M.I.D.C.
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STANDARDIZATION & AUTHENTICATION CERTIFICATE

Date –30.11.2016

Drug sample provided to Dr.Renuka M,Suryawanshi, P.G. Scholar – Rasashastra Dept, Tilak Maharashtra Vidyapeeth, Pune is studied exomorphically and microscopically.

We hereby authenticate that the sample belong to-

Sample no.	Drug Name	Scientific Name	Chemical Formula	Purchase Qty.
1.	Suvarnagairik	Oxide of Iron	Fe_2O_3	500 g

This certificate is provided on demand Dr.Renuka M,Suryawanshi for Research topic,

"Comparative Study of Effect of Goghrita & Godugdha Shodhita Gairika on Haematological Parameters of Wistar Rats".

Thus above Drug is authentified and standardized.

Encl.: Analysis / Standardization Report of Above Drug.

For S.G. Phyto Pharma Pvt. Ltd

Kolhapur

Nav Maharashtra Shikshan Mandal's

ABASAHEB KAKADE COLLEGE OF B PHARMACY

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Approved by Sate Govt. of Maharashtra,Mumbai
Approved by Directorate of Technical Education,Mumbai.
Approved by All India Council For Technical Education (A.I.C.T.E) New Delhi
PCI New Delhi Applied
DTE Institute Code : 5416



Sau.Harshdatai Kakade — Joint Secretary
Adv.Vidhyadar J.Kakade — Secretary
Late Abasaheb Kakade — Founder

Bodhegaon,Tal.Shevgaon, Dist. Ahmednagar.-414 503 Telefax : (02429) 240295 /8378993997 E-mail- kakadebpharmacy@gmail.com

Ref. No.04/2017-18

Date : 09/04/2017

To,
Dr. Renuka Madhav Suryawanshi
Assit. Professor.
(Department of Rasashastra avum Baishajya Kalpana)
PMT's Ayurved College Shevgaon
Dist- Ahamednagar 414502.

Subject:- Report of analysis of the sample Gairika(R) provided by you .

The sample provided by you were analysed as per your requirements and the sample were as followes

Sr. no	Test name	Results obtained %
1.	Nature	Massive clayey
2.	Color	Brick red
3.	Streak	Brick red
4.	Fracture	Uneven
5.	Luster	Earthy
6.	Tenacity	Brittle
7.	Transparency	Opaque
8.	Hardness	5.7
9.	Specific gravity	2.76
10.	pH (1%)	5.98
11.	Solubility (HCL)	87%
12.	Loss on drying @ (110^0c)	0.1%
13.	Total ash	99.07%
14.	Acid insoluble ash	10.26%
15.	Water soluble ash	98.73%
16.	Sulphated ash	73.88%
17.	Residue on ignition	0.02%

All the tests were performed according to standard methods. In case of any queries regarding the results please feel free to contact us back. .

Thanking You

Assistant Professor
Miss. Tarkasband Yogita S. (M.Pharm)
Pharmcognosy Department

Director
Prof. V.B. Gawali
DIRECTOR
Abasaheb Kakade College of B. Pharmacy
Bodhegaon, Tal. Shevgaon, Dist. A.Nagar

Nav Maharashtra Shikshan Mandal's

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Sau.Harshdatai Kakade — Joint Secretary
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Late Abasaheb Kakade — Founder

Bodhegaon,Tal.Shevgaon, Dist. Ahmednagar.-414 503 Telefax : (02429) 240295 /8378993997 E-mail- kakadebpharmacy@gmail.com

Ref. No 184/A/2017-18 Date : 18/08/2017

To,
Dr. Renuka Madhav Suryawanshi
Assit. Professor.
(Department of Rasashastra avum Baishajya Kalpana)
PMT's Ayurved College Shevgaon
Dist- Ahamednagar 414502.

Subject: - Report of analysis of the sample -1 Shudha Gairika (Goghrita) provided by you.

The samples provided by you were analysed as per your requirements and the samples were as follows

Sr. no	Test name	Results obtained %
1.	Nature	Massive clayey
2.	Color	Dark Brick red
3.	Streak	Brick red
4.	Fracture	Uneven
5.	Luster	Earthy
6.	Tenacity	Brittle
7.	Transparency	Opaque
8.	Hardness	5.4
9.	Specific gravity	2.71
10.	pH (1%)	5.80
11.	Solubility (HCL)	86%
12.	Loss on drying @ (1100c)	<0.1%
13.	Total ash	99.08%
14.	Acid insoluble ash	10.29%
15.	Water soluble ash	98.91%
16.	Sulphated ash	73.70%
17.	Residue on ignition	0.02%

All the tests were performed according to standard methods. In case of any queries regarding, the results please feel free to contact us back.

Thanking You

Assistant Professor
Miss. Tarkasband Yogita S. (M.Pharm)
Pharmcognosy Department

Director
Prof. S.B. Chavali
Abasaheb Kakade College of B. Pharmacy
Bodhegaon, Tal. Shevgaon, Dist. A.Nagar

Nav Maharashtra Shikshan Mandal's

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Late Abasaheb Kakade — Founder

Bodhegaon,Tal.Shevgaon, Dist. Ahmednagar.-414 503 Telefax : (02429) 240295 /8378993997 E-mail- kakadebpharmacy@gmail.com

Ref. No. 184/B/2017-18 Date : 18/08/2017

To,
Dr. Renuka Madhav Suryawanshi
Assit. Professor.
(Department of Rasashastra avum Baishajya Kalpana)
PMT's Ayurved College Shevgaon
Dist- Ahamednagar 414502.

Subject:- Report of analysis of the sample -2 Shudha Gairika (Godugdha) provided by you.

The samples provided by you were analysed as per your requirements and the samples were as follows

Sr. no	Test name	Results obtained %
1.	Nature	Massive clayey
2.	Color	Brick red
3.	Streak	Brick red
4.	Fracture	Uneven
5.	Luster	Earthy
6.	Tenacity	Brittle
7.	Transparency	Opaque
8.	Hardness	5.4
9.	Specific gravity	2.71
10.	pH (1%)	5.12
11.	Solubility (HCL)	89%
12.	Loss on drying @ (1100c)	<0.1%
13.	Total ash	99.34%
14.	Acid insoluble ash	10.26%
15.	Water soluble ash	98.87%
16.	Sulphated ash	69.72%
17.	Residue on ignition	0.02%

All the tests were performed according to standard methods. In case of any queries regarding the results please feel free to contact us back.
Thank you

Assistant Professor
Miss. Tarkasband Yogita S. (M.Pharm)
Pharmcognosy Department

Abasaheb Kakade College of B Pharmacy Bodhegaon

Director
Prof. V.B. Gawali
DIRECTOR
Abasaheb Kakade College of B. Pharmacy
Bodhegaon, Tal. Shevgaon, Dist. A.Nagar

Ref: -ICP AES-77
Date: 26/07/2017

Analytical report of the samples submitted by **Dr. Renuka Suryawanshi, Ayurved College Shevgaon,** using Inductively Coupled Plasma Atomic Emission Spectroscopy.

Sample	Cd	Cu	Fe	Pb	As	Hg
	%	%	%	%	%	%
S1	ND	0.0023	23.303	0.0044	ND	ND
S2	ND	0.0020	17.201	0.0067	ND	0.0142
R	ND	0.0016	26.353	0.0049	ND	ND

ND means less than 0.01 ppm

Note: Content of this report is meant for your information only and should not be quoted as certificate to third party for advertisement, evidence or litigation.

To,
Dr. B. T. Shinde,
Principal,
Ayurved College Shevgaon,

"Note: Content of this report is meant for your information only and should not be used for advertisement, evidence or litigation."

STATEMENT OF COMPLIANCE

We, the Undersigned hereby declare that this Research Project No "RP. No.03/1718" approved by IAEC dated 07/April/2017entitled "Comparative study of effect of Goghrita and GodugdhashodhitaGairika on haematological parameters of Wistar rats"was performed according to the agreed protocol and Standard Operating Procedures of the test facility. We accept the responsibility for validity of the data, as well as the interpretation, analysis, documentation and reporting of the results.

The study was performed at APT Research Foundation, Pune.

Submitted by:

Study Incharge	Dr. Bhagyashri Nagarkar	08/March/2018	Bhagarkar
Head of Test Facility	Dr. Kishori G Apte	08/March/18	Kapte
		Date	Signature

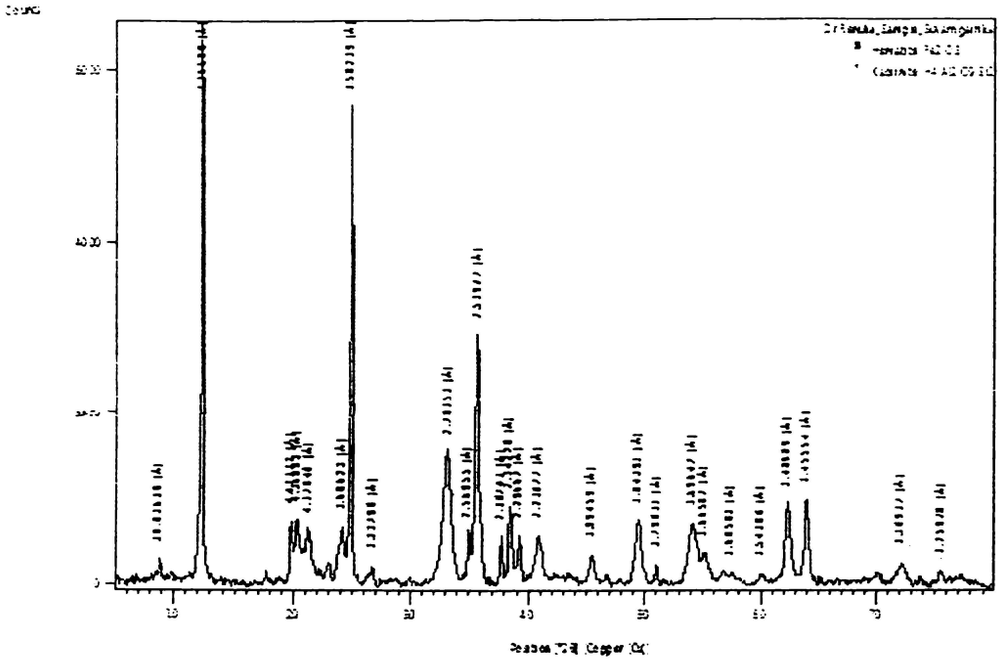
APT RESEARCH FOUNDATION PUNE

APTRF TEST REPORT

Measurement Conditions: (Bookmark 1)

Dataset Name	Dr Renuka_Sample_Suvarngairika
File name	D:\XRD Data\Year 2016\POWDER DIFFRACTION DATA\EXTERNAL\University\dR rENUKA\Dr Renuka_Sample_Suvarngairika.xrdml
Comment	Configuration=Stage Spinner, Owner=User-1, Creation date=8/28/2014 2:42:07 PM
Goniometer=Theta/Theta; Minimum step size 2Theta:0.0001; Minimum step size Omega:0.0001	
Sample stage=Reflection-transmission spinner; Minimum step size Phi:0.1	
Diffractometer system=EMPYREAN	
Measurement program=C:\PANalytical\Data Collector\Programs\STANDARD METHOD_FDS.xrdmp, Identifier={598C3F8C-3773-46F5-B457-395A0F781CD7}	
Batch program=C:\PANalytical\Data Collector\Programs\sample-changer- 1-5 samples.xrdmp, Identifier={8E6C02AA-7611-4E29-8082-89062ED60AFD}	
Measurement Start Date/Time	3/6/2017 12:24:20 PM
Operator	Indian Institute
Raw Data Origin	XRD measurement (*.XRDML)
Scan Axis	Gonio
Start Position [°2θ]	5.0066
End Position [°2θ]	79.9906
Step Size [°2θ]	0.0130
Scan Step Time [s]	37.9950
Scan Type	Continuous
PSD Mode	Scanning
PSD Length [°2θ]	3.35
Offset [°2θ]	0.0000
Divergence Slit Type	Fixed
Divergence Slit Size [°]	0.5000
Specimen Length [mm]	10.00
Measurement Temperature [°C]	25.00
Anode Material	Cu
K-Alpha1 [Å]	1.54060
K-Alpha2 [Å]	1.54443
K-Beta [Å]	1.39225
K-A2 / K-A1 Ratio	0.50000
Generator Settings	40 mA, 45 kV
Diffractometer Type	00000000111159166
Diffractometer Number	0
Goniometer Radius [mm]	240.00
Dist. Focus-Diverg. Slit [mm]	100.00
Incident Beam Monochromator	No
Spinning	Yes

Main Graphics, Analyze View: (Bookmark 2)



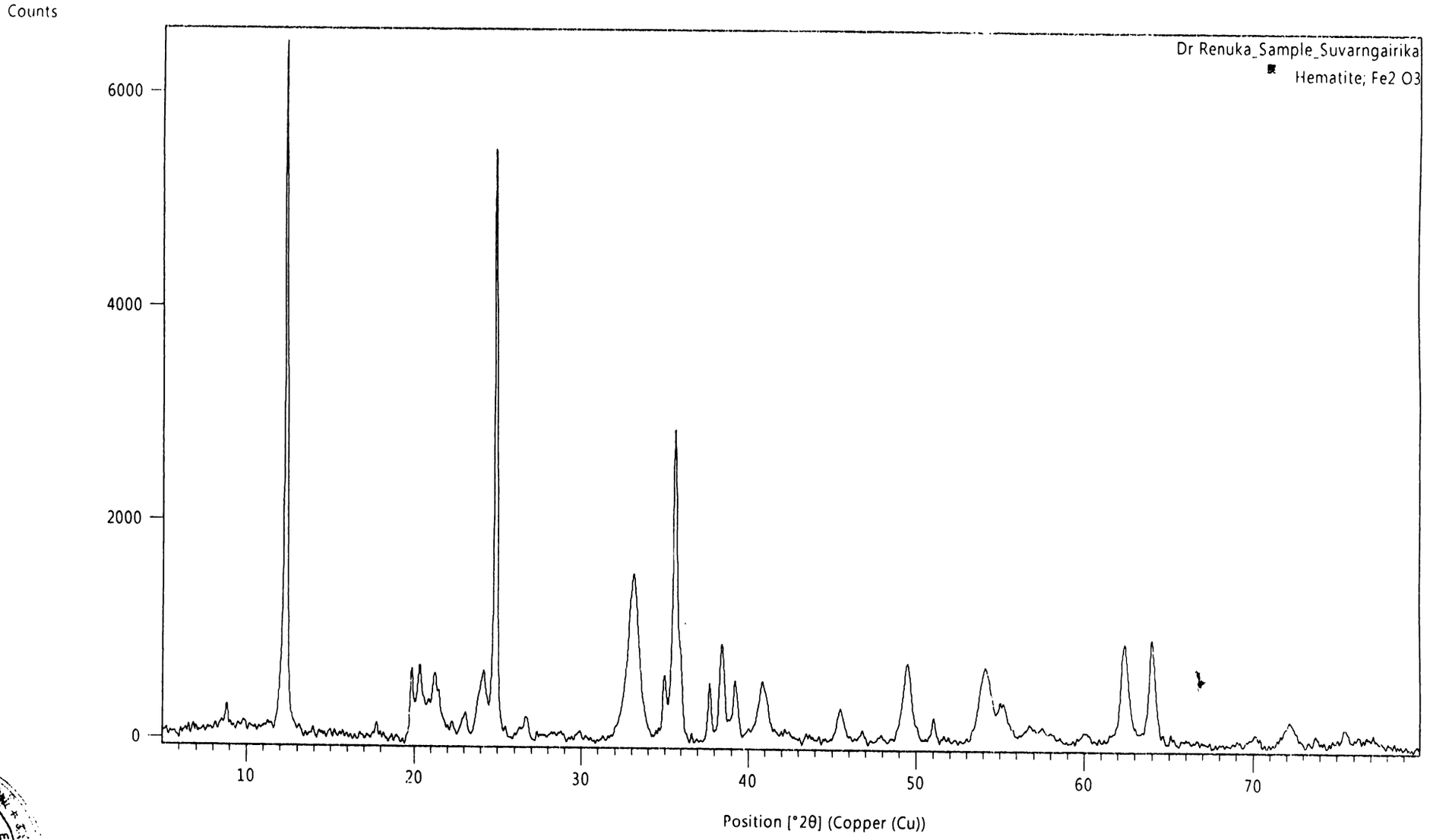
Peak List: (Bookmark 3)

Pos. [°2θ]	Height [cts]	FWHM Left [°2θ]	d-spacing [Å]	Rel. Int. [%]
8.8288	237.82	0.3070	10.01610	3.72
12.3522	6399.84	0.0895	7.16589	100.00
19.8551	638.03	0.1279	4.47172	9.97
20.3224	647.26	0.1535	4.36993	10.11
21.3059	503.90	0.2047	4.17040	7.87
24.1439	591.94	0.2047	3.68623	9.25
24.8562	5535.06	0.0895	3.58219	86.49
26.7078	205.09	0.3070	3.33790	3.20
33.1622	1463.70	0.4605	2.70151	22.87
34.9186	488.59	0.1791	2.56955	7.63
35.6386	2825.40	0.0640	2.51927	44.15
37.6790	514.06	0.1535	2.38741	8.03
38.4246	873.26	0.2047	2.34278	13.65
39.2273	507.62	0.2047	2.29667	7.93
40.8179	524.28	0.2558	2.21077	8.19
45.4755	302.19	0.3070	1.99459	4.72
49.4293	715.60	0.4093	1.84391	11.18
51.0189	236.23	0.2047	1.79013	3.69
54.0573	653.52	0.6140	1.69647	10.21
55.1355	274.26	0.3070	1.66582	4.29
57.3827	72.35	0.8187	1.60581	1.13
60.0030	85.12	0.6140	1.54180	1.33

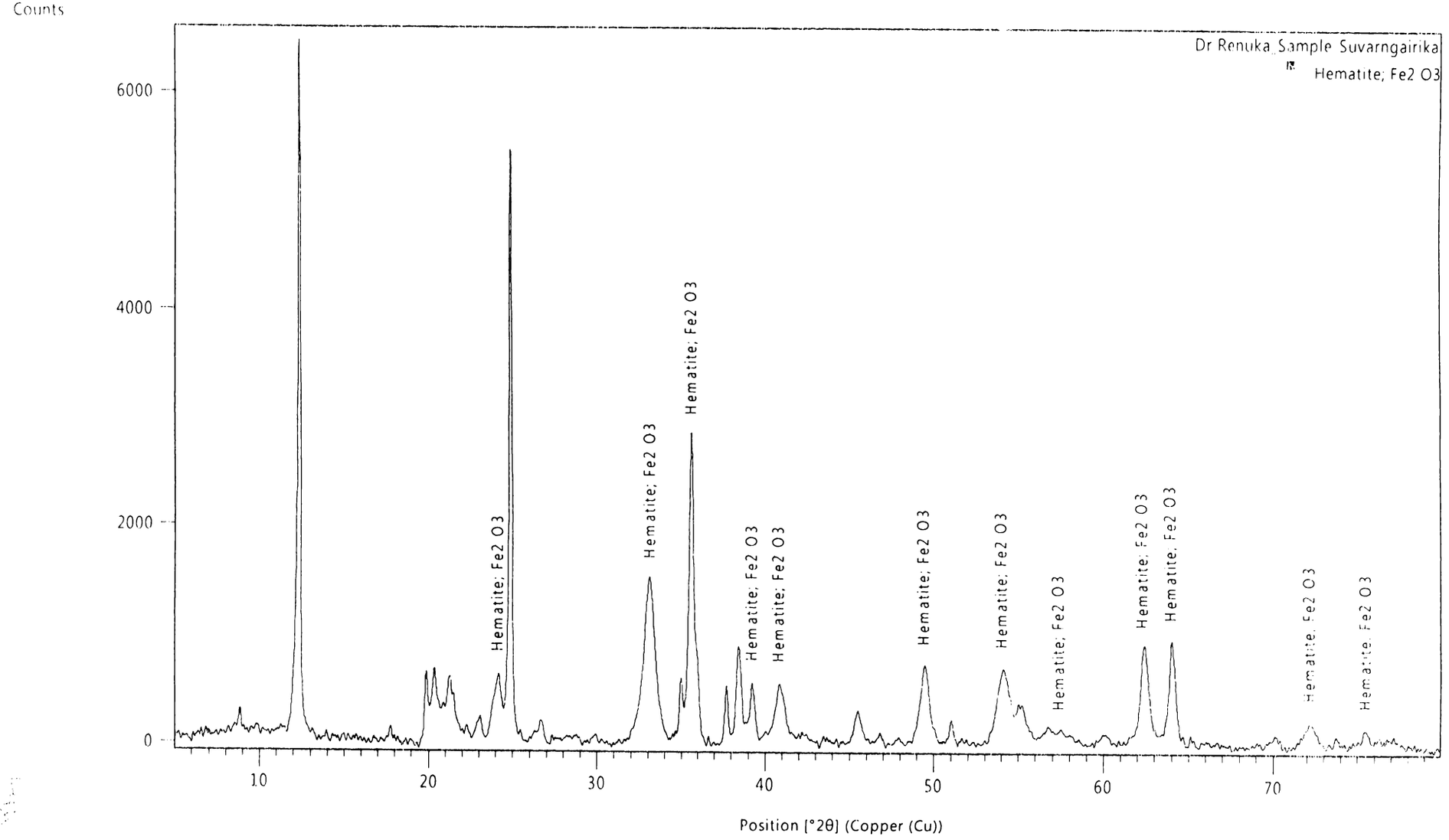
62.3219	881.30	0.4093	1.48989	13.77
63.9647	936.99	0.1791	1.45554	14.64
72.1414	211.47	0.4093	1.30937	3.30
75.4981	129.40	0.3070	1.25928	2.02

Pattern List: (Bookmark 4)

Visible	Ref.Code	Score	Compound Name	Displ.[°2θ]	Scale Fac.	Chem. Formula
*	98-018-4766	68	Hematite	0.000	0.368	Fe2 O3
*	98-008-7771	47	Kaolinite	0.000	0.717	H4 Al2 O9 Si2


Counts
Dr Renuka_Sample_Suvarngairika
Hematite; Fe2 O3
6000
4000
2000
0
10
20
30
40
50
60
70
Position [°2θ] (Copper (Cu))

Counts
0
2000
4000
6000
10
20
30
40
50
60
70
Position [°2θ] (Copper (Cu))
10.01610 [Å]
7.16589 [Å]; Kaolinite; H4 Al2 O9 Si2
4.47172 [Å]; Kaolinite; H4 Al2 O9 Si2
4.36993 [Å]; Kaolinite; H4 Al2 O9 Si2
4.17040 [Å]; Kaolinite; H4 Al2 O9 Si2
3.68623 [Å]; Hematite; Fe2 O3
3.58219 [Å]; Kaolinite; H4 Al2 O9 Si2
3.33790 [Å]
2.70151 [Å]; Hematite; Fe2 O3
2.56955 [Å]; Kaolinite; H4 Al2 O9 Si2
2.51927 [Å]; Hematite; Fe2 O3; Kaolinite; H4 Al2 O9 Si2
2.38741 [Å]; Kaolinite; H4 Al2 O9 Si2
2.34278 [Å]; Kaolinite; H4 Al2 O9 Si2
2.29667 [Å]; Hematite; Fe2 O3; Kaolinite; H4 Al2 O9 Si2
2.21077 [Å]; Hematite; Fe2 O3; Kaolinite; H4 Al2 O9 Si2
1.99459 [Å]; Kaolinite; H4 Al2 O9 Si2
1.84391 [Å]; Hematite; Fe2 O3; Kaolinite; H4 Al2 O9 Si2
1.79013 [Å]; Kaolinite; H4 Al2 O9 Si2
1.69647 [Å]; Hematite; Fe2 O3; Kaolinite; H4 Al2 O9 Si2
1.66582 [Å]; Kaolinite; H4 Al2 O9 Si2
1.60581 [Å]; Hematite; Fe2 O3; Kaolinite; H4 Al2 O9 Si2
1.54180 [Å]; Kaolinite; H4 Al2 O9 Si2
1.48989 [Å]; Hematite; Fe2 O3; Kaolinite; H4 Al2 O9 Si2
1.45554 [Å]; Hematite; Fe2 O3; Kaolinite; H4 Al2 O9 Si2
1.30937 [Å]; Hematite; Fe2 O3; Kaolinite; H4 Al2 O9 Si2
1.25928 [Å]; Hematite; Fe2 O3; Kaolinite; H4 Al2 O9 Si2
Dr Renuka Sample Suvarngairika
Hematite; Fe2 O3
Kaolinite; H4 Al2 O9 Si2

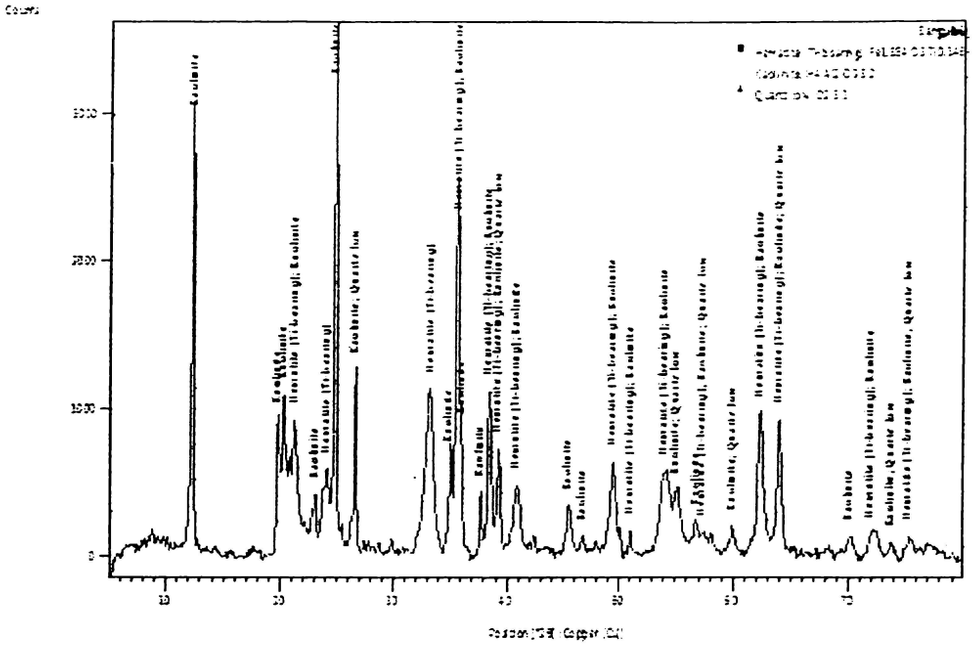

Counts
Dr Renuka Sample Suvarngairika
Hematite; Fe2 O3
6000
4000
2000
0
Hematite; Fe2 O3
Hematite; Fe2 O3
Hematite; Fe2 O3
Hematite; Fe2 O3
Hematite; Fe2 O3
Hematite; Fe2 O3
Hematite; Fe2 O3
Hematite; Fe2 O3
Hematite; Fe2 O3
Hematite; Fe2 O3
Hematite; Fe2 O3
10
20
30
40
50
60
70
Position [°2θ] (Copper (Cu))

This is the simple example template containing only headers for each report item and the bookmarks. The invisible bookmarks are indicated by text between brackets.
Modify it according to your own needs and standards.

Measurement Conditions: (Bookmark 1)

Dataset Name	Sample-I
File name	D:\XRD Data\Year 2016\POWDER DIFFRACTION DATA\EXTERNAL\University\dR rENUKA\Sample-I.xrdml
Comment	Configuration=Stage Spinner, Owner=User-1, Creation date=8/28/2014 2:42:07 PM
Goniometer=Theta/Theta; Minimum step size 2Theta:0.0001; Minimum step size Omega:0.0001	
Sample stage=Reflection-transmission spinner; Minimum step size Phi:0.1	
Diffractometer system=EMPYREAN	
Measurement program=C:\PANalytical\Data Collector\Programs\STANDARD METHOD_FDS.xrdmp, Identifier={DD75F814-00D7-457F-9399-98B392FC5600}	
Batch program=C:\PANalytical\Data Collector\Programs\sample-changer- 1-9samples.xrdmp, Identifier={FEA9AE87-7AA0-4EE8-904F-409E52035F0A}	
Measurement Start Date/Time	5/12/2017 12:14:20 PM
Operator	Indian Institute
Raw Data Origin	XRD measurement (*.XRDML)
Scan Axis	Gonio
Start Position [°2θ]	5.0066
End Position [°2θ]	79.9906
Step Size [°2θ]	0.0130
Scan Step Time [s]	37.9950
Scan Type	Continuous
PSD Mode	Scanning
PSD Length [°2θ]	3.35
Offset [°2θ]	0.0000
Divergence Slit Type	Fixed
Divergence Slit Size [°]	0.5000
Specimen Length [mm]	10.00
Measurement Temperature [°C]	25.00
Anode Material	Cu
K-Alpha1 [Å]	1.54060
K-Alpha2 [Å]	1.54443
K-Beta [Å]	1.39225
K-A2 / K-A1 Ratio	0.50000
Generator Settings	40 mA, 45 kV
Diffractometer Type	0000000011159166
Diffractometer Number	0
Goniometer Radius [mm]	240.00
Dist. Focus-Diverg. Slit [mm]	100.00
Incident Beam Monochromator	No
Spinning	Yes

Main Graphics, Analyze View: (Bookmark 2)



Peak List: (Bookmark 3)

Pos. [°2θ]	Height [cts]	FWHM Left [°2θ]	d-spacing [Å]	Rel. Int. [%]
12.3541	2898.17	0.1023	7.16474	82.10
19.8288	906.42	0.0768	4.47759	25.68
20.3239	1047.80	0.1279	4.36963	29.68
21.2232	831.97	0.3582	4.18645	23.57
23.1034	304.27	0.2047	3.84984	8.62
24.0978	483.43	0.1535	3.69318	13.69
24.8527	3530.17	0.1023	3.58269	100.00
26.6021	1195.18	0.0640	3.35091	33.86
33.1396	1080.79	0.4605	2.70330	30.62
34.9084	610.43	0.2047	2.57027	17.29
35.6194	2471.86	0.1151	2.52059	70.02
35.9874	817.81	0.1535	2.49565	23.17
37.6661	389.02	0.1279	2.38820	11.02
38.4272	1066.68	0.2814	2.34263	30.22
39.2279	657.79	0.1535	2.29664	18.63
40.8794	418.31	0.5628	2.20759	11.85
45.4405	314.40	0.3582	1.99605	8.91
46.7506	102.16	0.3070	1.94312	2.89
49.4591	630.77	0.2558	1.84287	17.87
51.0121	181.22	0.1535	1.79035	5.13
54.1162	479.78	0.7164	1.69476	13.59
55.1399	341.59	0.3070	1.66570	9.68

56.7753	152.58	0.3070	1.62154	4.32
57.3797	74.33	0.8187	1.60589	2.11
59.9678	148.77	0.3070	1.54262	4.21
62.2784	894.87	0.3582	1.49083	25.35
63.9558	864.35	0.1791	1.45572	24.48
70.1336	146.19	0.5117	1.34185	4.14
71.9777	147.38	0.8187	1.31195	4.17
73.7727	81.67	0.6140	1.28440	2.31
75.3088	118.58	0.6140	1.26198	3.36

Pattern List: (Bookmark 4)

Visible	Ref.Code	Score	Compound Name	Displ.[°2θ]	Scale Fac.	Chem. Formula
*	98-016-8008	62	Hematite (Ti-bearing)	0.000	0.657	Fe1.854 O3 Ti0.146
*	98-008-7771	49	Kaolinite	0.000	0.861	H4 Al2 O9 Si2
*	98-020-0721	39	Quartz low	0.000	0.337	O2 Si1

Document History: (Bookmark 5)

Insert Measurement:
- File name = "Sample-I.xrdml"
- Modification time = "5/19/2017 10:23:17 AM"
- Modification editor = "Indian Institute"

Default properties:
- Measurement step axis = "None"
- Internal wavelengths used from anode material: Copper (Cu)
- Original K-Alpha1 wavelength = "1.54060"
- Used K-Alpha1 wavelength = "1.54060"
- Original K-Alpha2 wavelength = "1.54443"
- Used K-Alpha2 wavelength = "1.54443"
- Original K-Beta wavelength = "1.39225"
- Used K-Beta wavelength = "1.39225"
- Irradiated length = "10.00000"
- Receiving slit size = "0.10000"
- Distance to sample = "Diffracted radius"
- Step axis value = "0.00000"
- Offset = "0.00000"
- Sample length = "10.00000"
- Modification time = "5/19/2017 10:23:17 AM"
- Modification editor = "Indian Institute"

Interpolate Step Size:
- Initial Scan Range = 5.00657 - 79.99360
- Initial Step Size = 0.01313

- Derived Step Size = 0.01300
- Use Derived Step Size = "Yes"
- Modification time = "5/19/2017 10:23:18 AM"
- Modification editor = "PANalytical"

Determine Background:
- Add to net scan = "Nothing"
- User defined intensity = "-5"
- Correction method = "Automatic"
- Bending factor = "5"
- Minimum significance = "0.7"
- Minimum tip width = "0"
- Maximum tip width = "1"
- Peak base width = "2"
- Use smoothed input data = "Yes"
- Granularity = "20"
- Modification time = "2/22/2001 10:17:43 AM"
- Modification editor = "PANalytical"

Search Peaks:
- Minimum significance = "2"
- Minimum tip width = "0.01"
- Maximum tip width = "1"
- Peak base width = "2"
- Method = "Minimum 2nd derivative"
- Modification time = "2/20/2001 11:55:18 AM"
- Modification editor = "PANalytical"

Search & Match:
- Allow pattern shift = "No"
- Auto residue = "Yes"
- Data source = "Profile and peak list"
- Demote unmatched strong = "Yes"
- Multi phase = "Yes"
- Restriction set = "Minerals"
- Restriction = "Restriction set"
- Subset name = ""
- Match intensity = "Yes"
- Two theta shift = "0"
- Identify = "Yes"
- Max. no. of accepted patterns = "5"
- Minimum score = "27"
- Min. new lines / total lines = "40"
- Search depth = "6"
- Minimum new lines = "3"
- Minimum scale factor = "0.06"
- Intensity threshold = "0"
- Use line clustering = "Yes"
- Line cluster range = "1.5"
- Search sensitivity = "1.8"
- Use adaptive smoothing = "Yes"

- Smoothing range = "1.5"
- Threshold factor = "3"
- Match Threshold = "0"
- Modification time = "2/5/2001 11:17:06 AM"
- Modification editor = "PANalytical"

Subtract Background:
- Add to net scan = "Nothing"
- User defined intensity = "0"
- Correction method = "Automatic"
- Bending factor = "1"
- Minimum significance = "1"
- Minimum tip width = "0.01"
- Maximum tip width = "1"
- Peak base width = "2"
- Use smoothed input data = "Yes"
- Granularity = "16"
- Modification time = "5/12/2017 2:26:17 PM"
- Modification editor = "Indian Institute"

Smooth:
- Polynomial type = "Cubic"
- Convolution range = "7"
- Degree of smoothing = "12"
- Fast Fourier = "Yes"
- Omit Peaks = "Yes"
- Adaptive Denoising = "No"
- Automatic Decomposition Level = "Yes"
- Decomposition Level = "4"
- Modification time = "5/1/2017 4:44:04 PM"
- Modification editor = "Indian Institute"

More items... (Bookmark 6)

More items... (Bookmark 7)

More items... (Bookmark 8)

More items... (Bookmark 9)

More items... (Bookmark 10)

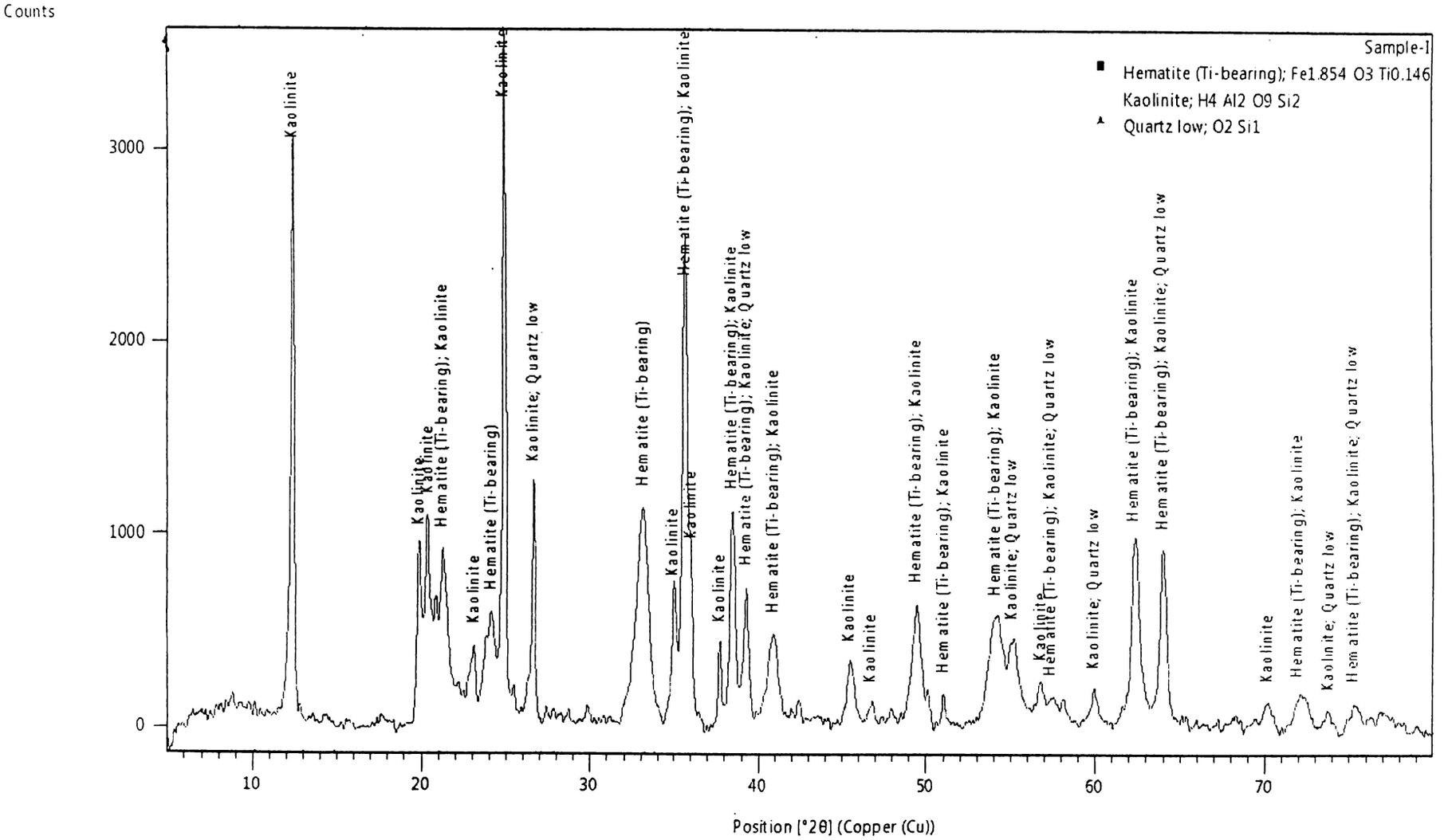
More items... (Bookmark 11)

More items... (Bookmark 12)

More items... (Bookmark 13)

More items... (Bookmark 14)

More items... (Bookmark 15)



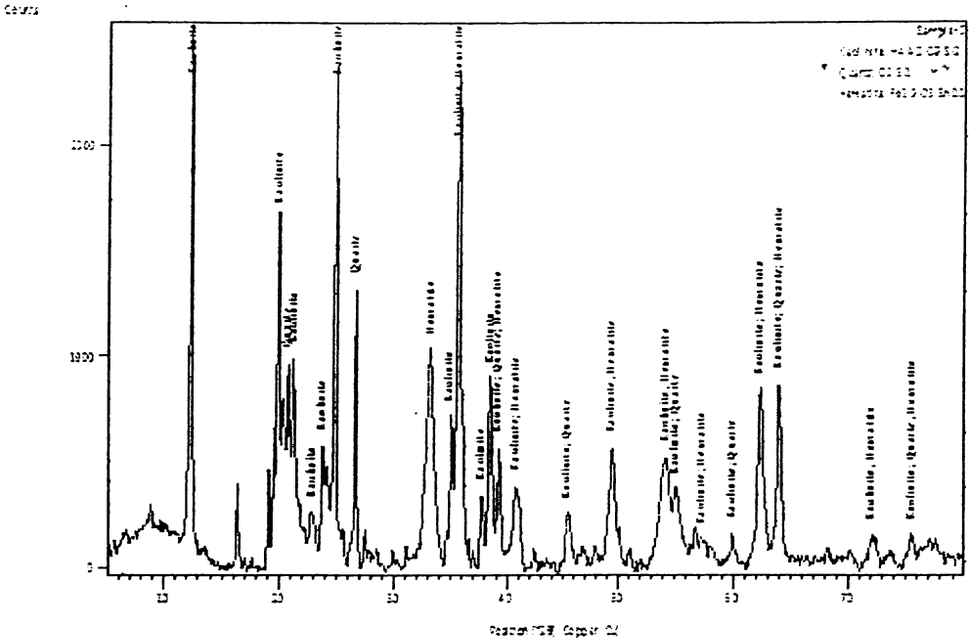
Disclaimer: Content of this report is meant for your information

This is the simple example template containing only headers for each report item and the bookmarks. The invisible bookmarks are indicated by text between brackets.
Modify it according to your own needs and standards.

Measurement Conditions: (Bookmark 1)

Dataset Name	Sample-II
File name	D:\XRD Data\Year 2016\POWDER DIFFRACTION DATA\EXTERNAL\University\dR rENUKA\Sample-II.xrdml
Comment	Configuration=Stage Spinner, Owner=User-1, Creation date=8/28/2014 2:42:07 PM
Goniometer=Theta/Theta; Minimum step size 2Theta:0.0001; Minimum step size Omega:0.0001	
Sample stage=Reflection-transmission spinner; Minimum step size Phi:0.1	
Diffractometer system=EMPYREAN	
Measurement program=C:\PANalytical\Data Collector\Programs\STANDARD METHOD_FDS.xrdmp, Identifier={DD75F814-00D7-457F-9399-98B392FC5600}	
Batch program=C:\PANalytical\Data Collector\Programs\sample-changer- 1-9samples.xrdmp, Identifier={FEA9AE87-7AA0-4EE8-904F-409E52035F0A}	
Measurement Start Date/Time	5/12/2017 12:30:42 PM
Operator	Indian Institute
Raw Data Origin	XRD measurement (*.XRDML)
Scan Axis	Gonio
Start Position [°2θ]	5.0066
End Position [°2θ]	79.9906
Step Size [°2θ]	0.0130
Scan Step Time [s]	37.9950
Scan Type	Continuous
PSD Mode	Scanning
PSD Length [°2θ]	3.35
Offset [°2θ]	0.0000
Divergence Slit Type	Fixed
Divergence Slit Size [°]	0.5000
Specimen Length [mm]	10.00
Measurement Temperature [°C]	25.00
Anode Material	Cu
K-Alpha1 [Å]	1.54060
K-Alpha2 [Å]	1.54443
K-Beta [Å]	1.39225
K-A2 / K-A1 Ratio	0.50000
Generator Settings	40 mA, 45 kV
Diffractometer Type	00000000011159166
Diffractometer Number	0
Goniometer Radius [mm]	240.00
Dist. Focus-Diverg. Slit [mm]	100.00
Incident Beam Monochromator	No
Spinning	Yes

Main Graphics, Analyze View: (Bookmark 2)



Peak List: (Bookmark 3)

Pos. [°2θ]	Height [cts]	FWHM Left [°2θ]	d-spacing [Å]	Rel. Int. [%]
12.3598	2350.25	0.0768	7.16149	100.00
16.4016	396.89	0.0384	5.40467	16.89
19.1609	425.25	0.1023	4.63213	18.09
19.5520	624.96	0.0640	4.54035	26.59
19.9763	1603.19	0.0768	4.44487	68.21
20.8405	877.30	0.0895	4.26245	37.33
21.2285	894.03	0.1023	4.18542	38.04
22.9010	142.91	0.4093	3.88340	6.08
23.7762	459.47	0.1023	3.74240	19.55
24.8690	2260.64	0.1023	3.58037	96.19
26.6193	1272.79	0.0512	3.34879	54.16
27.4674	166.78	0.1535	3.24729	7.10
33.1589	986.00	0.3582	2.70177	41.95
34.9295	664.66	0.1279	2.56877	28.28
35.5509	2109.46	0.1023	2.52528	89.75
37.6842	317.15	0.2558	2.38709	13.49
38.4684	848.70	0.1791	2.34021	36.11
39.2210	518.01	0.1023	2.29703	22.04
40.7659	351.20	0.6140	2.21347	14.94
45.4616	233.95	0.5117	1.99517	9.95
49.4558	526.91	0.3070	1.84298	22.42
54.1563	457.25	0.4093	1.69360	19.46

55.0791	290.42	0.4093	1.66739	12.36
57.3941	73.75	0.8187	1.60552	3.14
59.9890	151.38	0.3070	1.54213	6.44
62.2997	830.55	0.4093	1.49037	35.34
63.9767	855.78	0.2047	1.45529	36.41
72.1594	120.59	0.5117	1.30909	5.13
75.4741	141.92	0.3070	1.25962	6.04

Pattern List: (Bookmark 4)

Visible	Ref.Code	Score	Compound Name	Displ.[°2θ]	Scale Fac.	Chem. Formula
*	98-008-7771	41	Kaolinite	0.000	1.034	H4 Al2 O9 Si2
*	98-015-6196	44	Quartz	0.000	0.614	O2 Si1
*	98-017-4468	55	Hematite	0.000	0.707	Fe1.9 O3 Sn0.1

Document History: (Bookmark 5)

Insert Measurement:
- File name = "Sample-II.xrdml"
- Modification time = "5/19/2017 10:23:14 AM"
- Modification editor = "Indian Institute"

Default properties:
- Measurement step axis = "None"
- Internal wavelengths used from anode material: Copper (Cu)
- Original K-Alpha1 wavelength = "1.54060"
- Used K-Alpha1 wavelength = "1.54060"
- Original K-Alpha2 wavelength = "1.54443"
- Used K-Alpha2 wavelength = "1.54443"
- Original K-Beta wavelength = "1.39225"
- Used K-Beta wavelength = "1.39225"
- Irradiated length = "10.00000"
- Receiving slit size = "0.10000"
- Distance to sample = "Diffracted radius"
- Step axis value = "0.00000"
- Offset = "0.00000"
- Sample length = "10.00000"
- Modification time = "5/19/2017 10:23:14 AM"
- Modification editor = "Indian Institute"

Interpolate Step Size:
- Initial Scan Range = 5.00657 - 79.99360
- Initial Step Size = 0.01313
- Derived Step Size = 0.01300
- Use Derived Step Size = "Yes"

- Modification time = "5/19/2017 10:23:15 AM"
- Modification editor = "PANalytical"

Determine Background:
- Add to net scan = "Nothing"
- User defined intensity = "-5"
- Correction method = "Automatic"
- Bending factor = "5"
- Minimum significance = "0.7"
- Minimum tip width = "0"
- Maximum tip width = "1"
- Peak base width = "2"
- Use smoothed input data = "Yes"
- Granularity = "20"
- Modification time = "2/22/2001 10:17:43 AM"
- Modification editor = "PANalytical"

Search Peaks:
- Minimum significance = "2"
- Minimum tip width = "0.01"
- Maximum tip width = "1"
- Peak base width = "2"
- Method = "Minimum 2nd derivative"
- Modification time = "2/20/2001 11:55:18 AM"
- Modification editor = "PANalytical"

Search & Match:
- Allow pattern shift = "No"
- Auto residue = "Yes"
- Data source = "Profile and peak list"
- Demote unmatched strong = "Yes"
- Multi phase = "Yes"
- Restriction set = "Minerals"
- Restriction = "Restriction set"
- Subset name = ""
- Match intensity = "Yes"
- Two theta shift = "0"
- Identify = "Yes"
- Max. no. of accepted patterns = "5"
- Minimum score = "27"
- Min. new lines / total lines = "40"
- Search depth = "6"
- Minimum new lines = "3"
- Minimum scale factor = "0.06"
- Intensity threshold = "0"
- Use line clustering = "Yes"
- Line cluster range = "1.5"
- Search sensitivity = "1.8"
- Use adaptive smoothing = "Yes"
- Smoothing range = "1.5"
- Threshold factor = "3"

- Match Threshold = "0"
- Modification time = "2/5/2001 11:17:06 AM"
- Modification editor = "PANalytical"

Subtract Background:
- Add to net scan = "Nothing"
- User defined intensity = "0"
- Correction method = "Automatic"
- Bending factor = "1"
- Minimum significance = "1"
- Minimum tip width = "0.01"
- Maximum tip width = "1"
- Peak base width = "2"
- Use smoothed input data = "Yes"
- Granularity = "16"
- Modification time = "5/12/2017 2:26:17 PM"
- Modification editor = "Indian Institute"

Smooth:
- Polynomial type = "Cubic"
- Convolution range = "7"
- Degree of smoothing = "12"
- Fast Fourier = "Yes"
- Omit Peaks = "Yes"
- Adaptive Denoising = "No"
- Automatic Decomposition Level = "Yes"
- Decomposition Level = "4"
- Modification time = "5/1/2017 4:44:04 PM"
- Modification editor = "Indian Institute"

More items... (Bookmark 6)

More items... (Bookmark 7)

More items... (Bookmark 8)

More items... (Bookmark 9)

More items... (Bookmark 10)

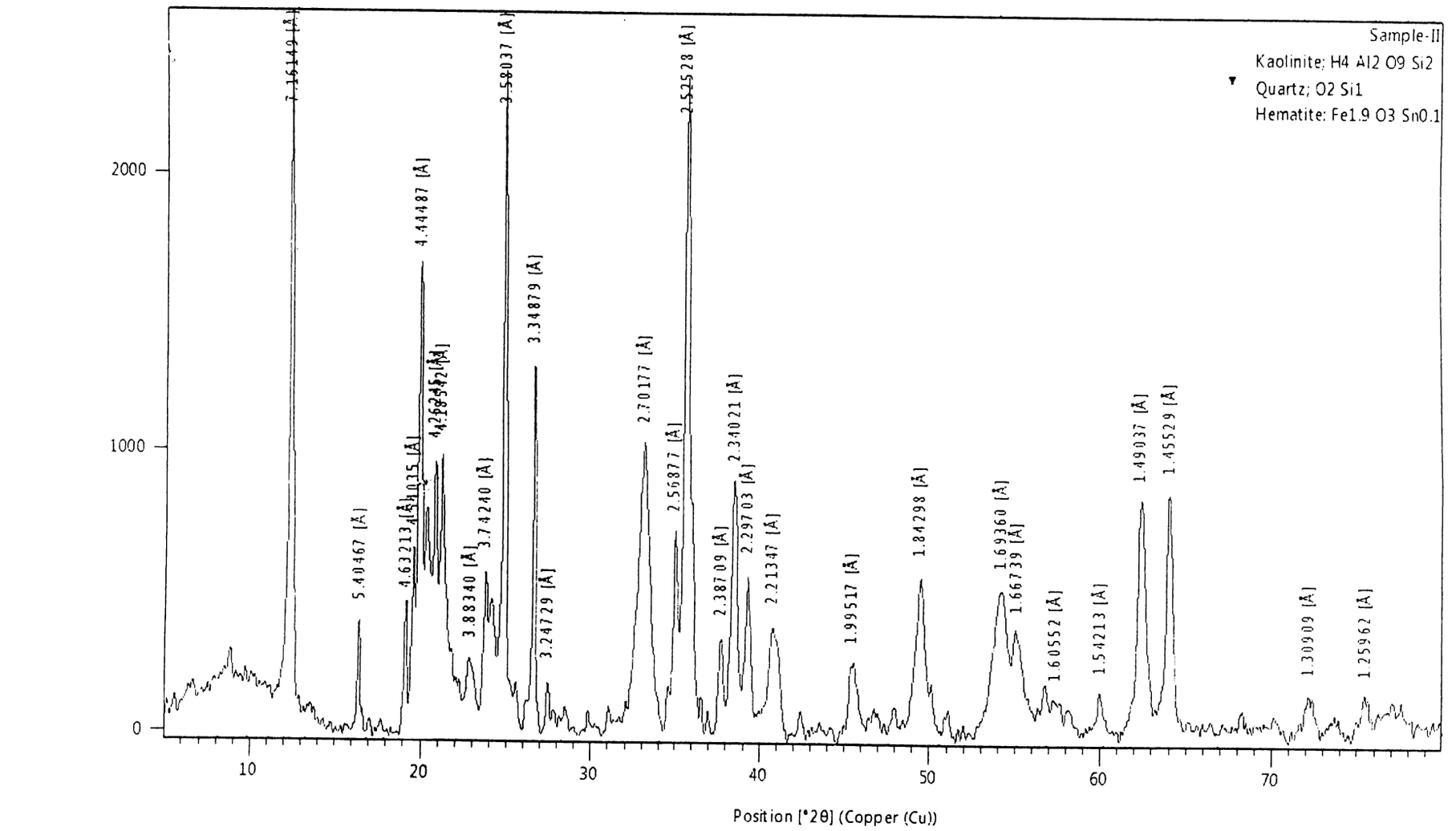
More items... (Bookmark 11)

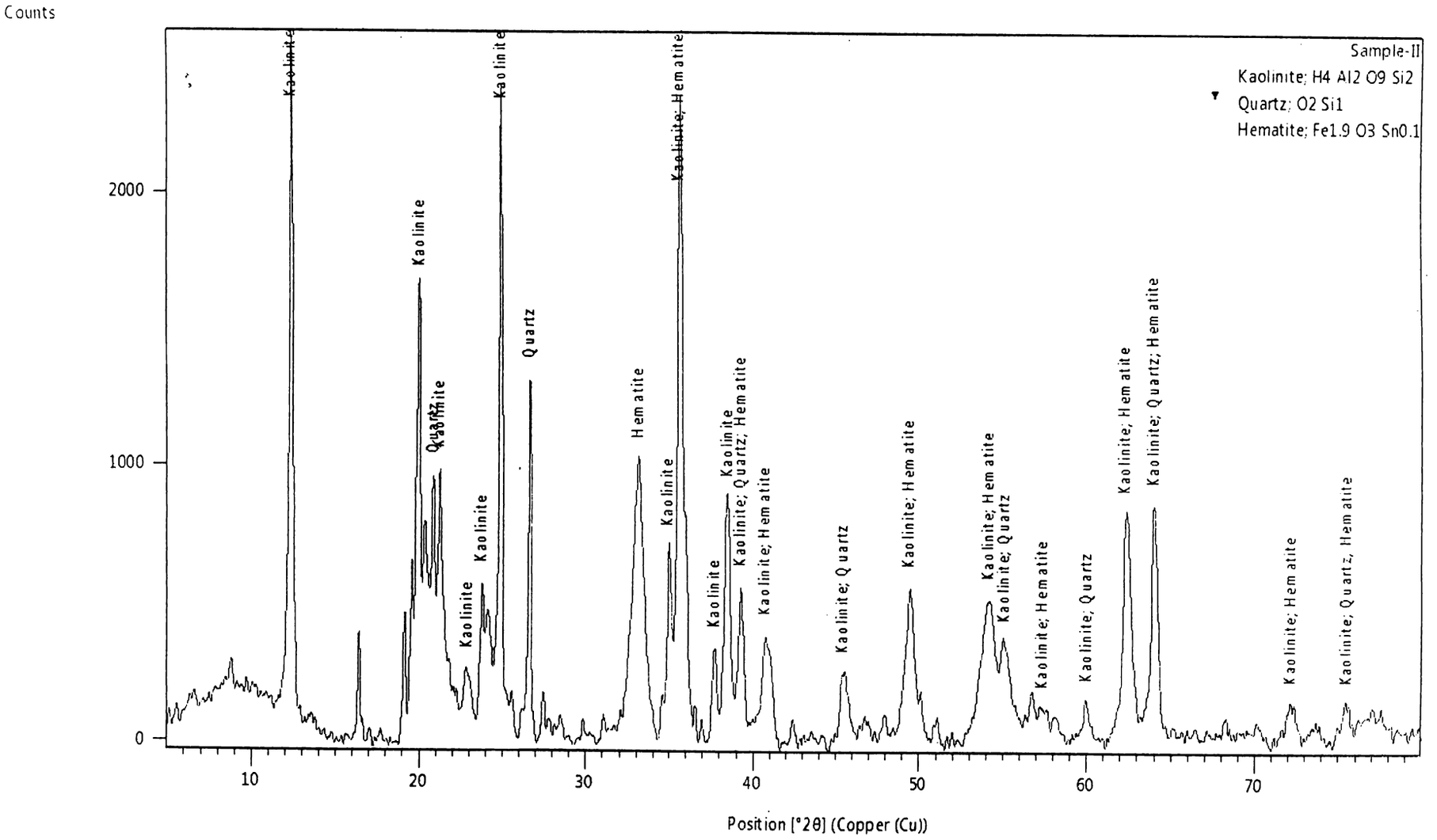
More items... (Bookmark 12)

More items... (Bookmark 13)

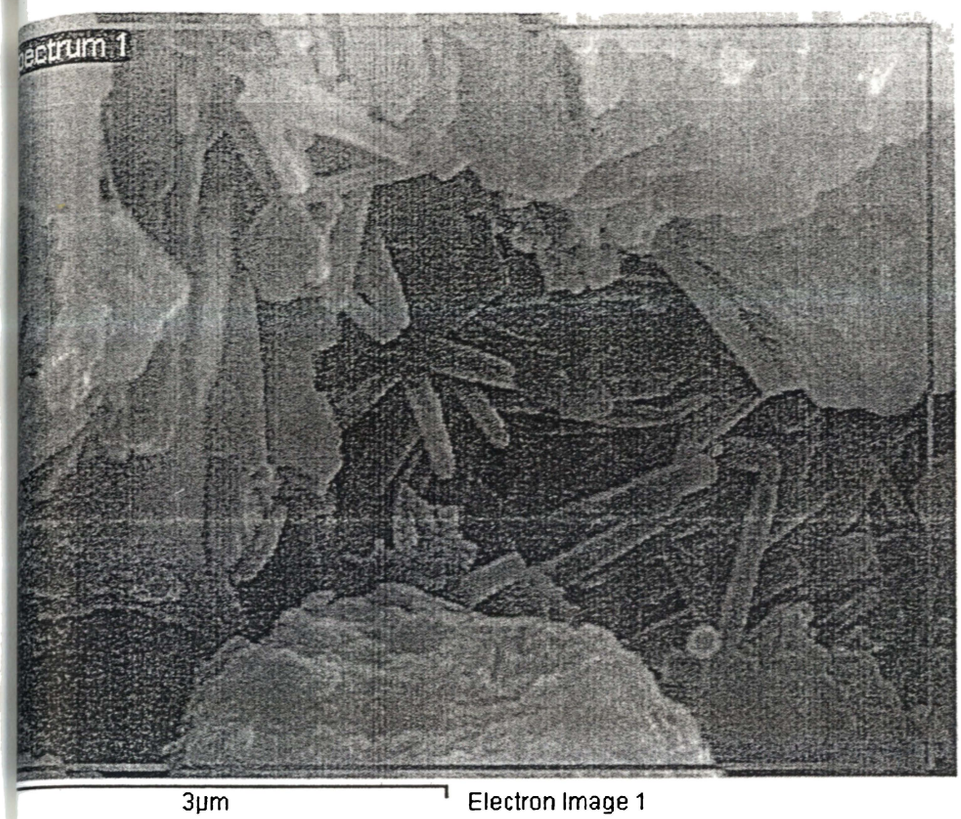
More items... (Bookmark 14)

More items... (Bookmark 15)


Counts
Sample-II
Kaolinite; H4 Al2 O9 Si2
Quartz; O2 Si1
Hematite; Fe1.9 O3 Sn0.1
2000
1000
0
7.16149 [Å]
5.40467 [Å]
4.44487 [Å]
3.88340 [Å]
3.74240 [Å]
3.58037 [Å]
3.34879 [Å]
3.24729 [Å]
2.70177 [Å]
2.56877 [Å]
2.52528 [Å]
2.38709 [Å]
2.34021 [Å]
2.29703 [Å]
2.21347 [Å]
1.99517 [Å]
1.84298 [Å]
1.69360 [Å]
1.66739 [Å]
1.60552 [Å]
1.54213 [Å]
1.49037 [Å]
1.45529 [Å]
1.30909 [Å]
1.25962 [Å]
10
20
30
40
50
60
70
Position [°2θ] (Copper (Cu))


Counts
Sample-II
Kaolinite; H4 Al2 O9 Si2
Quartz; O2 Si1
Hematite; Fe1.9 O3 Sn0.1
2000
1000
0
10
20
30
40
50
60
70
Position [°2θ] (Copper (Cu))
Kaolinite
Quartz
Hematite
Kaolinite; Hematite
Kaolinite; Quartz; Hematite
Kaolinite; Quartz
Kaolinite; Hematite; Quartz
Kaolinite; Quartz; Hematite

M 221 & 15_Dr Renuka_Ayurved College Shevgaon_EDS & WDS



ctrum processing :
ks possibly omitted : 2.064, 2.344, 9.439 keV

cessing option : All elements analyzed (Normalised)
mber of iterations = 6

ndard :
aCO3 1-Jun-1999 12:00 AM
iO2 1-Jun-1999 12:00 AM
MgO 1-Jun-1999 12:00 AM
Al2O3 1-Jun-1999 12:00 AM
iO2 1-Jun-1999 12:00 AM
Wollastonite 1-Jun-1999 12:00 AM
Fe 1-Jun-1999 12:00 AM
Cu 1-Jun-1999 12:00 AM

ement	Weight%	Atomic%
K	17.19	25.75
K	46.48	52.27
K	0.00	0.00
K	14.88	9.92
K	16.26	10.42
K	0.00	0.00
K	4.33	1.40
K	0.87	0.24
als	100.00	

EM 221 & 15_Dr Renuka_Ayurved College Shevgaon_EDS & WDS

oject: SEM 221 & 15_Dr Renuka_Ayurved College Shevgaon_EDS & WDS
wner: INCA
e: Site of Interest 1

mple: Sample 9
pe: Default
: SEM 15_1 WDS

bel : WD Data 1

quistion conditions :
= 20.0
t = 0.0 degs Azimuth = 0.0 degs Elevation = 30.0 degs
fective take off angle = 30.0 degs

ocessing option : All elements(Normalised)

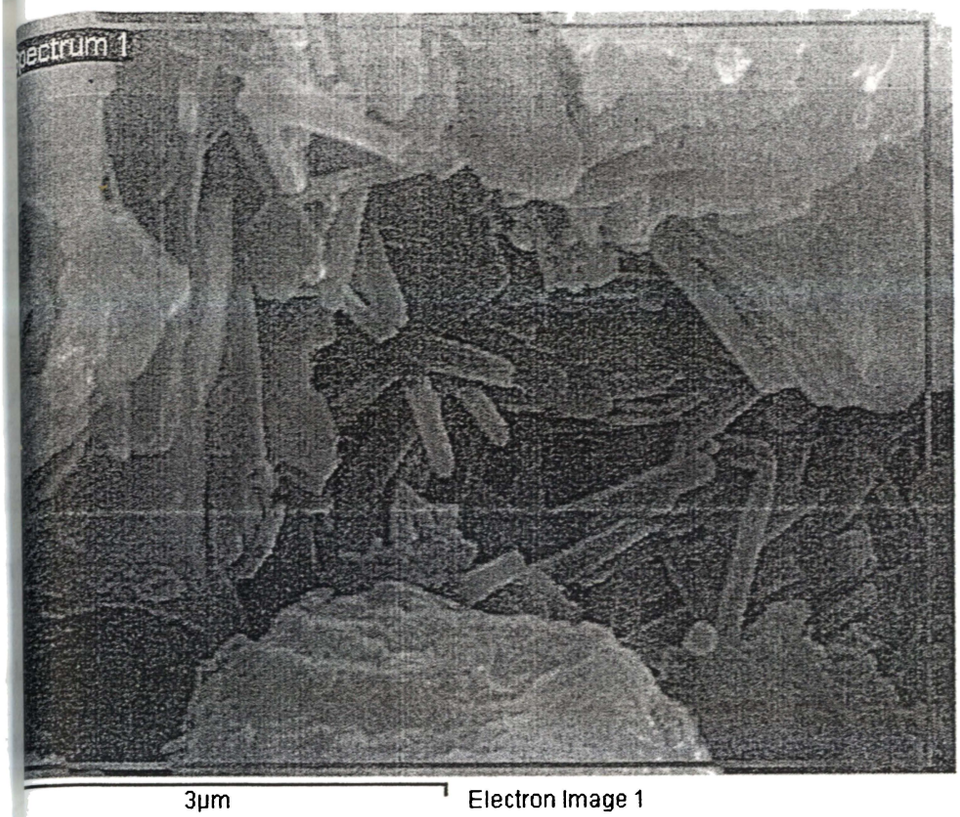
mber of iterations = 2

ndards :

Ka Cu_20kV
Ka Fe_20kV
Ka CaF2_20kV
Ka Al2O3_20kV
Ka MgO_20kV
Ka Al2O3_20kV

ement	k Ratio	Weight%	Weight% Sigma	Intensity Corrn.	Atomic%
Ka	0.00015	1.305	0.369	0.8146	0.500
Ka	0.00377	29.477	0.717	0.8819	12.858
Ka	0.00003	0.115	0.054	0.9333	0.070
Ka	0.00579	30.045	0.494	0.7131	27.126
Ka	0.00001	0.050	0.075	0.5906	0.051
Ka	0.01434	39.007	0.662	1.1705	59.394
als		100.000			

M 221 & 15_Dr Renuka_Ayurved College Shevgaon_EDS & WDS



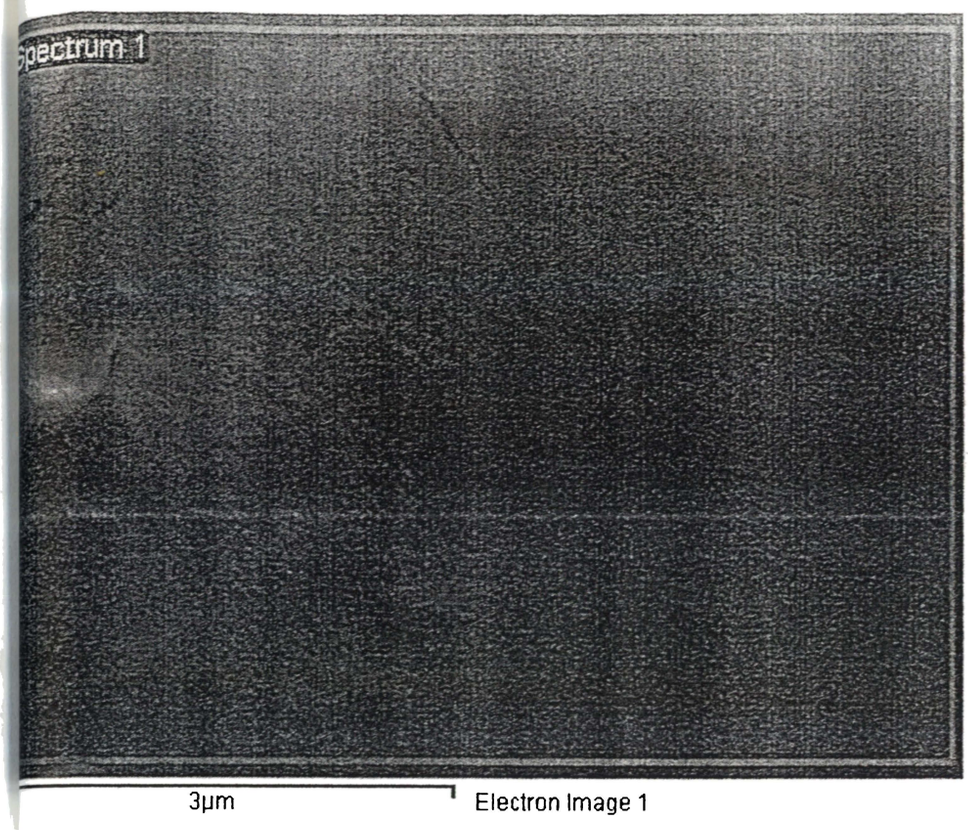
trum processing :
ks possibly omitted : 2.064, 2.344, 9.439 keV

cessing option : All elements analyzed (Normalised)
nber of iterations = 6

dard :
aCO3 1-Jun-1999 12:00 AM
iO2 1-Jun-1999 12:00 AM
Al2O3 1-Jun-1999 12:00 AM
iO2 1-Jun-1999 12:00 AM
e 1-Jun-1999 12:00 AM
Cu 1-Jun-1999 12:00 AM

ment	Weight%	Atomic%
	17.31	25.91
	46.45	52.19
K	14.84	9.88
	16.22	10.38
K	4.32	1.39
K	0.86	0.24
ls	100.00	

EM 221 & 15_Dr Renuka_Ayurved College Shevgaon_EDS & WDS



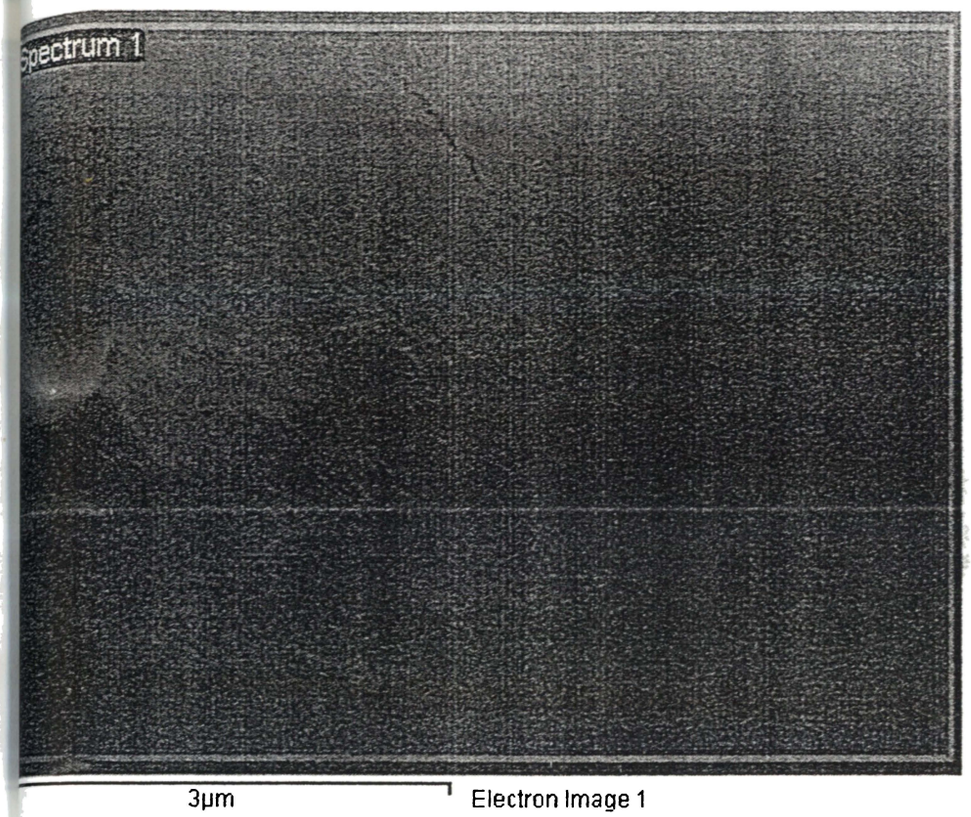
ectrum processing :
ks possibly omitted : 2.061, 4.506, 9.437 keV

cessing option : All elements analyzed (Normalised)
mber of iterations = 6

ndard :
CaCO3 1-Jun-1999 12:00 AM
SiO2 1-Jun-1999 12:00 AM
Al2O3 1-Jun-1999 12:00 AM
SiO2 1-Jun-1999 12:00 AM
KCl 1-Jun-1999 12:00 AM
MAD-10 Feldspar 1-Jun-1999 12:00 AM
Wollastonite 1-Jun-1999 12:00 AM
Fe 1-Jun-1999 12:00 AM
Cu 1-Jun-1999 12:00 AM

ment	Weight%	Atomic%
K	44.87	63.62
K	19.38	20.63
K	7.00	4.42
K	7.84	4.75
K	0.35	0.17
K	0.72	0.32
K	0.59	0.25
K	18.51	5.65
K	0.73	0.20

EM 221 & 15_Dr Renuka_Ayurved College Shevgaon_EDS & WDS



ectrum processing :
aks possibly omitted : 2.061, 4.506, 9.437 keV

ocessing option : All elements analyzed (Normalised)
mber of iterations = 6

ndard :
CaCO3 1-Jun-1999 12:00 AM
SiO2 1-Jun-1999 12:00 AM
MgO 1-Jun-1999 12:00 AM
Al2O3 1-Jun-1999 12:00 AM
SiO2 1-Jun-1999 12:00 AM
KCl 1-Jun-1999 12:00 AM
MAD-10 Feldspar 1-Jun-1999 12:00 AM
Wollastonite 1-Jun-1999 12:00 AM
Fe 1-Jun-1999 12:00 AM
Cu 1-Jun-1999 12:00 AM

ement	Weight%	Atomic%
K	44.87	63.62
K	19.38	20.63
K	0.00	0.00
K	7.00	4.42
K	7.84	4.75
K	0.35	0.17
K	0.72	0.32
K	0.59	0.25

M 221 & 15_Dr Renuka_Ayurved College Shevgaon_EDS & WDS

ject: SEM 221 & 15_Dr Renuka_Ayurved College Shevgaon_EDS & WDS
mer: INCA
: Site of Interest 1

nple: Sample 11
e: Default
SEM 15_2 WDS

el : WD Data 1

uistion conditions :
= 20.0
= 0.0 degs Azimuth = 0.0 degs Elevation = 30.0 degs
ctive take off angle = 30.0 degs

cessing option : All elements(Normalised)

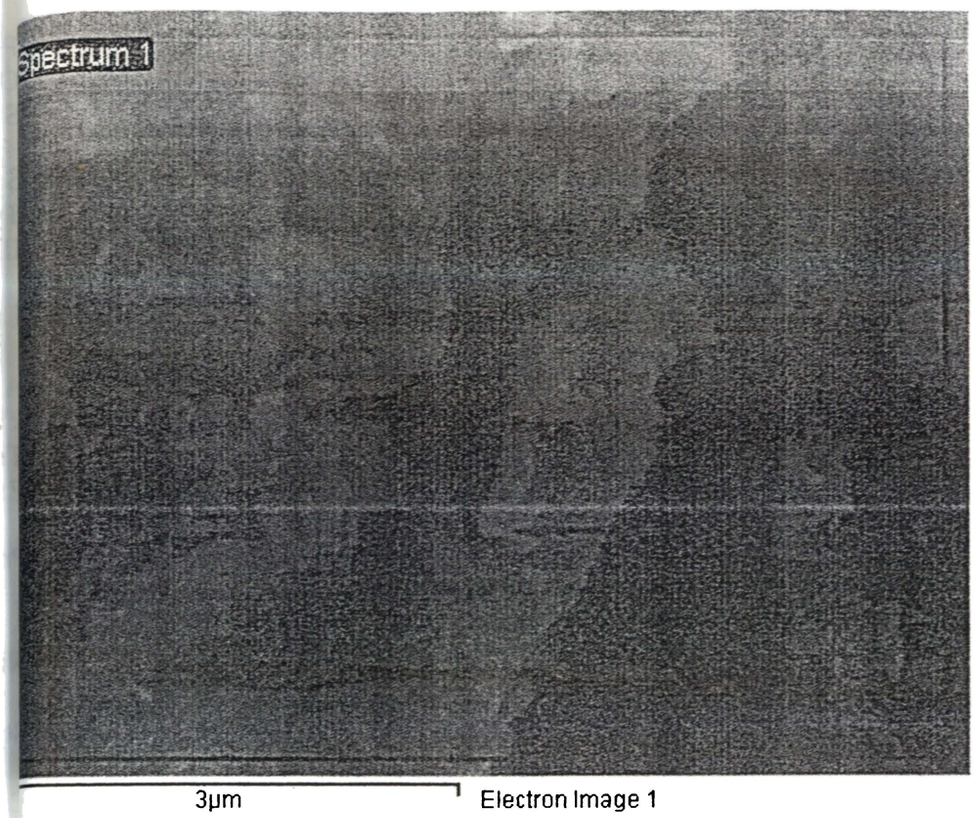
mber of iterations = 2

ndards :

Ka Cu_20kV
Ka Fe_20kV
Ka CaF2_20kV
Ka Al2O3_20kV
Ka MgO_20kV
Ka Al2O3_20kV

ement	k Ratio	Weight%	Weight% Sigma	Intensity Corrn.	Atomic%
Ka	0.00011	0.669	0.215	0.8247	0.306
Ka	0.00832	45.223	0.616	0.9079	23.532
Ka	0.00055	1.466	0.099	0.9591	1.063
Ka	0.00672	27.325	0.412	0.6485	29.430
Ka	0.00009	0.510	0.139	0.5293	0.610
Ka	0.01157	24.807	0.521	1.0692	45.059
tals		100.000			

EM 221 & 15_Dr Renuka_Ayurved College Shevgaon_EDS & WDS



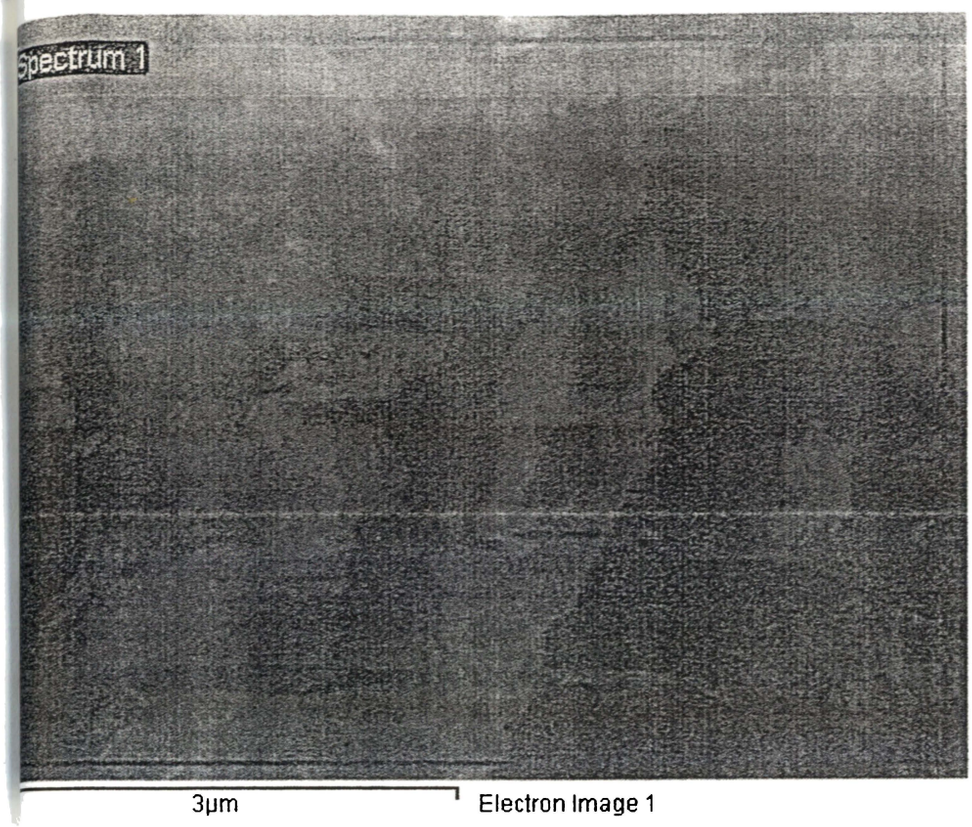
ectrum processing :
aks possibly omitted : 2.065, 2.348, 3.317, 7.479, 9.443 keV

ocessing option : All elements analyzed (Normalised)
mber of iterations = 6

ndard :
CaCO3 1-Jun-1999 12:00 AM
SiO2 1-Jun-1999 12:00 AM
Al2O3 1-Jun-1999 12:00 AM
SiO2 1-Jun-1999 12:00 AM
Fe 1-Jun-1999 12:00 AM
Cu 1-Jun-1999 12:00 AM

ement	Weight%	Atomic%
K	5.33	8.89
K	52.69	65.95
K	13.14	9.75
K	14.39	10.26
K	13.83	4.96
K	0.61	0.19
tals	100.00	

EM 221 & 15_Dr Renuka_Ayurved College Shevgaon_EDS & WDS



ectrum processing :
aks possibly omitted : 2.065, 2.348, 7.479, 9.443 keV

ocessing option : All elements analyzed (Normalised)
mber of iterations = 6

ndard :
CaCO3 1-Jun-1999 12:00 AM
SiO2 1-Jun-1999 12:00 AM
MgO 1-Jun-1999 12:00 AM
Al2O3 1-Jun-1999 12:00 AM
SiO2 1-Jun-1999 12:00 AM
Wollastonite 1-Jun-1999 12:00 AM
Fe 1-Jun-1999 12:00 AM
Cu 1-Jun-1999 12:00 AM

ement	Weight%	Atomic%
K	5.18	8.64
K	52.71	66.07
K	0.00	0.00
K	13.18	9.80
K	14.44	10.31
K	0.00	0.00
K	13.87	4.98
K	0.61	0.19
als	100.00	

SEM 221 & 15_Dr Renuka_Ayurved College Shevgaon_EDS & WDS

oject: SEM 221 & 15_Dr Renuka_Ayurved College Shevgaon_EDS & WDS
wner: INCA
e: Site of Interest 1

mple: Sample 7
pe: Default
: SEM 221 WDS

bel : WD Data 1

quistion conditions :
= 20.0
t = 0.0 degs Azimuth = 0.0 degs Elevation = 30.0 degs
fective take off angle = 30.0 degs

ocessing option : All elements(Normalised)

mber of iterations = 3

ndards :

.Ka Cu_20kV
Ka Fe_20kV
Ka CaF2_20kV
Ka Al2O3_20kV
Ka MgO_20kV
Ka Al2O3_20kV

ement	k Ratio	Weight%	Weight% Sigma	Intensity Corrn.	Atomic%
Ka	0.00030	0.638	0.108	0.8007	0.219
Ka	0.01151	22.998	0.333	0.8611	8.959
Ka	0.00005	0.048	0.021	0.9308	0.026
Ka	0.01816	23.390	0.207	0.7072	18.860
Ka	0.00004	0.076	0.041	0.5843	0.068
Ka	0.09081	52.850	0.326	1.3943	71.868
tals		100.000			

APT TESTING AND RESEARCH PRIVATE LIMITED

APPROVED BY FDA - MAHARASHTRA STATE LIC NO. - 37-PD/TL/7
ISO 9001:2015 CERTIFIED LABORATORY (Regd. No. QMS.91.002.04.16)
Regd. Office: S. No. 36/1/1, M.N. 199, Vadgaon Khurd, Pune 411 041, Maharashtra, India.
● **Tel.:** 020 - 6533 9233 / 6530 4803 ● **E-mail:** ntcpune@gmail.com ● **Web:** ntc-apt.com

Research Project No. 03/1718

CERTIFICATE

This is to certify that the project entitled: **"Comparative study of effect of Goghrita and Godugdha shodhita Gairika on haematological parameters of Wistar rats."** has been approved by IAEC.

The study will be conducted by: Ms. Renuka M. Suryawanshi
Ph.D. Scholar
Rasashastra & B.K. Dept.
Tilak Maharashtra Vidyapeeth, Pune.

The project will be conducted in collaboration with: **APT Research Foundation**
APT Testing and Research Pvt. Ltd.,
Pune 411 041.

Name of Chairman IAEC:

Dr. P.B. Parab
Chairman

Name of CPCSEA Nominee:

Dr. Shirish D. Pawar
CPCSEA
Nominee

Signature with date: 07/April/2017

APT Testing & Research Pvt. Ltd.
NTC
विपश्यना

STATEMENT OF COMPLIANCE

We, the Undersigned hereby declare that this Research Project No "RP. No.03/1718" approved by IAEC dated 07/April/2017entitled "Comparative study of effect of Goghrita and GodugdhashodhitaGairika on haematological parameters of Wistar rats"was performed according to the agreed protocol and Standard Operating Procedures of the test facility. We accept the responsibility for validity of the data, as well as the interpretation, analysis, documentation and reporting of the results.

The study was performed at APT Research Foundation, Pune.

Submitted by:

Study Incharge	**Dr. Bhagyashri Nagarkar**	08/March/2018	Bhagyashri Nagarkar
Head of Test Facility	**Dr. Kishori G Apte**	08/March/18	K.G.Apte
		Date	**Signature**

APT RESEARCH FOUNDATION PUNE

APTRF TEST REPORT

QUALITY AYURVEDIC MEDICINES

SG Phyto Pharma Pvt ltd

B-53, Gokulshirgaon MIDC, Kolhapur. Phone : 0231/2672528

Manufacturers of Ayurvedic Medicines
Drug Licence No. PD / AYU / 16
Drug Licence No. PD / AYU / 6A
Drug Licence No. PD / AYU / 89
Food lincence No. Kol/KAR/G.S./26/152/04

Subject to Kolhapur Jurisdiction

To Dr. Renuka Shivgaonkar
Shevgaon,

INVOICE NO. CM460 Date 30/11/2016

Description	Batch No.	Expiry Date	Quantity / In Units	Rate Per Unit	Amount Rs.	Ps.
Avazgaiak	R-983/16	—	500gm x 01 No.		125	00
[Rs. one hundred & twenty - five only]					125	00

eby give the warranty that the goods herein described y us and do not contravene in any way the provisions 18 of the Drug Act. 1940

General Warranty under Sction 19037 of the Drugs Act 1940.

Vat No. :- 27120005896-V-w.e.f. 1.4.2006
27120005896-C-W.e.f. 1.4.2006

I/We hereby certify that my/our registration certificate under the B.S.T Act 1959 is in force on the date on which the sales of the goods specified in the transactions of sales covered by this bill/ cash memorandum is made by me/us and the transaction of sales covered by this bill/cash memorandum has been effected by me/ us in the regular cource of my/our business.

Checked by

30/11

S. G. PHYTO PHARMA PVT. LTD.

ent through _____ RR No. _____

_____ No. of packages _____

_____ and the documents through

परिष्कृत वैश्लेषिक यंत्र सुविधा
भारतीय प्रौद्योगिकी संस्थान मुंबई
पवई, मुंबई-400 076, भारत
Sophisticated Analytical Instrument Facility
Indian Institute of Technology Bombay
Powai, Mumbai-400 076, India

Tel (+91-22) 2576 7691, 2576 7692, (+91-22) 2576 7690, 2572 8806 (DiR)
EPABX (+91-22) 2572 2545, Extn.: 7691, 7692, 7690
Fax (+91-22) 2572 3480
Website : www.rsic.iitb.ac.in

IIT Bombay

: Anindya Dutta
d

SAIF/3/2017.04.26/FEG-SEM-15

BILL/INVOICE Date : 01-May-2017

: Bill/Invoice for the testing using "Field Emission Gun-Scanning Electron Microscopes "
r reference : Your letter number "PMT/AYU/2017/453 dt 20.04.2017 "

PAN No : AAATI1446A

Service Tax Code (Registration Number) : AAATI1446AST002

Taxable Services : Scientific And Technical Consultancy Sponsorship Service

Name/Address	Charges	Amount
: Renuka Madhav Suryawanshi pt. of Rasashastra & Bhaishajyakalpana urved College Shevgaon evgaon, istrict: Ahmednagar, Maharashtra - 414502	a) Instrument Charges : b) Service Tax @ 14 % of (a) c) Swachh Bharat Cess @ 0.5 % on (a) : d) Krishi Kalyan Cess @ 0.5 % on (a) :	4500/- 630/- 23/- 23/-
	Total (a+b+c+d)	5176/-

(Total Amount In Words : Five Thousand One Hundred and Seventy Six only)

(Head)

OTE :
The DD should be drawn in favour of **"Registrar, IIT Bombay"**

IIT Bombay is exempted from paying Income Tax under Income Tax Act, 1961.

Please collect your samples while collecting results.

In any event, the content of report/bill is meant for your information only and should not be quoted as rtificate to third party for advertisement, evidence or litigation.

परिष्कृत वैश्लेषिक यंत्र सुविधा
भारतीय प्रौद्योगिकी संस्थान मुंबई
पवई, मुंबई-400 076, भारत
Sophisticated Analytical Instrument Facility
Indian Institute of Technology Bombay
Powai, Mumbai-400 076, India

Tel (+91-22) 2576 7691, 2576 7692,
(+91-22) 2576 7690, 2572 8806 (DIR)
EPABX : (+91-22) 2572 2545,
Extn.: 7691, 7692, 7690
Fax : (+91-22) 2572 3480
Website : www.rsic.iitb.ac.in

IIT Bombay

of. Anindya Dutta
ead

o. SAIF/3/2017.03.02/FEG-SEM-221

BILL/INVOICE Date : 01-May-2017

ub : Bill/Invoice for the testing using "Field Emission Gun-Scanning Electron Microscopes "
our reference : Your letter number "PMT/AYU/2017/149 dt 14.02.2017 "

PAN No : AAATI1446A
Service Tax Code (Registration Number) : AAATI1446AST002
Taxable Services : Scientific And Technical Consultancy Sponsorship Service

Name/Address	Charges	Amount
r. Renuka Madhav Suryawanshi	a) Instrument Charges :	2250/-
ept. of Rasashastra & Bhaishajyakalpana	b) Service Tax @ 14 % of (a)	315/-
yurved College Shevgaon	c) Swachh Bharat Cess @ 0.5 % on (a) :	11/-
hevgaon,	d) Krishi Kalyan Cess @ 0.5 % on (a) :	11/-
istrict: Ahmednagar, Maharashtra - 414502	e) Post	100/-
	Total (a+b+c+d+e)	2687/-

(Total Amount In Words : Two Thousand Six Hundred and Eighty Seven only)

(Head)

OTE :
The DD should be drawn in favour of **"Registrar, IIT Bombay"**

IIT Bombay is exempted from paying Income Tax under Income Tax Act, 1961.

Please collect your samples while collecting results.

In any event, the content of report/bill is meant for your information only and should not be quoted as rtificate to third party for advertisement, evidence or litigation.

Indian Institute of Technology, Bombay

Projects & Consultancy Account

Receipt No:Re/2017-2018/P/00506

Date:05/05/2017

Particulars	Amount (₹)
Received from Ayurved College Shevgaon, District: Ahmednagar (-) - : 2017.04.26/FEG-SEM-15	5280.00
Total Amount (₹)	**5280.00**

Cashier

Cheque Number:- 272

Recipient's Bank Name:- CANARA

Cheque Date :- 18/04/2017

Reference Number: SAIF/16373

Instrument Remarks:- HDFC

Account Details

GroupCode	HeadCode	Account Head Description	Amount (₹)	Cross Refe By
P07IN001	CCT	Consumables and Contingencies/Earnings from SAIF Facilities	4591.00 CR	----
PGSTX	G	G/SERVICE TAX ON CONSULTATION FEES	689.00 CR	----

Net Recieved Amount (₹) 5280.00

(₹ Five Thousand Two Hundred Eighty only.)

DD/Cheque Subject to Realisation only.

Counterfoil

Receipt No:Re/2017-2018/P/00506 Dated:05/05/2017

Received from Ayurved College Shevgaon, District: Ahmednagar(-)

- : 2017.04.26/FEG-SEM-15

05/05/2017 12:45

परिष्कृत वैश्लेषिक यंत्र सुविधा
भारतीय प्रौद्योगिकी संस्थान मुंबई
पवई, मुंबई-400 076, भारत
Sophisticated Analytical Instrument Facility
Indian Institute of Technology Bombay
Powai, Mumbai-400 076, India

Tel (+91-22) 2576 7691, 2576 7692,
(+91-22) 2576 7690, 2572 8806 (DIR)
EPABX (+91-22) 2572 2545,
Extn.: 7691, 7692, 7690
Fax (+91-22) 2572 3480
Website : www.rsic.iitb.ac.in

IIT Bombay

TAX INVOICE

Original

GSTIN : 27AAATI1446A1Z7	PAN No. AAATI1446A		TAN No : MUMI00377G
Invoice No:- IITBINT17180078	**Invoice Date :** 22/08/2017	**Due Date :** 21/09/2017	**Payment Term :** 100% Advance

To,
Dr. Renuka Madhav Suryawanshi,
Ayurved College Shevgaon,
Dept. of Rasashastra & Bhaishajyakalpana
Shevgaon,
District: Ahmednagar Maharashtra
Pincode : 414502

Piace of Supply: Maharashtra
State Code: 27

Registration No : 2017.07.17/ICP-AES-77

Sr. No	Category	SAC	Taxable Value	Postal charges	CGST		SGST		IGST	
					Rate	Amt.	Rate	Amt.	Rate	Amt.
1	Technical testing and analysis services	99834	4380.00	100.00	9.0%	394.00	9.0%	394.00		0.00
		Total	4380.00	100.00		394.00		394.00		0.00

Total Invoice Value(in figures):- Rs. 5268.00

Total Invoice Value(in Words):- Rupees Five Thousand Two Hundred SixtyEight only

Head, SAIF

NOTE :

1. The DD should be drawn in favour of "Registrar, IIT Bombay"
2. IIT Bombay is exempted from paying Income Tax under Income Tax Act, 1961.
3. Please collect your samples while collecting results.
4. In any event, the content of report/bill is meant for your information only and should not be quoted as certificate to third party for advertisement, evidence or litigation.
5. The results may be collected or would be despatched after receipt of payment.

Indian Institute of Technology, Bombay

Projects & Consultancy Account

Receipt No:Re/2017-2018/P/02082

Date:24/08/2017

Particulars	Amount (₹)
Received from Ayurved College Shevgaon, Ahmednagar (-) Registration No : 2017.07.17/ICP-AES-77	5268.00
Total Amount (₹)	**5268.00**

Cheque CashierNumber:- 451888

Recipient's Bank Name:- CANARA

Cheque Date :- 10/07/2017

Reference Number: IITBSAIF171816887

Instrument Remarks:- HDFC

Account Details

GroupCode	HeadCode	Account Head Description	Amount (₹)	Cross Refe By
P07IN001	CCT	Consumables and Contingencies/Earnings from SAIF Facilities	4464.00 CR	----
PGST	CGST	CENTRAL GST/GST on Services accounted by IRCC	402.00 CR	----
PGST	SGST	STATE GST/GST on Services accounted by IRCC	402.00 CR	----

Net Recieved Amount (₹) 5268.00

(₹ Five Thousand Two Hundred SixtyEight only.)

DD/Cheque Subject to Realisation only.

Counterfoil

Receipt No:Re/2017-2018/P/02082 Dated:24/08/2017

Received from Ayurved College Shevgaon, Ahmednagar(-)

Regd. Office: S. No. 36/1/1, M.N. 199, Vadgaon Khurd, Pune 411 041, Maharashtra, India.
• **Tel.:** 020 - 6530 4803 • **E-mail:** aptresearch@gmail.com • **Web:** ntc-apt.com
DSIR SIRO Recognised Research Laboratory

APT RESEARCH FOUNDATION

Quotation

To,	Quotation No	015/1718
Vd. Renuka M. Suryawanshi, Ph.D Scholar, Rasashastra & B.K. Dept, Tilak Maharashtra Vidyapeeth, Pune	DATE	25/January/2018
	Pan No. AACTA5306K	

Description	Rate Rs.	Charge Rs.
Quotation for Research Project No. 03/1718 entitled: "Comparative study of effect of Goghrita and Godugdha shodhita Gairika on haematological parameters of Wistar rats".		
Animals charges		**9,000/-**
Biochemistry (TIBC, Ferritin, Iron)		**16,200/-**
Haematology		**6,000/-**
Study charges		**2,000/-**
Maintenance		**12,000/-**
Total Rs.		**45,200/-**
IN WORDS: Rs. Fourty Five Thousand and Two Hundred Only.		

for Bhagyash
Dr. K. G. APTE

APT RESEARCH FOUNDATION PUNE

N.B: Under section 12AA of the Income Tax Act, 1961 (43 of 1961) by way of charitable activities are to be charged for GST @NIL%.

Regd. Office: S. No. 36/1/1, M.N. 199, Vadgaon Khurd, Pune 411 041, Maharashtra, India.
• **Tel.:** 020 - 6530 4803 • **E-mail:** aptresearch@gmail.com • **Web:** ntc-apt.com
DSIR SIRO Recognised Research Laboratory

APT RESEARCH FOUNDATION

BILL

To, Vd. Renuka M. Suryawanshi, Ph.D Scholar, Rasashastra & B.K. Dept, Tilak Maharashtra Vidyapeeth, Pune	BILL NO	044/1718
	DATE	25/January/2018
	Pan No. AACTA5306K	

Description	Rate Rs.	Charge Rs.
Charges for Research Project No. 03/1718 entitled: "Comparative study of effect of Goghrita and Godugdha shodhita Gairika on haematological parameters of Wistar rats".		
Animals charges		9,000/-
Biochemistry (TIBC, Ferritin, Iron)		16,200/-
Haematology		6,000/-
Study charges		2,000/-
Maintenance		12,000/-
Total Rs.		**45,200/-**

IN WORDS: Rs. Fourty Five Thousand and Two Hundred Only.

for Bagade J.

APT RESEARCH FOUNDATION PUNE

Dr. K. G. APTE

N.B: Under section 12AA of the Income Tax Act, 1961 (43 of 1961) by way of charitable activities are to be charged for GST @NIL%

Regd. Office: S. No. 36/1/1, M.N. 199, Vadgaon Khurd, Pune 411 041, Maharashtra, India
• **Tel.:** 020 - 6530 4803 • **E-mail:** aptresearch@gmail.com • **Web:** ntc-apt.com

DSIR S/80 Recognized Research Laboratory

APT RESEARCH FOUNDATION

Date: 21/February/2018

R E C E I P T

Received with thanks from Vd. Renuka M. Suryawanshi, Ph.D Scholar, Rasashastra & B.K. Dept, Tilak Maharashtra Vidyapeeth, Pune, Rs. 45,200/- (Rs. Forty Five Thousand and Two Hundred Only) by NEFT (521805479016671) dated 21/February/2018 against total charges of Rs. 45,200/- (Rs. Forty Five Thousand and Two Hundred Only) as an Experimental Charges for the Research Project No.03/1718 entitled: "Comparative study of effect of Goghrita and Godugdhashodhita Gairika on haematological parameters of Wistar rats".

This payment has been made against Bill no 044/1718.

For APT Research Foundation,

FOR Bhagwat

Dr. K. G. Apte
Secretary,
APT Research Foundation, Pune.