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A Review on Kanta Loha (Magnetite)

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Abstract

The pharmaceutical branch of *Ayurveda*, *Rasa Shastra* goes into great depth regarding how to prepare various metals and minerals for maximum therapeutic benefit. One of the most prominent *Rasa Dravyas*, *Loha* (iron) is non-homologous and extremely harmful to the human body. It must be transformed into a homologous form known as *Loha Bhasma*. Among the *Loha, Kanta Loha* is considered the best. In this article, the information regarding *Kanta Loha*, collected from Ayurvedic classics, as well as information regarding magnetite, is also included. The goal of this study was to highlight the Ayurvedic classic references and modern knowledge of *Kanta Loha* (Magnetite) and its importance. This article contains studies on *Kanta Loha* that have been published in both index and non-index journals. For acquiring pertinent knowledge, Ayurvedic Samhitas with commentaries and textbooks on Ayurveda and modern medicine are advised. The knowledge on *Kanta Loha* scattered across *Ayurveda* has been gathered together for a better understanding of its relevance in the human body through various approaches, as well as its modern elements. According to a critical analysis of these *Kanta Lohas*, ancient seers administered magnetite in a more acceptable form.

Keywords: *Kanta Loha, Bhasma, Magnetite*

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Introduction

Rasa Shastra is an important branch of Ayurvedic pharmacology. This branch deals with the use of metals, minerals, and gemstones and their processing. Iron is a noncontroversial metal for therapeutic use since centuries in east as well as west. Iron containing drugs are widely used in modern medicine as hematinics. As per Ayurvedic texts Iron, that is, *Loha* is obtained in three varieties called as *Munda Loha*, *Theekshna Loha*, and *Kanta Loha*. In Ayurvedic literature, *Kanta Loha* (Magnetite iron ore) is considered as best among other *Lohas*. The first reference of *Kanta Loha* is found in *Rig Veda* as the word *Ayas*, which appears in numerous *Rig-Veda* hymns. The availability of *Kanta Loha* (magnetite iron ore) is rare, hence in many Ayurvedic pharmaceutical industries, *Loha Bhasmas* prepared by *Teekshna Loha*.

Despite its importance, when offered in its natural state, it possesses harmful qualities. As a result, it should be transformed into *Bhasma*, which will be in the oxidized form of Fe2+ and Fe3+, allowing it to maintain its regular electron-transfer activity. To make *Loha Bhasma*, a number of pharmaceutical procedures are explained, such as *Shodhana* (detoxification), *Marana* (incineration), and *Amruteekarana*, so that its therapeutical effects can be obtained in a variety of medical conditions.

Aim and Objectives

The objectives are as follows:

1. To evaluate, elaborate and discuss *Kanta Loha* as per *Ayurveda*
2. To evaluate modern knowledge of (Magnetite) and its importance.

Material and Method

An Ayurvedic *Samhitas* and modern medicine textbooks, as well as studies published in index and non-index journals, were used to acquire material on the subject.

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Historical and Ayurvedic Literature about *Kanta Loha*

Pre-Vedic period

The Indus-Valley civilization (c. 5000–6000 BCE) in Harappa and Mohenjo-Daro is the oldest civilization found so far, with pots colored with a mixture of iron. When manganese oxide is combined with ferric oxide, a pure black hue is produced; however, when the quantity of iron in the mixture predominates, a chocolate color is produced. Dark red pottery bangles have been discovered in Harappa. It contains silica, alumina, ferric oxide, ferrous oxide, manganese oxide, copper oxide, and other elements, according to the chemical analysis. However, no iron metallurgy was discovered.

Loha in Vedic period

The Vedas are a set of rules for the advancement of mankind in science, medicine, and spirituality. In *Rig-Veda,* the word *Ayas*, which appears in numerous *Rig-Veda* hymns, clearly refers to iron. Iron, steel, and wood were used to make all of the weapons and chariots used in combat. Ironsmiths and goldsmiths are caste-specific occupations. Vishphala's legs were amputated during the conflict, and *Ashwini Devata* endowed him with an artificial Iron leg. In *Atharvaveda*, there are many references which quotes *Loha* as *Shareera Ghataka*. *Shyama* in this context refers to *Lohamaya*. A comparison of universal powers and metal powers is made here. "His flesh is the color of Iron *Shyama*."[1,2]

Loha in Smriti period

This time period belongs to the Vedic era. In *Manu Smruti*, there is a reference to *Loha*. There are six *Dhatus*, according to *Yajnavalkala Smruti*. *Ayas* is one of them, and it is used to create icons. During *Ayas' Shodhana*, ten *Pala* will be lost for every hundred *Pala*. In *Brahma Sahitya*, *Uddarana* of 5 *Dhatu's* are available-*Swarna*, *Rajata*, *Tamra*, *Loha,* and *Seesa*. In *Shatapatha Brahmana*, it refers to *Loha* as a *Dhatu*. From *Ashma*, *Ayas* originated; by heating *Ayas*, *Hiranya* is obtained. *Ayasmayena Cha Aruna* is explained.

Loha in Purana period

It was not utilized for medicine, but it was frequently used in the creation of weapons, idols, and other objects. The *Mahabharata* contains a description of the *Dhritarastra*-powered preparation of an Iron idol of *Bheema*.

Samhita period

Kantaloha was first mentioned in *Sushruta Samhita Sutra Sthana* under *Upa Yantra Varga*.[3] *In Astanga Samgraha*, for the 1st time it was explained that *Krushnayas* is different from *Teekshna Loha*. *Kantayasa* is mentioned along with precious stones. *Kanta Loha* is also mentioned as one of the *Anu Yantra*. Using *Kantayasa*, the foreign body (arrow head) which is without earlike projections and which has created a wide opening in the body and lodged straight can be removed. In the preparation of Yogaraja *Awaleha* (*Bhallataka* as main ingredient) *Lohakanta* is used as one of the *Prakshepaka*.[4]

AH- Kanta Loha references:

- *Sutra Sthana* (3/41, 5/46, 7/67)
- *Shareera Sthana* (2/4, 3/87)
- *Chikitsa Sthana* (8/101)
- *Uttara Sthana* (6/15, 22/12, 37/45).

Classification of *Kanta Loha*

K***tx****anta Loha* is mentioned under *Maharasa* (one in Eight *Vaikranta, Kanta, Sasyaka, Makshika, Vimala, Adrija, Darada, Rasaka*) in RHT. Their *Sattva* is said to possess *Rasayana* property (). *KL* is told to be a precious stone (*Kanta Mani*).[7]

Origin of *Kanta Loha*: Is from *Kanta Loha Pashana*. It is procured in *Sattva Rupa* by exposing of *Kanta Loha Pashana* to intense fire.[8]

- *Bhramaka Kanta Loha:* This type of *Kanta Loha* turns the iron into flakes, when brought in the surrounding area.
- *Chumbaka Kanta Loha*: It attracts the iron flakes from a distance.
- *Karshaka Kanta Loha*: Similar to *Chumbaka Kanta Loha* but more attractive power than that.
- *Dravaka Kanta Loha:* One which attracts the iron flakes from a very long distance. When heated along with other metal, it facilitates their melting.
- *Romaka kanta Loha:* On the cut surface of which hairline like structure are seen. When it is cut into pieces, the tiny flakes stand erect like hair. This variety is supposed to be the best one.

Superiority of *Kanta Loha* Over other *Lohas*

The *Munda* (used for preparing *Kadayi* etc. iron vessels) variety of Loha is 10 times superior therapeutically to *Mandura*. The *Teekshna Loha* (steel used for the preparation of swords, knifes etc) is 100 times beneficial as compared to the Munda *Loha*. However, *Kanta Loha* (lodestone, magnetite) is said to be 100,000 times superior to the *Teekshna Loha*. Hence *Kanta Loha* is superior to other *Loha* varieties. According to *Rasa RatnaSamuchchhaya* and *Rasa Tarangini, Kanta Loha* is the best.

Characteristics of *Uttama Kanta Loha*

Rasa Ratna Samuchchhaya has described the characteristics of best *Kanta Loha*.[9] They are:

1. If a drop of oil is put on the surface of water taken in a vessel made of *Kanta Loha*, it does not spread, when water is boiled in the *Kanta Loha* container,
2. If the paste of *Hingu* is applied on the surface of *Kanta Loha* vessel, it loses its smell and attains the taste of *Nimba*.[10]
3. If milk is heated in a vessel made of *Kanta Loha*, it does not fall off even on strong heating and it will attain *Shikharakara*.
4. When Water is boiled in *Kanta Loha* container, *Hingu* like odor comes out.

Seven *Doshas* of *Loha*

1. *Guruta* (heavyness)
2. *Dridhatva* (hard)
3. *Utkleda* (nausea)
4. *Murchchha* (fainting)
5. *Daha* (burning sensation)
6. *Ashma Dosha* (calculi)
7. *Durgandhatva* (foul smell).[11]

Asuddha Kanta Loha Sevana Janya Dosha[12]

1. *Hritpida,*
2. *Vahni Dourbalya,*
3. *Maharoga* (seven great diseases *Vatavyadhi, Apasmara, Gulma, Shotha, Udara, Kushta, Madhumeha, and Rajayakshma)*

Pharmacotherapeutic Properties of *Kanta Loha*[13]

Shodhana of Kanta Loha is done by *Bhavana* with *Shasha Rakta* (rabbit's blood).[14] *Kanta Sattva* appears like "*Lohanibham.*"[15] *Trika Bija Sanjna* is given to triad of *Tamra-Kanta-Abhraka Sattva*.[16]

Collection of *Kanta Loha*

Kanta Loha should not be collected from the earth which is exposed to the air. *Kanta Loha* has to be collected by digging deep from the earth. Induction of magnetism or conversion of *Bhramaka Kanta Loha* in to *Chumbaka Kanta Loha* is also mentioned.[17]

Purification of *Kanta Loha*

- *Kanta Loha* is heated by applying blood of rabbit for 3 times. By which *Naisargika Dosha* can be removed.
- *Nirvapa* in *Triphala Kwatha* for 3 times will remove *Girija Dosha*.
- *Sthalipaka* with *Gomutra* and after washing with *Kanji* will purify *Kanta Loha*.
- *Karanja Twak, Hamsapadi, Gojihwa, Triphala, Guduchi, Gopali, Tumburu,* and *Rudravanti*, fine powder of all these eight drugs is made and paste is prepared with cow urine and applied on

the leaves of *Kanta Loha*, remaining powder is mixed in cow urine.
- The *Kanta Loha* which is coated with the paste is heated and quenched in the cow urine for 21 times.

Properties of *Kanta Loha*

Sindhura colored *Kanta Loha Bhasma* is *Aayushyakara, Bala Veerya Vardhaka, Deha Dardyakaram*, Increases Strength of Senses, *Tridosha Nashaka*, cures *Rajayakshma, Jwara, Raktapitta, Pandu,* and *Ashta Maha Gada*. (*Ananda Kanda*).

API specifications of *Kanta Loha*

Definition: *Kanta Loha* is an iron ore containing magnetite, a ferric oxide (Fe_3O_4) mineral.

Synonyms: *Samskrita*: *Kanta, Kantaka, Kantayasa*

Names: names in languages:

English: magnetite

Gujarati: Naatisa

Hindi: chumbaka, chumbaka patthar

Tamil: Kantham (SFI)

Telugu: sudantu rayi, ayaskantamu, kantapu rallu

Urdu: faulad, aahan (NFUM)

Broad classification: oxide

Origin and occurrence: *Kanta Loha* occur in igneous as well as metamorphic rocks as accessory mineral. It is a wide spread oxide mineral found in earth's crust in ore form. *Kanta Loha* is commonly associated with hematite (Fe_2O_3).

In India, *Kanta Loha* occurs mainly at

1. Guntur in Andhra Pradesh.
2. Selam and Tiruchirappalli in Tamil Nadu.
3. Shimoga, Bellari, and Kudremukh in Karnataka.
4. Mandi in Himachal Pradesh.
5. Mayurbhanj in Orissa.
6. Noamundi, notoburo, gore pahar, and bilwabathan in Jharkhand.
7. Other known deposits with hematite as predominant mineral occurs in the states of Bihar, Goa, Madhya Pradesh, and Rajasthan.

Physical properties (definition/explanation of technical terms and methods of determination as given in appendix-1)

Chemical Properties

Assay

Kanta Loha in ore form should contain not <60% iron (Fe) when analyzed by gravimetric method (appendix-3.1.4)

Heavy metal and arsenic

Kanta Loha in ore form should not contain more than the stated limits for the following: - arsenic ≤2 ppm and cadmium ≤7 ppm (appendix 3.2)

Other elements

Kanta Loha in ore form may contain the following within ±20% of the stated limits: - zinc 95 ppm mangeneese 500 ppm and silver 55 ppm (appendix – 3.1 and 3.2)

Acid insoluble

Take about 1 g of pre-dried finely powdered (150 mesh) sample of *Kanta Loha* in 250% ml beaker. Add 50 ml dilute hydrochloric acid. Stir the solution and cover the beaker with a watch glass. Heat on the hot plate at 150% and digest for 2 h. Cool, filter in buchnar funnel, wash with water and ignite at 900°C. Weigh the residue it should not be more than 13% of the initial weight of the sample.

Shodhana

Shall not be used in formulations without subjecting it to *Shodhana*. *Kanta Loha* is used in the form of *Bhasma*, the details of which are given in the monograph of *Bhasma*.

Recent Researches Related To *Kanta Loha*

Identifications Studies of *Loha Bhasma* by X-ray Diffraction and X-ray Fluorescence

Procedures for preparation of Loha Bhasma are described in ancient texts of *Ayurveda*. These procedures also begin with different source material for iron such as *Teekshna Loha* and *Kanta Loha* etc. In the present study, we have selected different source materials, namely, magnetite iron ore for *Kanta Loha*. The standard procedures of preparation of *Loha Bhasma* are carried out in identical conditions for these two raw materials. The final product from the *Puta* is characterized using X-ray diffraction and X-ray fluorescence spectroscopy to understanding the crystallographic form or forms of iron oxides and their composition at the end of each *Puta*. The iron content at the end of repeated *Putas* (18 for *Kanta Loha)* have shown only marginal decreases in the case of *Kanta Loha* because the Fe_3O_4 of magnetite is undergoing oxidation to Fe_2O_3. The trace elements remain within the *Bhasma* in the form of various oxides of Si, Al, Ca, etc.[19]

Standardization Of *Kantha Chendooram*[20]

Organoleptic Characters

Color (Red), Odor (Odorless), Taste (Tasteless), Appearance (Fine powder), and Solubility (Insoluble in water, organic solvents, and acids but sparingly soluble in aqua regia.)

Table 1: *Kanta Loha* in *Rasa Shastra*

Name of the book	*Details of Kanta Loha*
Rasendra Mangala of Nagarjuna (5–6th century ace)	In this book *Tikshna Loha Shodhana Vidhi, Marana Vidhi, Loha Druti Nirmana* is explained. And also, a different formulation which contains *Loha Bhasma* is explained like *Svacchanda Bhairava Rasa, Tikshna Mukha Rasa* etc.
Rasa Hrudaya Tantra (10th century ace)	explains method of *Shodhana* of *Kanta Loha*.
Rasarnava (12th century ace)	Different types of *Kanta Loha* is explained with its *Shodhana* method. *Vishuddha Loha Lakshana* is mentioned. *Ayaskanta - Dhumra Varna*. Specialty of each type of *Kanta Loha* is explained, and it is said that it should be procured from *Atapa Maruta Vikshipta Bhumi*. *Kanta Loha* should not be used for any *Karma*. *Gupta Yantra* is prepared with *Kanta Loha*. *Kanta Loha* is also listed as one among the substances with which *Khalva Yantra* is prepared. Mythological origin of *Kanta Loha* is described. *Kanta Loha* is considered as *Ankusha* for *Paarada*. Collection of Lodestone has to be done by digging earth (mining). That which is exposed to air, sunlight, should be left out. Method of conversion of *Bhramaka Kanta Loha* to its superior *Chumbaka Kanta Loha* and ultimately into *Dravaka Kanta Loha* is explained.
Rasendra chudamani (12th century ace)	*Kanta Loha – 4* types and their properties are explained. Its availability and their *Pariksha* for identification are mentioned
Ananda Kanda (13th century ace)	*KantaLoha Paryaya*, *Ashuddha Kanta Loha Sevana Dosha*, special method for *Kanta Loha Grahana* is explained.
Rasa Ratnakara (13th century ace)	Mainly explained about *Kanta Loha*, *Ashuddha Kanta Loha Dosha*.
Rasa Prakasha Sudhakara (13th century ace)	*Loha bheda, Kanta Loha Bheda, Lakshana, Shuddha Kanta Loha Lakshana*, *Gunadhikyata* are explained. *Loha Shodhana*, 3 different methods of *Marana* are explained, in which one special method is explained- *Bhasma* is prepared using sunlight. *Loha Bhasma Guna* is also dealt. *Niruttha Loha Bhasma* taken along with *Tanka Matra of Vyosha, Vella, Aajya, Madhu* will act as *Jara*, *Marana, Vyadhi Hara*, and by intake of this, *Gara Dosha Krut Roga* can be avoided.
Rasa Ratna samuccaya (13th century ace)	In 5th chapter *Loha* is explained in detail. 3 types of *Loh*a and its subtypes, *Kanta Loha Vishesha Marana Vidhi* all these are explained in detail. कान्तयो अतरिसयन उत्तरोत्तरं स्वस्थे चरियु :प्रदं स्नग्दिं मेहहरं ॥ *Kanta Loha* considered to be *Ati rasayana* and posses the *Mehahara* property.
Rasa Paddhati (13th century ACE)	*Loha Traya- Kanta, Teekshna, Munda;* Where *Kanta* is *Roga Harana, Kanta Loha Grahya Lakshanas* are explained
Rasendra Chintamani (15th century ace)	*Gunadhikya* of different *Loha*s (8 types of *Loha*) mentioned. *Kanta loha* is considered to be *Mahabala Pradam*.
Sharangadhara Samhita (15th century ACE)	*Kanta Loha* is mentioned as one of the 9 *Dhatus*.
Loha Sarvasva (15th century ace)	*"Sarvan Vijayate Rogaan Kaanta Loham Na Samshaya".* The administration of *Kanta Loha* alleviates all the diseases. In the context of *Vidhi Sevitha Loha guna, Loha* is indicated in *Meha*.
Rasa Chintamani (15th century ace)	*KantaLoha Rasayana Vidhi* is explained.
Rasendra Saara Sangraha (16th century ace)	8 types of *Loha* mentioned. Out of these divisions, *Kanta Loha* is considered to be best.
Rasa Manjari (15th century ace)	*Nirutha Pareeksha* of *Kanta Loha* mentioned.
Bhava Prakasha (16th century ace)	*Kanta Loha Lakshanas* mentioned.
Rasa Ratnakara	*Shodhana* and *Marana Kanta Loha, Lakshana* of *Kanta Loha, Shreshta Kanta Loha lakshana* mentioned.
Rasa Sanketa Kalika (16th century ace)	*Kanta Loha -4* types.
Bhaishajya Ratnavali (17th century ace)	*Kanta Loha* mentioned as one among the three types of *Loha*. Five types of *Kanta Loha* mentioned. *Guna* of *Kanta Loha Bhasma* mentioned. Numerous *Yogas* of *Kanta Loha* mentioned
Ayurveda Prakasha (17th century ace)	In *Trutiya Adyaya* there is mentioning of *Loha*. *Kanta Loha* is rare. *Vishesha Guna* of *Kanta Loha* is also explained.
Rasa Kamadhenu (17th century ace)	Different *Yogas* of *Kanta Loha* mentioned such as *Khandakadya Loham etc.*
Yogaratnakara (18th century ace)	*Kanta Loha Lakshana, Shodhana* and *Marana Vidhi,* method of *Loha Nirutthikarana*, use of *Rajata Bhasma* in the unavailability *of Kanta Loha Bhasma*, "*Loha Sevane Varjyani*" all these points are explained in this text.
Bruhat Rasaraja Sundara (19th century ace)	*Kanta Loha Pariksha, Trivarna Kanta Loha* explained.
Basavarajeeyam (18th century ace)	Description of *Kanta Loha*, Method of *Shodhana*, Preparation of *Bhasma*, explanation of *Kanta Sindura* is available.
Rasatarangini (20th century ace)	20th chapter is dedicated for *Loha*. *Kanta Loha Lakshana* are explained.
Rasamruta (20th century ace)	*Kanta Loha Bhasma Nirmana* is explained.

Table 2: Classification of *Kanta Loha*

Name of text	*Types*	*Varieties mentioned*
RRS-5/6-20 (*Rasa RatnaSamuchchhaya*)	5	*1. Bhramaka* *2. Chumbaka* *3. Karshaka* *4. Dravaka* *5. Romaka.*
Vanga Sena.	7	*1. Hrinthala,* *2. Taara,* *3. Batta,* *4. Baajira,* *5. Kalaka,* *6. Bramaka,* *7. Chumbaka*

Table 3: *Kanta Loha*/*Kanta Pashana* in classification

	Text
Dhatu	*RRS*
Maharasa	*Rasa Hridaya Tantra n 9/4*
Uparasa	*Rasarnava, AK, RSS, AP 2/9, Rasamanjari*[7][5]
Upadhatu	*RT 21ch*
Mani (precious stone)	*ASS, RHT*

Table 4: Pharmacotherapeutic properties of *Kanta Loha*

Rasa:	*Tikta, Madhura, Kashaya*
Guna:	*Sheeta, Guru, Snigdha*
Veerya:	*Sheeta/Ushna*
Dosha	*Triosha samaka*
Prabhava:	
Indications:	*Kanta Loha Bhasma* is a rejuvenator (*Rasayana*) and can eradicate the diseases like *krimi*, anemia (*Pandu*), *Vataroga*, debility (*Dourbalya*), *Pittavyadhi*, obesity (*Sthoulya*), hemorrhoids (*Arsha*), chronic dysentry (*Grahani*), fevers (*Jwara*), *Kaphavyadhi*, swellings (*Shopha*), diabetes like polyuric disorders (*Prameha*), abdominal enlargement (*Gulma Roga*), splenic disorders (*Pliharoga*), poisoning (*Visha-Vikara*), skin diseases (*Kushtha*) and loss of appetite (*Agnimandhya*) and is anabolic. It is excellent Rasayana and wards off untimely death.

Figure 1: Original *Kanta Loha* collected from Bellary and Kudremukh (Karnataka)

Analytical Data

Loss on drying at 110°C (3.0378%), acid insoluble ash (8.0677%), water soluble ash (4.093%), water soluble extractive value (0.3%), and alcohol soluble extractive value (0.4%)

Qualitative Analysis

Quantitative Analysis: (Wet and AAS)

Zinc (80 mg/kg), Copper (610 mg/kg), Iron (23.57%), Lead (<1.0 mg/kg), and Mercury (<6.0 mg/kg)

Antiulcer Activity *Kantha Chendooram*

Kantha Chendooram is a popular siddha preparation of eight ingredients. It consists of Purified Lode Stone (suththi seitha kantham), Purified Sulphur (Suththi seitha kanthakam), Lead Wort root powder (Koduveliver podi), Eclipta juice (Karisalaisaru), Lime juice (Elumicham pazha saru), Milk (Paal), Egg albumin (Muttaiyin venkaru), and Mudar Latex (Erukkan paal). Kantha Chendooram is indicated for microcytic anemia, anemia, chlorosis, obesity, edema, scrotal swellings, and rheumatic diseases, enlargement of liver and spleen and abdominal tumors. The anti-ulcer screening of *Kantha Chendooram* was carried out in albino rats using modified pylorus ligated (Shay) rat model. *Kantha Chendooram* at both the dose levels have anti-ulcer activity. The anti-ulcer activity of *Kantha Chendooram* at both the dose levels of 20 mg/kg and 40 mg/kg produced a significant decrease in the ulcer index ($P < 0.01$), which is also evidenced by significant increase in percentage protection from ulcers at both the dose levels (75.56 and 79.47), respectively. The activity was comparable and equipotent with that of standard drug Ranitidine (27 mg/kg).[20]

PET/NIRF/MRI Triple Functional Iron Oxide Nanoparticles (IONPs)

Engineered nanoparticles with theranostic functions have attracted a lot of attention for their potential role in the dawning era of personalized medicine. IONPs, with their advantages of being non-toxic, biodegradable, and inexpensive, are candidate platforms for the buildup of theranostic nanostructures; however, progress in using them has been limited largely due to inefficient drug loading and delivery. In the current study, we utilized dopamine to modify the surface of IONPs, yielding nanoconjugates that can be easily encapsulated into human serum albumin (HSA) matrices (clinically utilized drug carriers). This nanosystem is well-suited for dual encapsulation of IONPs and drug molecules, because the encapsulation is achieved in a way that is similar to common drug loading.

To assess the biophysical characteristics of this novel nanosystem, the HSA coated IONPs (HSA-IONPs) were dually labeled with 64Cu-DOTA and Cy5.5, and tested in a subcutaneous U87MG xenograft mouse model. *In vivo* positron emission tomography (PET)/near-infrared fluorescence (NIRF)/magnetic resonance imaging (MRI) tri-modality imaging, and *ex vivo*

Table 5: Physical properties of *Kanta Loha*

Nature	*Lump*	*Tenacity*	*Brittle*
Color	Grayish black	Transparency	Opaque
Streak	Reddish black	Magnetism	Magnetic in nature
Cleavage	None	Hardness	5.5–6
Fracture	Uneven	Sp. Gr	5–6
Luster	Metallic		

Table 6: Chemical properties of *Kanta Loha*

Magnetite: General and geological Information[18]	
Chemical Formula:	$Fe^{++}Fe^{+++}2O4$
Composition:	Molecular Weight=231.54 g Iron 72.36% Fe 31.03% FeO/68.97% Fe_2O_3 Oxygen 27.64% O 100.00% 100.00%=TOTAL OXIDE
Empirical Formula:	$Fe^{3+}{}_2Fe^{2+}O_4$
Environment:	Common accessory mineral in igneous and metamorphic rocks. Can be biogenically produced by a wide variety of organisms.
IMA Status:	Valid Species (Pre-IMA) 1845
Locality:	Many localities and environments
Name Origin:	Named for Magnes, a Geek shepherd, who discovered the mineral on Mt, Ida, He noted that the nails of his shoe and the iron ferrule of his staff clung to a rock.
Name:	Magnetite
Synonym:	ICSD 65339 Lodestone Magnetic iron ore PDF 19–629
Magnetite Crystallography	
Cell Dimensions:	a=8.391, Z=8; V=590.80 Den(Calc)= 5.21
Crystal System:	Isometric – Hexoctahedral H-M Symbol (4/m 3 2/m) Space Group: F d3m
X Ray Diffraction:	By Intensity(I/I_o): 2.53 (1), 1.483 (0.85), 1.614 (0.85),
Physical Properties of Magnetite	
Cleavage:	None
Color:	Grayish black, Iron black.
Density:	5.1–5.2, Average=5.15
Diaphaneity:	Opaque
Fracture:	Sub Conchoidal - Fractures developed in brittle materials characterized by semi-curving surfaces.
Habit:	Crystalline - Fine - Occurs as well-formed fine sized crystals.
Habit:	Massive - Granular - Common texture observed in granite and other igneous rock.
Habit:	Massive - Uniformly indistinguishable crystals forming large masses.
Hardness:	5.5–6 - Knife Blade-Orthoclase
Luminescence:	Non-fluorescent.
Luster:	Metallic
Magnetism:	Naturally strong
Streak:	Black

analyses and histological examinations were carefully conducted to investigate the *in vivo* behavior of the nanostructures. With the compact HAS coating, the HSA-IONPs manifested a prolonged circulation half-life; more impressively, they showed massive accumulation in lesions, high extravasation rate, and low uptake of the particles by macrophages at the tumor area.[21]

Table 7: Qualitative analysis of *KL*

Chlorides, Calcium, Alkaloid, Carbohydrates, Glycosides, Albumin	(+ve)
Sulfates, Magnesium, Potassium, Saponins, Carbonates, Phytosterols	(-ve)

Effect of Superparamagnetic IONPs on Glucose Homeostasis on Type 2 Diabetes Experimental Model

SPIONs are powerful glucose and lipid- lowering factor that play important role in diabetic treatment. SPIONs produce their effect through multiple pathways. The used doses of SPIONs produce anti diabetic effect equivalent to metformin; however, high doses have hepatorenal toxicities and may worsen the diabetic situation. Hence, further studies are necessary to explore the metabolic effects of SPIONs at lower doses than used in the present study, longer time intervals between doses (bi-weekly or monthly), and for longer durations.

Observations and Results

Kanta Loha information from all across *Ayurveda* has been gathered for a greater understanding of its importance in the human body through various approaches, as well as modern aspects.

Discussion

Munda Loha (Cast Iron), *Teekshna Loha* (Iron Turnings), and *Kaanta Loha* (Magnetic ore of Iron) are the three main forms of *Loha*. *Kaanta Loha* is the best therapeutically, *Teekshna Loha* is better, and *Munda Loha* is less beneficial. In a nutshell, these are better in order of quality.

Kanta Loha's historical review, classification, origin, characteristics, pharmacotherapeutic qualities, physical properties, chemical assay, chemical properties, qualitative analysis, and recent research are all described in this article.

Because of its vast medicinal capabilities, *Loha* (iron) is one of the most important *Rasa Dravyas*, used in the treatment of many diseases, either as a single medicine or as an ingredient in compound formulations. Hemoglobin, an erythrocyte protein that transports oxygen from the lungs to the tissues, contains the majority of iron in the body. The iron in hemoglobin is also responsible for the blood's red color. Iron is a necessary component of myoglobin, a protein that transports oxygen throughout the body.[22,23]

Free iron molecules are extremely toxic to the human body, they must go through a series of pharmaceutical procedures such as *Samanya Vishesha Shodhana*, *Trividha Loha Paaka*, *Marana*, *Amrutikarana*, and others to prepare *Loha Bhasma* (bio-metallic [iron] medicinal powers) for maximum medicinal benefits.

Conclusion

This research attempted to combine information on *Kanta Loha* from *Ayurvedic Samhitas* and magnetite from modern texts in order to gain a better understanding of *Kantaloha*(Magnatite) and its significance in the therapeutic field. *Loha* is the hardest metal and is incompatible with the human body; it must be transformed into a homogeneous form known as *Loha Bhasma*. To obtain good quality *Bhasma, Loha Samanya* and *Vishesha Shodhana* should be performed, followed by Marana. Following the production

of *Bhasma*, *Amruteekarana* should be performed to increase its medicinal potency.

References

1. Anand M. Sharan, The Existence of iron in The Vedas, Ramayana, and Mahabharata. Available from: http://www.engr.mun.ca/~asharan/bihar/ironage/IRONAGEINDIA2.htm [Last accessed on 2022 Jan 23].
2. Habib I. Vijay Kumar Thakur, The Vedic Age and the Coming of Iron, c. 1500-700 B.C. Tulika: Aligarh Historians Society; 2003.
3. Sharma PV. Sushruta Samhita of Sushruta, Sutra -7/15. Varanasi: Chaukhambha Orientalia; 2009. p. 34.
4. Srikanta Murthy KR Ashtanga Samgraha of Vriddha Vagbhata, Kushta Chikitsa, 21/12-3. 5th ed. Varanasi: Choukhamba Orientalia; 2005. p. 494-5.
5. Sharma SN. Rasamanjari of Shalinath. 1st ed. Varanasi: Chaukhamba Orientalia; 1995. p. 23.
6. Bajapeyi Rameshwar Dayalu. Rasa Hridaya Tantra of Govinda Bhagavatpada. 1st ed. Varanasi: Chaukhambha Krishnadas Academy; 1998. p. 76.
7. Bajapeyi Rameshwar Dayalu. Rasa Hridaya Tantra of Govinda Bhagavatpada. 1st ed. Varanasi: Chaukhambha Krishnadas Academy; 1998. p. 141.
8. Kashinath S. Rasa Tarangani of Sadananda Sharma, 20/8. 11th ed. New Delhi: Motilal Banarasidas; 1989 (2004 Reprint). p. 481.
9. Kulkarni DA. Rasa Ratna Samucchaya of Rasa Vagbhata, 5/95. New Delhi: Mehar Chand Lacchmandas Publishers; 1998. p. 113.
10. Mishra Gulrajsharma. Ayurveda Prakasha of Upadhyaya Madhava, 3/217. 4th ed. Varanasi: Chaukhambha Bharati Academy; 1994. p. 392.
11. Mishra Gulrajsharma. Ayurveda Prakasha of Upadhyaya Madhava, 3/223. 4th ed. Varanasi: Chaukhambha Bharati Academy; 1994. p. 392.
12. Mishra SN. Ananda Kanda of Manthana Bhairava, 2(Kriyakarana Vishranti)-5th Ullasa/7th Shloka. 1st ed. Varanasi: Choukhamba Orientalia; 2008. p. 713.
13. Kulkarna DA. Rasa Ratna Samucchya of Rasa Vagbhata, 5/96. Varanasi: Chaukhambha Krishnadas Academy p. 113.
14. Bajapeyi Rameshwar Dayalu. Rasa Hridaya Tantra of Govinda Bhagavatpada. 1st ed. Varanasi: Chaukhambha Krishnadas Academy; 1998. p. 77.
15. Bajapeyi Rameshwar Dayalu. Rasa Hridaya Tantra of Govinda Bhagavatpada. 1st ed. Varanasi: Chaukhambha Krishnadas Academy; 1998. p. 82.
16. Bajapeyi Rameshwar Dayalu. Rasa Hridaya Tantra of Govinda Bhagavatpada. 1st ed. Varanasi: Chaukhambha Krishnadas Academy; 1998. p. 85.
17. Sharma SN. Manthana Bhairava, Ananda Kanda 1-5/9-13. Varanasi: Choukhamba Orientalia; 2009 edition. p. 714.
18. Available from: http://webmineral.com/data/Magnetite.shtml#.UHKo3ZjYHsQ. [Last accessed on 2013 Feb 20].
19. Bhargava SC, Reddy KR, Sastry GV. Identifications studies of Lauha Bhasma by X-ray diffraction and X-ray fluorescence. Ayu 2012;33:143-5.
20. Elango K, Suresh B, Ramesh BR, Vadivelan R. Sampathkumar standardization of kantha chendooram. Anc Sci Life 2006;26.
21. Vadivelan R, Elango K, Suresh B, Ramesh BR, Bhadra S, Raghuram A, *et al.* Pharmacological validation of Kantha chendooram for antiulcer activity in modified pylorus ligated (shay) rat model. Anc Sci Life 2007;27:38-43.
22. Xie J, Chen K, Huang J, Lee S, Wang J, Gao H, *et al*. PET/NIRF/MRI triple functional iron oxide nanoparticles. Biomaterials 2010;31:3016-22.
23. Wessling-Resnick M. Iron. In: Ross AC, Caballero B, Cousins RJ, Tucker KL, Ziegler RG, editors. Modern Nutrition in Health and Disease. 11th ed. Baltimore, MD: Lippincott Williams & Wilkins; 2014. p. 176-88.
24. Aggett PJ. Iron. In: Erdman JW, Macdonald IA, Zeisel SH, editors. Present Knowledge in Nutrition. 10th ed. Washington, DC: Wiley-Blackwell; 2012. p. 506-20.