STANDARDIZATION ON PURIFICATION PROCESS OF GAANTHAM (MAGNETIC OXIDE OF IRON)

The dissertation Submitted by

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BONAFIDE CERTIFICATE

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DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled **"Standardization on Purification Process of Gaantham (Magnetic oxide of Iron)"** is a bonafide and genuine research work carried out by me under the guidance of **Dr. S. Murugesan M.D(S),** Associate Professor, Department of **Nanju Maruthuvam,** National Institute of Siddha, Chennai - 47, and the dissertation has not formed the basis for the award of any Degree, Diploma, Fellowship or other similar title.

Date:

Place: Chennai-47

Signature of the Candidate,

Dr. E.Selvasankari

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CONTENTS

1.INTRODUCTION:

Siddha system of medicine is one of the classical system of medicine consisting of Herbal, Metal, Mineral and Animal origin. The noble Siddha medicine is one among the Traditional system of Indian medicine. It has its origin strictly belongs to southern part of India. Siddha system of medicine not only deals with the treatment but also to prevent and promote human health through principles of "Unave marunthu, marunthae unavu". This system has its own basic principle. Vali, Azhal, Iyyam.[1]

மிகினும் குறையினும் நோய்செய்யும் நூலோர்
வளிமுதலா எண்ணிய மூன்று- **திருக்குறள்**

There are vast number of Herbal, Herbo mineral, Herbo metallic and Herbo marine preparations mentioned in Siddha Literatures. Siddhar's used their extensive knowledge of minerals, metals and plants from time immemorial[2].

Siddha medicine incorporates wide usage of heavy metals and minerals for curing chronic illness. The scientific evaluation is needed to validate its preciousness. The Siddha system has not only the curative and preventive effects on different diseases but also paves the way for longevity and immortality[5]. WHO has also recognized Indian system of medicine has an effective alternative medicine in the place of conventional allopathic system of medicine.

In spite of strong efficacy in Siddha system is facing crisis in getting appreciation among the mass. The western scientific community condemned the Indian system of medicine to market the drugs reporting the presence of heavy metals like arsenic, lead, cadmium & mercury[3].

In Siddha system all drugs must be purified individually as told in the text before converting into medicine. Detoxification and purification process of raw drugs have been meticulously described in Siddha literature where, purification is primary step in removing impurities of the drug[4].

” ஒன்றான சரக்கு சுத்தி
யாவருமுறைக்கவில்லை
கண்ணான சரக்குக் கெல்லாங்
கர்மங்கள்தீரா விட்டால்
பன்றான மருந்து சேர்த்துப்
பருகிடில்பிணி யாளர்க்கும்
நன்றானசிந்தூரங்கள்
உட்படும் நன்றாகதே”

-Agasthiyar kanma soothiram[6]

Standardization is the process of implementing and developing technical standards. Standardization helps to maximize, compatibility, interoperability, safety, repeatability or quality. It can facilitate commoditization of formerly custom process. Aim of Standardization is to scientifically valid the quality and safety of single drugs of herbals, minerals, metals animal origin and also compound formulations as per Active Pharmaceutical Ingredient-API guidelines. This process helps metallic drug to lose their undesirable or toxic effect and there by aid better dosage efficacy[8].

Gaantham is one of the metallic drug which widely used in our day today practice for treating vatha disease, anaemia, dropsy, jaundice, ascites, leucorrhea, eye diseases in Siddha system of medicine. Gaantham is a mineral used extensively in various Siddha formulations, with great therapeutic significance[9]. Gaantham is also included as the major ingredient of many Siddha medicines like Rasa ganthi mezhugu, Pattu karuppu, Kushtagaja kesari, Thiriloga ratchamani and Vatha ratchasan[10].

Strandadization of Siddha medicine from purification itself is the major responsibility of Siddha toxicologist. Since, no scientific validation of changes that occurred during purification process of Gaantham has been documented. This study is aimed to reveal the strandadization of one of the purification process of Gaantham which is mentioned in Siddha literature Theran yemaga venpa[7].

2. AIM&OBJECTIVS

2.1. AIM:

To standardize the purification process of Gaantham.

2.2.OBJECTIVES:

- To discover the importance of purification process.
- To analyse the changes during purification process by chemical analysis.
- To analyse the changes during purification process by physico-chemical analysis.
- To evaluate the importance of purification by comparing the unpurified and purified Gaantham by Quantitative analysis.
    - XRD
    - ICP-OES
    - FTIR
    - VSM
    - GCMS

3. LITERATURE REVIEW

3.1.காந்தம்- MAGNETIC OXIDE OF IRON

3.1.1. SIDDHA ASPECT

வேறு பெயர்கள்:

- சிவலோகச் சேவகன்
- தரணிக்கு நாதம்
- சூத அங்குசம்
- நவலோதத்துரட்டி
- காயசித்திக்குப் பாத்திரவான்
- முருகன் புராணம்
-

காந்தத்தின் குணம்:

லோகத்தைத் மிடுக்காய் இழுக்கின்ற இடத்திற்கு "முகம் " என்பது பெயர்.இதற்கு ஒன்று, இரண்டு, மூன்று, நான்கு, ஐந்து முகங்களும் அதற்கு மேற்பட்ட முகங்களும் இருப்பதுண்டு.

ஐந்து முகங்களுக்கு மேற்பட்ட சர்வமுகங்களுள்ள காந்தமே சிறந்தது.

காந்தத்தின் வகைகள்:

காந்தம் ஐவகைப்படும்.

1. பிராமுகம் (கற்காந்தம்)
2. கம்பகம் (ஊசிக்காந்தம்)
3. கர்ஷகம் (பச்சைக்காத்தம்)
4. திராவகம் (அரக்குக்காந்தம்)
5. ரோமகம் (மயிர்க்காந்தம்)

பிராமுகம்-லோகத்தைப் பிரமிக்கப் பண்ணும்
கம்பகம்-லோகத்தை இழுத்துக் கொள்ளும்
கர்ஷகம் -லோகத்தைத் தூர ஓட்டிவிடும்
திராவகம்- லோகத்தைத் தண்ணீராக்கும்
ரோமகம்-லோகத்தில்மயிர்போலத்தொத்துவிக்கும்
காந்த வகைகளின் குணங்கள்:
பிராமுகத்தையும், கம்பகத்தையும் நோய் தீர்க்கவும்;
கர்ஷகத்தையும், திராவகத்தையும் இரசாயனத்திற்கும் (உடல்தேற்றவும்);
ரோமகத்தை இரசத்தை கட்டுவதற்கும் உபயோகிக்க வேண்டும்.

நிலம்:

காந்தம் பெரும்பாலும் மலைப்பகுதிகளில் கிடைப்பதால் குறிஞ்சி நிலத்தை சேரும்.

காலம்:

காந்தத்தாது வருடம் முழுவதும் மலைப்பிரதேசங்களில் கிடைப்பதால் குறிப்பிட்டகாலம் என்று எதுவுமில்லை.

சுவை:

துவர்ப்பு

வீரியம்:

வெப்பம்

நட்புச்சரக்குகள்:

இரும்பு, நாகம், செம்பு, பூரம், பூநாகம், சுந்தகம், வெள்ளி, தங்கம், கற்பூரம் மயூரகச் செம்பு

- **குணபாடம் தாது சீவ வகுப்பு (ப.எண் 89)**
- **இராஜ வைத்திய போதினி (ப.எண் 97)**

பகைச்சரக்குகள்:

நவாச்சாரம், துருசு, அப்பிரகம், அப்பிரகம், நிமிளை, வெடியுப்பு, வெண்கலம், வீரம். மனோசிலை, வெங்காரம், கௌரி, மிருதார்சிங்கி, பூநீறு அண்டவோடு, வங்கம், கிளிஞ்சல்

-குணபாடம்தாதுசீவவகுப்பு (ப.எண்: 89)

-இராஜவைத்தியபோதினி (பஎண்.99)

காந்தத்தின் சிறப்பு:

காந்தத்திற்கு, அயத்திற்கு இருக்கும் குணங்களே உண்டு என்று பலநூல்கள் கூறினும் **அயத்திலுங் காந்தம் மேன்மை** உடையது என்று சொல்லப்பட்டிருக்கிறது. அதைத்**தேரர்** கீழ் செய்யுள் மூலமாய் விளக்கிக் காட்டியிருக்கின்றார்.

இரும்பினுங் காந்தம் மேன்மை

என்பதவ் விரும்பைக் கூட

விரும்பியுள் ளடக்கிக் கொள்ளும்

மேன்மையி னாலல் லாது

பெரும்பிணி யினங்கட் கெல்லாம்

பெரும்புலி யெனவு ரக்குந்

திரும்பவு மவைகட் கெல்லாந்

திறம்பெறு நண்பு மாமே."

அகத்தியர் வயித்திய இரத்தினச் சுருக்கத்தில் **திரிலோக செந்தூரம்** மற்றும் **பஞ்சலோக செந்தூரத்தில்** சேரும் உலோக சேர்க்கையில் காந்தமும் ஒன்று என்று கூறப்பட்டுள்ளது இதனை,

"கேளப்பா திரிலோக செந்தூரத்தைக்
கெட்டியாம்லோகமப் பிரகங் காந்தம்
நாளப்பா மூன்றையுமே சுத்திசெய்து
நலமாகச் சாறுகூட்டி"

- என்றபாடலின்மூலமும்,

'கேளடா பஞ்சலோகச் செந்தூரத்தைக்
கேடில்லாத் தங்கமொடு வெள்ளி செம்பு
நாளடாகாந்தமோ டிரும்பிவ் வைந்தும்
நலமாகச் சுத்தி செய்து சரியாய்க்கூட்டி"

- என்றபாடலின் மூலமும் அறியலாம்.

போகர் 120 உபரசங்களில் ஒன்றாக காந்தத்தைக் கூறியுள்ளார்.

"கண்டுகொள் ளுபரசத்தின் வகையைச் சொல்வேன்
காந்தமோ டப்பிரகந் துருசு கன்னார்..... "

- **போகர்காரசாரத்துறை**

பொதுக்குணம்:

காந்தத்தாற் சோபைகுன்மங் காமிலமே கம்பாண்டு
சேர்ந்ததிரி தோடவெட்டை சீதங்கால்-ஓய்ந்தபசி
பேருதரங் கண்ணோய் பிரமிய நீராமையும்போம்
ஓரினிறை யாயுளுறும் உன்."

காந்தத்தால் வீக்கம், குன்மம், காமாலை, மேகம், பாண்டு, முத்தோடம், வெள்ளை வீழல், சீதளம், வாதநோய், மந்தம், மகோதரம், விழிநோய், பிரமியம், நீராமைக்கட்டி முதலியன நீங்கும். பூரண ஆயுளும் உண்டாம்.

காந்தத்தின் சிறப்பு பண்புகள்:

- காந்தத்தால் செய்த பாத்திரத்தில் பால் விட்டுக் காய்ச்சிக் குடித்து வந்தால் இரத்தவிருத்தி உண்டாகும்; துர்ப்பலம் நீங்கும்; தேகம் மேனி தரும்,

- காந்தப் பாத்திரத்தில் பால் விட்டுக் காய்ச்சினால், பொங்கி உள்ளேயே நிற்கும். பால் வெளியில் வராது. இஃது ஒரு விசேட குணம்.
- சிறந்த காந்தத்தால் ஆன பாத்திரத்தில் ஒரு துளி எண்ணெய் விட அது தண்ணீரில் பரவாமல் இருக்கும்.
- காந்ததில் வேப்பிலையின் கற்கத்தை பூச வேப்பிலையின் கசப்பு நீங்கும்.

- Indian materia madica 1993 (P.no-54)

காந்தத்தின் சுத்திமுறைகள்:

ஒருபலம் (35 கிராம்) காந்தப்பொடிக்கு, ஆறுபலம் (210 கிராம்) பொன்னாவாரை வேர்ப்பட்டைச் சாறு விட்டுக் காலை முதல் மாலை வரை வெயிலில் வைக்கவேண்டும். இவ்விதம் பத்து நாள் செய்து, இரண்டு நாள் சாறு விடாமல் உலர்த்திப் பின்னும் இதுபோல இருமுறை செய்து, கழுவி எடுக்கச் சுத்தியாம். இவ்விதம் சுத்தி செய்த காந்தத்தினால் செய்யப்பட்ட மருந்துகள்உயிரை இரட்சித்து வாத கணப்பிணிகளைப் கொல்லும் என்ப.

வீணைமுனி யாவரை வேர்ப்பட்டை நீர்ப்பட்டை
வீணைமுனி யாவரை வேயழுக்கு - வீணைமுனி
கண்டீ ரவமாமேகத்திங்கண் மட்டுநிதங்
கண்டீ ரவமாமேகால்.

-தேரன் யமக வெண்பா[7]

பிற சுத்திமுறைகள்:

1."முன்னரக் காந்த சுத்தி
முறையறைகின்றேன்கொன்றைப்
பன்னநீர் தொடிக்கெண் கூறு
பாய்ச்சிநித் தியமொன் பானாள்
உன்னவா தபத்தின் மீட்டும்
ஒன்பது பிருந்தைச் சாற்றில்
பின்னரப் படிவல் லாரை.
பேசுதா ரகைநா ளாமே."

ஒரு பலம் (35 கிராம்) காந்தத்தை ஒரு மண்சட்டியிலிட்டு, கொன்றை இலைச்சாறு எட்டுப்பலம் (280 கிராம்)விட்டு, வெயிலில் வைக்கவும். இவ்வாறே நாள் ஒன்றுக்கு எட்டெட்டுப் பலம் (280 கிராம்) வீதம் ஒன்பது நாள் விட்டு வெயிலில் வைத்துப் பின்பு துளசிச்சாறு ஒன்பது நாளும், வல்லாரைச் சாறு ஒன்பது நாளுமாய் இருப்பத்தேழு நாள் ஆன பின் தூய்மை செய்து வைத்துக் கொள்ள வேண்டும்.

- **குணபாடம்தாதுசீவவகுப்பு**[9]

2.காந்தத்தை எலுமிச்சம் பழச்சாற்றிலரைத்து முக்கால்மணிநேரம் வைக்கச் சுத்தியாகும்.

3.காந்தத்தை ஆலம்பாலில் ஒரு நாள் ஊற வைத்து உலர்த்த சுத்தியாகும்.

4.ஊசிக்காந்தத்தை ஒரு எலுமிச்சம் பழச்சாற்றில் முக்கால் மணிநேரமும், காடியில் முக்கால் மணிநேரமும் ஊற வைக்கச் சுத்தியாகும்.

5. எலுமிச்சம் பழச்சாறு, காடி, புளித்த மோர்க் கலவையில் கொதிக்க வைத்து எடுத்து பின்னர் சாணநீரில் ஏழுமுறைகாய்ச்ச சுத்தியாகும்.

6. காந்தத்தைப் பொடி விழாமல் சிறுக வெட்டி கிழிகட்டி பானையில் விட்டு ஆடு, மாடு, கழுதை, குதிரை ஆகிய பிராணிகளின் மூத்திரத்தைக் கூட்டி ஏழுநாட்கள் தோலாயந்திரமாக எரிக்க சுத்தியாகும்.

7. காந்தத்தைப் பொடித்து முடிகட்டி, காடியிலும் கொள்ளுக் குடிநீரிலும் முறையே அவித்து எடுத்துக் கழுவி உலர்த்தி கொள்ள சுத்தியாகும்.

8. எலுமிச்சம் பழச்சாறு, புளித்தகாடி, புளித்தமோர் இவைகளில் முறையே மூன்று நாள் தனித்தனியே காந்தத்தை ஊற வைத்து வெயிலில் வைத்துக் கழுவி எடுக்க சுத்தியாகும்.

9. காந்தத்தைக் கொல்லன் உலையிலிட்டுக் காய்ச்சி ஏழு அல்லது இருபத்தொரு முறைகொள்ளுக்குடிநீரில் தோய்த்து கழுவி எடுக்க சுத்தியாகும்.

-சரக்கு சுத்தி செய்முறைகள்[12]

10.காந்தங் காடி மோர்தன்னில்
கடுதரம் நிம்பப் பழச்சாற்றில்
சேந்து ரண்டு நாழிகை
செவ்வே யூற சுத்தியாம்

11.துவைத்திடவே காந்தத்தைச் சுட்டு நீகேள்
தூசிபற்று காந்தத்தைத் துண்டாய் வெட்டே

-உரோமரிஷி மருத்துவாகடம்[12]

காந்தபற்பம்

"சுத்தி செய்த காந்தத்தை நிறுத்துக் கொண்டு
தொடி யொன்றுக் கிரண்டுபலந் துளசிச் சாறு
துய்க்க நிதம் இவ்வாறே மூன்று வைகல்
துய்ப்பித்தங் கூறியபின் நாலாம் நாளில்"

அத்திப்பால் நாற்றொடிவிட் டதைமத் திப்ப
தப்படிநா ளிரட்டையிணை யான பின்னர்
அதையுருட்டி வில்லைசெய்து ரவியோர் நாள்வை
ஐயிரண்டாம் நாளிலதைச் சீலை மண்செய்

வித்தொருாள் வெயிலுலர்த்திப் பதினோராநாள்
விராட்டியெழு பத்திரண்டு மிருபத் தெட்டும்
மேவுபுட மிட்டதனை யொருநா ளாற
விட்டெடுத்துப் பதின்மூன்றாம் நாளிற் பார்க்கச்

சுத்தமாக பதியுணவு போலத் தோன்றும்
கரரெனவே திறமாவர் துய்த்த பேர்கள்
சொல்லுமதைப் படைத்தவயித் தியர்வல் லாண்மை
சுவேதவா கனனெனவே துலங்கு வாரே."

இப்பற்பத்தை உண்ணும் அளவும் துணைமருந்தும் தீரும் நோயும்.

இப்பற்பத்தை கடுகு, தினை, நெல், குன்றி அளவுகளில்,தேன், நெய், வெல்லம், சீந்தில் உப்பு இவைகளில் சேர்த்து உண்டால், அசதிசுரம், சேத்துமசுரம், இரத்தகாசம், உளைமாந்தை, அச்சரம், சுவாசம், வாதநோய்கள்; வாத பித்தக் கலப்பு நோய்கள் ஆகியவை தீரும்.

இப்பற்பத்திற்குப்பத்தியம்

இதற்குப் பத்தியம் இச்சாபத்தியமாகும்.கலியாணப் பூசினிக்காய், கொள், கடுகு, காடி இவைகள்ஆகா. நெய், பால், சர்க்கரை, கோதுமை, இவைகள்உத்தமம். நெல்லரிசிமா, மத்திமம், சோளம், எப்போதும் கூடாது, அப்படித் தவறிச் சேர்த்துக் கொண்டால், தின்ற மருந்து ஒரு பலனையும் தராது வீணாய் முடியும். அங்ஙனமாயின், பெண்ணைப் பற்றிச் சொல்லவும் வேண்டுமா?

"பத்தியம்இச்சாபத்தியம்
பறங்கிகொள் கடுகு காடி
சுத்தமா காது; நேயம்
சுதைச்சருக் கரைகோ தும்பை
உத்தமம்; நென்மா மத்தி;
உறவொண்ணா திறுங்கெப் போதும்;
நத்திடில் விருமா வாம் பெண்
நாமினியுரைப

காந்த பற்ப நாளளவின் பலன்

ஒரு மாதமானால் நோய்களெல்லாம்ஓடிப் போய் விடும்; இரண்டு மாதங்களானால்உடலுக்குமிக்க வ ன்மை உண்டாகும்.இதனை.

"ஒருமதி யமையுமுன்னே
யோடிடும் பிணிக ளெல்லாம்
வருமுடற் கதிக லாபம்
மாதமற் றிரண்டே யாகில்
பெருமித மாகும்."

என்பதாலுணர்க.

காந்த செந்தூரம்

காந்தத்திற்குச் சமன் கந்தி கூட்டி, கல்வத்திலிட்டுக்கரிசாலைச் சாற்றாலாட்டி, வில்லைதட்டிக் காய வைத்து, ஓட்டிலிட்டு,ஓடு மூடி ஏழு மண்சீலை செய்து, கச புடமிட்டெடுத்து, இவ்வெடைக்குக் கந்தி கூட்டி, முன் சாற்றாலரைத்து, முன்போலக் கச புடமிட்டெடுத்து, இவ்வெடைக்குக் கந்தி கூட்டிப் பழச் சாற்றாலரைத்து முன்போல கச புடமிட்டெடுத்து, அவ்வெடைக்குக் கந்தி கூட்டி அவ்வெடைக்குச் சித்திரமூலங் கூட்டி முலைப்பாலாலரைத்து, வில்லைதட்டி ஒட்டிலிட்டு, முன்போலப் புடமிட்டெடுத்து, கந்தியும் சித்திரமூலமும் இவ்வெடைக்கு ஒன்றாய்க் கூட்டி, கோழிமுட்டை வெண்கருவினாலரைத்து வில்லை செய்து புடமிட்டு எடுத்துகல்வத்திலிட்டு எருக்கம் பாலால் நான்கு சாமம் அரைத்துப் புடமிட்டெடுக்கச் செங்கறுப்பாய் இருக்கும்.

அளவு:

பணவெடை (488 மி. கிராம்)

துணைமருந்து:

தேன்.

பத்தியம்:

இச்சாபத்தியம்.

தீரும்நோய்:

விஷப்பாண்டு, கவிசைச்சுட்டி, சோகை, பித்தப்பாண்டு, நீராம்பல், அண்டவாயு, ஆநந்தவாயு, வாயு.

காந்தம்சேரும்பிறமருந்துகள்:

1.காந்தாதிக் குளிகை

அளவு: 1/2-3/4 குன்றி (65-97.5 மிகி)

துணைமருந்து:வெண்ணெய், பறங்கிபட்டைவெல்லம், வில்வாதிஇளகம்,

தீரும்நோய்:சூலை,குன்மம்,குடல்வாதம்,

-**அனுபோக வைத்திய நவநீதம் பாகம்**[13] **1 (ப.எண்.67)**

2.காந்தரச வில்லை

அளவு: குன்றி (130 மி.கி)

அனுபானம்: பனைவெல்லம், சர்க்கரை, தேன், நெய்,வாழைப்பழம்.

தீரும்நோய்கள்: இலிங்கப்புற்று,யோனிப்புற்று,கன்னப்புற்று.

பலகிரந்திரோகங்கள், சூலைவகைகள்.வாயுவகைகள், இரணவகைகள்.

-**வீரமாமுனிவர்வாகடத்திரட்டுபாகம் 2**[15]**(ப.எண்:102)**

3. வாத ராட்சன்

அளவு:உரைத்துக்கொடுத்தல்

தீரும்நோய்:சன்னி,தோஷம்,வாதம்.

- சித்தவைத்தியதிரட்டு[10] **(ப.எண்.41)**

4.பட்டு கருப்பு

அளவு: 1- 2 அரிசி

அனுபானம்: தேன்

தீரும்நோய்: சூதக சூலை,சூதக்ச் சன்னி, சூதக வெட்டை

5.வான் மெழுகு

அளவு: உளுந்தளவு (65 மிகி)

அனுபானம்: பனைவெல்லம்

தீரும்நோய்: எண்வகை சுரம், காசம், குட்டம், குன்மம்,சூதகக்கட்டு. காமாலை, சோகை, மகோதரம்,கல்லடைப்பு. நீரிழிவு, சூலை, பவுத்திரம்

-**சித்தவைத்தியதிரட்டு**[10] **(ப.எண்.197)**

6. விஷ்ணு சக்கர மாத்திரை

அளவு:உளுந்து (65 மி.கி)

அனுபானம்:தேன். இஞ்சிச்சாறு

தீரும்நோய்:கபாலசூலை, பீநிசம், பித்தவாயு, வாதவலி,கபம், சோகை, மகோதரம், கழிச்சல்,அதிவியாவை, சுரம், கண், சிரசு, இடுப்பு முதலியவிடங்களில் பற்றிய வலி.

-கண்ணுசாமிப் பரம்பரை வைத்தியம்[14] **(ப.எண். 149)**

7. அயகாந்த சண்டமாருத செந்தூரம்:

அளவு-1 குன்றி (65 மிகி-130 மிகி)

தீரும்நோய்:சர்வவாதரோகங்கள், பித்தரோகங்கள், கபரோகங்கள், குன்மம்,வயிற்றுவலி, மேகம், பவுத்திரம், சந்நி, சுரம், வயிற்றுபொருமல்

- **கண்ணுசாமிப் பரம்பரை வைத்தியம்**[14] **(ப.எண்.313)**

8. பஞ்சலோக செந்தூரம்

அளவு:2-3 அரிசி

அனுபானம்:பனைவெல்லம்

தீரும்நோய்:யானைக்கால்சுரம், வீக்கம், பெருத்தசரீரம், இளைத்தல்

-பதார்த்த குண விளக்கம்(தாது)

சீவவர்க்கம்[16](ப.எண்.62)

9. அத்திநக மாத்திரை

அளவு:1-2 குன்றி (130-260மி.கி)

அனுபானம்:தேன், நெய், சர்க்கரை

தீரும்நோய் :எலும்புருக்கி, கணைவெட்டை, சோகை

-அனுபோக வைத்திய நவநீதம்பாகம்[13] (ப.எண்:55)

10.ரசகந்தி மெழுகு

அளவு: சுண்டைக்காய்

தீரும்நோய் : வெடிசூலை, ஏகசூலை, இடிசூலை, புடைசூலை, துடிசூலை, வாதசூலை. கால்குடைச்சல், கரணை, விப்புருதி. கண்டமாலை, குட்டம். விஷநீர், குறைநோய், சிரங்கு, புழுவெட்டு,தடிப்பு, யோனிச்சிலந்தி, லிங்கச்சிலந்தி, செங்கிரந்தி, கருங்கிரந்தி, பொரிகிரந்தி, பருகிரந்தி, இடிகிரந்தி, புரையோடும்புண், அரைக்கடி, தண்டிற்புண், தொடைவாழை, விலாவாழை, மார்புச்சிலந்தி, யோனிப்புற்று, இலிங்கப்புற்று, இடிப்புற்று, கன்னப்புற்று, சிலந்தி, பிளவை: நேத்திரப்பிளவை. தடிச்சிலந்தி, புடைச்சிலந்தி, பௌத்திரம், முளைமூலம், பாதச்சக்கரம் முதலியவை தீரும்.

3.1.2.GEOLOGICAL ASPECT

MAGNETITE OR LODESTONE[18]

Lodestone is one of only a very few minerals that is found naturally magnetized. Magnetite is black or brownish-black, with a metallic luster, a mohs hardness of 5.5–6.5 and a black streak.

It's **chemical formula** $Fe0_3$ (magnetite) and $Fe0_4$ (maghemite).

Origin

The process by which lodestone is created has long been an open question in geology. Only a small amount of the magnetite on the Earth is found magnetized as lodestone. Ordinary magnetite is attracted to a magnetic field like iron and steel is, but it does not tend to become magnetized itself; it has too low a magnetic coercivity to stay magnetized for long.

The other question is how lodestones get magnetized. The Earth's magnetic field at 0.5 gauss is too weak to magnetize a lodestone by itself. The leading theory is that lodestones are magnetized by the strong magnetic fields surrounding lightning bolts.

Historical uses

Lodestones have two uses in navigation. First, they may be used as compasses in and of themselves. If they are hung from a rope, they will naturally turn until the north pole of the magnetite points towards Earth's north pole. Second, and more common, they can be used to magnetize iron or steel needles. By rubbing a piece of ferrous metal with a lodestone one can magnetize the smaller metal, which is useful for replacing compass needles when they rust or lose their magnetism.

Use of Magnetite as an Ore of Iron

Most of the iron ore mined today is a banded sedimentary rock known as taconite that contains a mixture of magnetite, **hematite**, and **chert**. Once considered a waste material, taconite became an important ore after higher grade deposits were depleted. Today's commercial taconites contain 25 to 30% iron by weight.

At the mine site, the taconite ore is ground to a fine powder, and strong magnets are used to separate magnetically susceptible particles containing magnetite and hematite from the chert. The concentrate is then mixed with small amounts of **limestone** and clay, then

rolled into small round pellets. These pellets are easy to handle and transport by ship, rail, or truck. They can be directly loaded into a blast furnace at a mill and be used to produce iron or steel.

Use of Magnetite as a Heavy Media

Powdered magnetite is often mixed with a liquid to produce a thick, high-density slurry that is used for specific gravity separations. Much of the high-sulfur **coal** that is mined in the eastern United States is floated across a slurry of magnetite. Clean coal particles have a low specific gravity and float on the slurry. Particles contaminated with **pyrite** (a sulfide mineral with a high specific gravity) sink into the high-density slurry.

3.1.3. CHEMICAL ASPECT

MAGNETIC OXIDE OF IRON

Magnetite is black or brownish black with a metallic luster, has a Mohs hardness of 5-6 and a black streak.

Synonym : Lodestone, magnetic iron ore.

Habitat : In India-Bihar, mysore, orissa, himachal Pradesh, Chennai.

- Wealth of India (P.No: 256)

Category :Oxide mineral spinel group **Chemical formula** :Iron (II, III) Oxide, Fe_3O_4

Composition :Iron – 72.36% Fe

31.03% FeO

68.07% Fe_2O_3

Oxygen – 27.64%

Molecular weight: 231.54 gm

Empirical Formula: $Fe_2^{3+} Fe^{3+} O_4$

Environment :Common accessory mineral in igneous and metamorphic rocks.

Locality :South Africa, Germany, Russia and many localities

Name of origin :Named as magnes, a Greek shepherd, who discovered the mineral on mountain Ida.

Properties of magnet:

Naturally magnetized pieces of magnetite called lodestone, will attract small pieces of iron and this was how ancient people first noticed the property of magnetism. Lodestones were used as an early form of magnetic compass. The relationship between magnetite and other iron-rich relationship such as ilmenite, hematite and other ulvospinel have been much studied, as the complicated reactions between minerals and oxygen influence how and when magnetite preserves records of the Earth's magnetic field. Magnetite reacts with oxygen to produce hematite and the mineral pair forms a buffer that can control oxygen fugacity.

Specimens:

Magnetite is a natural magnet. Electricity produces magnetic fields just as magnetism produces electric fields. Magnetite is a member of the spinel group which has the standard formula A(B)204. The A and B represent usually different metal ions that occupy specific sites in the Crystal structure. In the case of magnetite Fe_3O_4 the A metal is Fe +2 and the B metal is Fe +3, two different metal ions in two specific sites. This arrangement causes a transfer of electrum between the different irons in a structural path or vector. This electric vector generates the magnetic field.

Physical Properties:

- **Colour** : Black, grey with brownish tint in reflected light.
- **Crystal habit** : Octahedral, fine granular to massive
- **Crystal system** : Isometric hexoctahedral
- **Twinning** : On (III) as both twin and composition plane, thespinel law as contact twins.
- **Crystal symmetry**: Isometric 4/m $3\,\bar{2}$/m
- **Cleavage** : Indistinct, parting on (III), very good.
- **Fracture** : Uneven
- **Tenacity** : Brittle

Mohs Scale:

- **Hardness** : 5-6
- **Luster** : metallic
- **Streak** : Black
- **Diaphaneity** : Opaque
- **Specific gravity**: 5.17-5.18

- **Solubility** : Dissolves slowly in Hydrochloric acid
- **Transparency**: Crystals are opaque
- **Major varieties**: Lodestone – magnetic with definite north & south poles.

Best field indicator is magnetism, Crystal habit and streak.

Distribution of Deposits:

Magnetite is sometimes found in large quantities in beach sand. Such black sands (mineral sands or iron sands) are found in various places, such as california and the west coast of New Zealand. The magnetite is carried to the beach via rivers from erosion and is concentrated via wave action and currents. High deposits have been found in bounded iron formations. These sedimentary rocks have been used to infer changes in the oxygen content of the atmosphere of the earth.

Biological occurences:

Crystals of magnetite have been found in some bacteria (e.g magnetospirillium, magnetotacticum) and in the brains of bees, termites, fish, some birds (e.g the pigeon) and humans. These crystals are thought to be involved in magnetoreception, the ability to sense the polarity or the inclination of the earth's magnetic field and to be involved in navigation. Also chitons have teeth made of magnetite on their radula, making them unique among animals. This means they have an exceptionally abrasive tongue with which to scrape food from rocks.

Preparation as a ferrofluid:

Magnetite can be prepared in the laboratory as a ferrofluid in the massart method by mixing iron (II) chloride and iron (III) chloride in the presence of sodium hydroxide.

Transformation of Ferrous hydroxide into magnetite:

Under anaerobic conditions, the Ferrous hydroxide [$Fe(OH)_2$] can be oxidized by the protons of water to form magnetite and molecular hydrogen. This process is described by the schikorr reaction:

$$3Fe(OH)_2 \longrightarrow Fe_3O_4 + H_2 + 2H_2O$$

Ferrous hydroxide — magnetite + Hydrogen + water

The well crystallized magnetite (Fe_3O_4) is thermodynamically more stable than the Ferrous hydroxide [Fe (OH) $_2$].

Application as a sorbent:

Magnetite powder efficiently removes arsenic (III) and arsenic (IV) from water, the efficiency of which increases 200 times when the magnetite particle size decreases from 300 to 12nm. Arsenic contaminated drinking water is a major problem around the world which can be solved using magnetite as a sorbent.

Inorganic chemistry:

Magnetic materials are classified as,

1) Diamagnetism
2) Paramagnetism according to their properties in a magnetic field

Diamagnetism is based on orbital of the electrons and is induced by the magnetic field.

Paramagnetic substances are characterised by one or more unpaired electrons, magnetization is aligned parallel to the external field.

In solid bodies, strong interaction may develop between adjacent mons. So that spontaneous magnetization results. Pure magnetic iron oxide particles used as diagnostic agent in nuclear MRI.

3.1.4.OTHER ASPECT OF MAGNET[17]

"Magnetism is the king of all secrets" **– Paracelus**

Physical disability such as spinal cord injury, multiple sclerosis and post polio syndrome, often aggrevates many ailments that are amenable to magnetic therapy, an increasingly popular alternative medicine modality.

Therapeutic uses:

Therapeutic magnets are often cased inceramic or embedded in an elastic patch or flexible strip. They are incorporated in wrist and back supports, seat and mattress pads, jewels, clothing-related items, shoe inserts and belts.

Many medical applications and scientific studies have used pulsed electromagnetic fields. In these fields, the electric current generating the magnetic field is turned on and off at a specified frequency. Because magnetic fields drop off quickly with distance, the closer the magnet is to the skin the better. Although effectiveness may wear off as the body adopts, magnets may be worn as long as desired.

In **Homoepathy**,

'Magnetis Poliambo' is the medicine prepared from magnet and is given for anxious, coldness of eyes as if a peice of ice-lay in orbit, constipation, disturbed sleep. Cracking in cervical vertebrae, tooth ache, dryness of eyelids, in growing toenails, shooting pain in soles, dislocation of joints of foot, abdominal flatulence, somnambulism, increased flow of saliva.

- Pocket manual of Homoepathic materia medica and Repertory (P.No.41)

Action of magnet on the body:

Scientists believe that magnetic fields perturb the body's own magnetic energy, which in turn triggers more conventional biochemical and physiological mechanism Magnetic field causes,

- Increased blood flow, bringing more O_2, nutrients and flushing away waste products.
- Alter the acidity or alkalinity of body fluids, which are often out of balance with illness.
- Alter the enzyme activity and other bio hemical processes, such as the production of ATP.
- Affect hormone production (including those of the brain)
- Magnetic fields can attract calcium ions to heal a broken bone or help to move calcium away from painful arthritic joints.
- Stimulate electromagnetic energy flow through acupuncture meridians.
- Alters cell chromosome alignment
- Penetrates A-549 cells mainly then a macropinocytosis process.

Indications:

General uses include relief of Pain and discomfort, reduction of inflammation, improved circulation, ability to fight infection, reduction of stress, sleep promotion, correction of various central nervous disorders, enhancement of overall energy of the body, acceleration of healing (especially bone fracture) and athletic performance enhancement.

3.2. பொன்னாவாரை - *CASSIA OCCIDENTALIS OR SENNA OCCIDENTALIS*

IN SIDDHA LITERATURE:

சுவை - கைப்பு, துவர்ப்பு

தன்மை - வெப்பம்

பிரிவு - கார்ப்பு

செய்கை:

- நச்சரி (Antidote)
- நீர்மலம்போக்கி (Purgative)
- சிறுநீர்ப்பெருக்கி (Diuretic)

அளவு:

இலையின்அளவு 6 கிராம் எடை

வேரின்அளவு 2 - 4 கிராம் எடை

பயன்கள்:

- இதன் இலையைச் சமைத்துத் தின்பார்கள். இதனால் கழிச்சலுண்டாகும்.
- விரையை வறுத்துப் பொடித்துக் காப்பிக் கொட்டைக்குப் பதிலாக சிலர் வழங்குகின்றனர்.
- இதன் இலைவேர்கழிச்சலை ,விதை , உண்டாக்கும் தன்மை உடையதால்அளவறிந்து , வழங்கல் வேண்டும்இதை . அரைத்து சொறி , சிரங்குகளுக்கும் போடலாம்.
- இதன் வேர்க்குடி நீர் நஞ்சை முறிக்கும்நீரைக்,மேலும் . கழிக்குந்தன்மை இதற்கிருப்பதால்இது , பாண்டு நோய்க்கும் கொடுக்கப்படுகிறது[11].

TAXONOMICAL CLASSIFICATION[21]

Kingdom : Plantae *(Plants)*

Subkingdom: Tracheobionta (*Vascular plants)*

Superdivision: Spermatophyta (*Seed plants)*

Division : Magnoliophyta (*Flowering plants)*

Class : Magnoliopsida (*Dicotyledons)*

Order : Fabales

Family : Fabaceae

Genus : Cassia

Species : *Cassia occidentalis*

VERNACULAR NAMES

Sanskrit : Kasamarda, Vimarda, Arimarda

English : Negro coffee , Coffee Senna, coffee weed

Hindi : Kasunda, Bari kasondi

Urdu : Kasonji

Telugu : Thangedu

Bengali : Kalkashunda

Marathi : ran-takda, kasivda, kasoda, rankasvinda

Oriya : Kasundri

Gujarathi : Kasundri

Tamil : Nattam takarai, Payaverai

Malayalam : Mattantakara

Kannada : Kolthogache

Parts used

Leaves**,** Root**,** Seed

Flowering

March, June

Geographical distribution:

Occurs in the tropics including India, Sri Lanka, Maldives, and Philippines Islands.

Morphology:

Cassia occidentalis, is a much branched, smooth, half woody herb or shrub about 0.8 to 1.8 m tall.

1. **Stem** is erect, and without hairs.
2. **Leaves** are lanceolate or ovate-lanceolate, bipinnately compound, and about 20 to 25 cm in length. Each pinna has four to seven pairs of leaflets, which are 3 to 9 cm in length, and 2 to 4 cm in width, and arranged oppositely. **Leaflets** are ovate or ovate lanceolate in shape with a long, fine pointed tip. Each leaf has a distinct spherical shaped gland, which is located about 0.3 to 0.5 cm from the base of the petiole.
3. **Inflorescence** is a terminal or axillary raceme. Flowers are yellow colored, and about 2 cm long, and 3 to 4 cm wide.
4. **Fruit** is a pod / legume, compressed, 8 to 12 cm long, 0.7 to 1 cm wide, and curved slightly upwards. Each pod contains 20 to 30 **seeds**, which are ovoid in shape, smooth, shiny, and dull brown to dark olive-green in colour.

Dosage:

Leaves are used in a dose of 5-10 grams, and the seeds in 1-3 grams.

Fresh leaf juice can be taken in a dose of 10-20 ml.

The root bark decoction is taken in a dose of 50-100 ml.

Therapeutic action:

The seed is bitter and has purgative properties. It is also used as a diuretic, liver detoxifier, as a hepato-tonic (balances and strengthens the liver), antidote,-root is an antidote for snakebite (Husain et al, 1992), Diuretic, purgative, antiperiodic.

Systemic Use:

- Whooping cough, convulsion, throat inflammation, colds, asthma, fever, flu and againsts poisonous snake bites. Seeds and leaves are applied externally in skin diseases.
- The **whole plant** is diuretic, febrifuge, stomachic and tonic. It is used in the treatment of hypertension, dropsy, diabetes, fevers, biliousness, rheumatism, ringworm and eczema The plant is boiled and gargled for treating throat troubles
- Applied externally, it is pounded and mixed with wood-ash and rubbed on areas of leishmaniasis and eczema
- The **root** is cholagogue, emetic and purgative. An infusion is used in the treatment of bilious fever, ordinary fever, stomach-ache, and to ease menstruation A tincture of the root is rubbed onto rheumatic area.
- A tea made from roots and dried flowers is used as a treatment for colds and upset stomach.
- The **leaf** is used as a remedy for renal calculi. Leaves are made into a tea for treating after birth problems, fevers, coughs and colds, headaches, hemorrhage and thrush.
- An ointment prepared from the leaves is applied as a remedy for ringworm and other affections of the skin.
- The **flowers** are used in a preparation to reduce stomach acid in children.
- The **seed** is febrifuge and sedative. An infusion is drunk to calm ones nerves, and as a treatment for kidney problems, haemorrhage, worms, and cleaning womb and tubes.

Phytochemistry[20]:

The chief constituents in this herb are achrosine, aloe-emodin, anthraquinones, anthrones, apigenin, aurantiobtusin, campesterol, cassiollin, chryso-obtusin, chrysophanic acid, chrysarobin, chrysophanol, chrysoeriol, emodin, essential oils, funiculosin, galactopyranosyl, helminthosporin, islandicin, kaempferol, lignoceric acid, linoleic acid, linolenic acid, mannitol, mannopyranosyl, matteucinol, obtusifolin, obtusin, oleic acid, physcion, quercetin, rhamnosides, rhein, rubrofusarin, sitosterols, tannins, and xanthorin.

The **leaf** contains flavonoid glycosides, an anthraquinone, and a bianthraquinone

The **seed** contains N-methyl morpholine, campesterol and beta-sitosterol glucosides

Precautions:

It is better to avoid this herb in pregnancy as it is a hot in potency, and has purgative effect.

RECENT RESEARCH

1. Studies on the contemporary science of Kantham based traditional Herbo-metalic formulation from Siddha repertoire[25].

Kantham formulations Kantha parpam, Kantha chendurum along with the negative control were prepared. Using contemporary analytical techniques the formulationwas characterized with all the intermidiates and it was found that the final formulation is iron-oxide in nano dimension with silicate coating and completely devoid of any organic substances. The role of herb was found to differently influence the final product.

Acetylphenylhydrazine induced anemia model in rats was selected to demonstrate the safety of the Kantham formulations, acute and sub- acute toxicity studies of Kantha parpam and Kantha chendurum were also performed in rats by administering the drug orally and both the preparations were found be safe.

2.Acute toxicological and Biodistribution aspects of Superparamagnetic Magnetite Nanoparticles in Vitro and on Animal tissues[22].

Superparamagnetic iron oxide nanoparticles (SPIONS) have been considered potential candidates for various therapeutic pplications. This study characterized magnetite based SPIONS coated with stabilizing polymer PVA by XRD, TIM, FTIR and Magnetometry. Posteriorly ,the SPIONS were injected intraperitonealy into Balb-C mic to perform magnetic detection, histopathology, MTT assay with $HepG_2$ cells.

In vivo assays, no mortality, weight and behaviour alterations were observed, and the cytotoxicity assay did not show a reduction in the viability of $HepG_2$ cells. The data suggest that these nanoparticles are promising.

3.Evaluation of *Cassia Occidentalis* for in Vitro cytotoxicity against human Cancer cell lines and antibacterial activity[23].

The study evaluate the in Vitro cytotoxicity and anti-bacterial properties of *Cassia occidentalis* (whole plant) via alcoholic, hydro-alcoholic and aqueous extracts against eight human cancer cell lines from six different tissues and from bacterial strains.

Aqueous extracts from leaves of *Cassia occidentalis* to contain flavonoids and anti-oxidant polyphenolic compounds. These compounds are known to scavenge the formation of free radicals, here great potential in ameloilating disease processes like cancer and diabetes. Hydro alcoholic extract of *Cassia occidentalis* showed potent anti-bacterial activity against Bacillus subtillis strain indicating the precence of chemical constituent responsible for anti-bacterial activity.

3.3. SUDDHI[4]

Siddha system of medicine emphasis, before going to medicine preparation every raw drug must be purified. The concept of Suddhi (purification) in Siddha is not only a process of purification / detoxification, but also a process to enhance the potency and efficacy of the drug .

Purification of raw drug is a process aimed at both purification as well as concentration of the raw drug. It usually involves processes like cleaning, frying, soaking, and grinding until impurities are removed.

FORENSIC TOXICOLOGY:

Forensic Toxicology deals with the source, physical and chemical properties, absorption, fate, pharmacological and toxic actions, signs and symptoms in human beings, fatal dose, and fatal period of different poisons, laboratory investigations, diagnosis, treatment, and circumstances and other medico legal aspects of different poisoning cases.

Drugs are natural or synthetic substances which are used to exert physiological or psychological effects in the consumer.

SIDDHA TOXICOLGY:

The Siddha literature insists that for any medicine preparation, the evil effects of the following are to be noted and weeded out primarily. It starts from purification.

Assessing the worthiness of the substance:

The substance should be ascertained whether it is a real one and whether it has been prepared afresh to be beneficial for the intended time and season.

Assessing the purity of the substance:

i) Whether it has been properly purified strictly following the prodedures

ii) Whether the substance purified with numerous substances, has been qualified or disqualified for consumption, after going through all the purificatory process?

iii) Though it is purified Whether it is within the required formula and dosage is suitable for consumption? (Even the nectar is poisonous ifit exceeds the limit

iv) Whether the antagonist of substance is avoided and the regimen has not been followed?

v) Even if it is a poisonous substance whether its beneficial aspect has been lost at the required consistency?

It is our primary responsibility to protect health by curing the disorders caused by the toxins of the substances as well as to prevent the occurrence of toxicity.

VARIOUS SUDDHI OR PURIFICATION PROCESS:

1. Removing the outer skin (epicarp)
2. Removing the inner nuts.
3. Removing the cotyledons.
4. Boiling with milk, cows urine, etc.
5. Frying ordinarily, with cows ghee, etc.
6. Soaking in Mothers milk, cows urine, herbal juices, etc.
7. Pacing the raw drug inside another material and treating.
8. Grinding with various juices.
9. By Thula endiram

a) immersed

b) Without immersed

10. By Pudam process
11. Simply washing or removing dust.

OBJECTIVES OF SUDDHI:

- To remove impurities, toxins present
- To enhance the brittleness
- To improve the potency and efficacy of the drug
- To enhance the synergistic effect through purification methods
- Transformation of the non edible non-homogenous material to edible and beneficial homogenous material
- Alleviation of desired therapeutic qualities
- To prove the unique and favourable changes from physico-chemical changes for further application or benefits of drug.

4.MATERIALS AND METHODS

4.1. TEST DRUG COLLECTION

Gaantham(Magnetic oxide of iron) was procured from a well reputed indigenous drug shop at Thenkanikottai, Krishnagiri district.

Ponnavarai(*Cassia occidentalis*) root was collected near the campus of National institute of Siddha at Tamparam sanatorium, Chennai-47.

4.2. IDENTIFICATION AND AUTHENTICATION

The mineral drug **Gaantham** was identified and authenticated by competent authority of Gunapadam Department, National institute of Siddha, Chennai-47 & Department of Chemistry in Siddha Central Research Institute (SCRI) Arumbakkam, Chennai.

The plant **Ponnavari** was idenified and authenticated by Botanist, Department of Medicinal Botany, National institute of Siddha, Chennai-47.

4.3. PURIFICATION PROCEDURE[7]

Required materials:

- Raw drug Gaantham (Magnatic oxide of Iron)
- Extract of Ponavarai root (*Cassia occidentalis*)

GAANTHAM

PONNAVARI

Purification process of Gaantham:

Take 35grams of powdered Gaantham in a pot, add 210 grams of Ponnavarai root juice on the pot. Then keep the pot in the sunlight for a day. Doing this procedure for 10 days, then keep it dry for next 2 days without letting the juice. Repeat the whole procedure for 2 times and wash Gaantham thoroughly to get purified form of Gaantham. - Theran yemaka venpa (P.No:105)

VARIOUS STAGES OF PURIFICATION

PROCESS OF GAANTHAM

(MAGNETIC OXIDE OF IRON)

Root of Ponnavarai

Root extract of Ponnavari

Unpurified Gaantham

Day1-Unpurified Gaantham poured into the extract

Day11-Without Extract

Day 36-Purified Gaantham

4.4.METHOD OF STANDARDIZATION:

The purification procedures as per text after that Subjected to standardization procedures as per PLIM guidelines[26]. Both Un purified (S_1) and Purified (S_2) Gaantham was subjected to the following Quantitative and Qualitative analysis.

S_1 denotes the Unpurified Gaantham.

S_2 denotes the Purified Gaantham.

4.4.1.QUALITATIVE ANALYSIS

The physico-chemical analysis was done at Centre for Advanced Research in Indian System of Medicine (CARISM), SASTRA University, and Thanjavur.

The physico-chemical parameters were analyzed to evaluate the quality of the drug. Physico-chemical parameters are done for both unpurified and purified drug.

4.4.1 (a) ORGANOLEPTIC CHARACTERS

Color, odor and nature of the sample to be observed.

Procedure:

5 gm of unpurified Gaantham(S_1) and purified Gaantham(S_2) samples were taken in a clean glass and test for its color by viewing virtually. The samples were placed separately in 100 ml of beaker and tested for its odour by wafting the air above the beaker. The state of the samples were identified in naked eye.

4.4.1(b) PHYSICO-CHEMICAL ANALYSIS

Physico-chemical analysis of the test drug is necessary for standardization, as it helps in understanding the significance of physical and chemical properties of the substance being analysed in terms of their observed activities and especially for the determination of their purity and quality. It includes the following analysis.

1. Loss on drying at 105ºC:

A glass stoppered Petridish was weighed and has been dried under the same conditions to be employed in the determination. The specific quantity of sample was transferred to the dish, covered and accurately weighed. Then the sample is evenly distributed in the petridish. Then the stopper is removed and the loaded dish is placed in the drying chamber as directed in the monograph. The sample is dried to constant weight or till two consecutive weights remain within ± 0.5mg.After drying is completed, the sample is cooled in desiccators. The dish and the contents are weighed.

$$\text{Loss on drying (\%w/w)} = \frac{\text{Loss in weight (g)} \times 100}{\text{Mass of the sample (g)}}$$

2.Determination of pH:

The pH meter was operated according to the manufacturer instructions. The apparatus was calibrated using buffer solutions, adjusting the meter to read the appropriate pH value corresponding to the temperature of the solution. The electrode is immersed in the solution being examined and the pH is measured at the same temperature as for the standard solutions. At the end of a set of measurements, the pH of the solution used to standardize the meter and electrodes was recorded. If the difference between the reading and the original value is greater than 0.05, the set of measurements must be repeated. All solutions and suspensions of substance being examined must be prepared using carbon dioxide - free water.

3. Total Ash:

About 2 to 3g accurately weighed taken from the ground drug is incinerated in a tared platinum or silica dish at a temperature not exceeding 650 ºC, until free from carbon, cooled and weighed. If a carbon free ash cannot be obtained in this way, the charred mass is exhausted with hot water, the residue is collected on an ash less filter paper, the residue and filter paper is incinerated, the filtrate is added, evaporated to dryness, and ignited at a temperature not exceeding 650ºC.The percentage of ash with reference to air-dried drug is calculated.

$$\text{Percentage of total ash (\%w/w)} = \frac{\text{Mass of ash (g)} \times 100}{\text{Mass of sample (g)}}$$

4. Acid Insoluble Ash:

The ash obtained is boiled for 5 minutes with 25ml of dilute hydrochloric acid. The insoluble matter is collected in a Gooch crucible, or on an ash less filter paper, washed with hot water and ignited to constant weight. The percentage of acid-insoluble ash with reference to the air dried drug is collected.

$$\text{Precentage of Acid soluble ash} = \frac{\text{Mass of Acid insoluble residue x 100}}{\text{Mass of sample (g)}}$$

5. Water soluble extractive:

5g of the coarsely powdered drug is macerated with 100ml of chloroform water in a closed flask for 24 hours. It is frequently shaked for first six hours and allowed to stand for eighteen hours. Then it is filtered rapidly, 25ml of filtrate is evaporated to dryness in a tarred flat bottomed shallow dish over a water bath. Dried at 105ºC, in an oven to constant weight and the dish is weighed. The percentage of water soluble extractive with reference to the air-dried drug is calculated.

$$\text{Precentage of water soluble} = \frac{\text{Mass of the residue (g) x 100 x100}}{\text{Mass of the Sample x 25}}$$

6. Alcohol soluble extractive:

5g of the coarsely powdered drug is macerated with 100ml of ethanol, of specified strength (as specified in the monograph) in a closed flask for 24 hours. It is frequently shaked for first six hours and allowed to stand for eighteen hours. Then it is filtered rapidly, taking precautions against loss of ethanol25ml of filtrate is evaporated to dryness in a tarred flat bottomed shallow dish over a water bath dried at 105 ºC, in an oven to constant weight and the dish is weighed. The percentage of alcohol soluble extractive of the drug is calculated.

$$\text{Precentage of alcohol soluble} = \frac{\text{Mass of the residue (g) x 100 x100}}{\text{Mass of the Sample x 25}}$$

4.4.1(c).CHEMICAL ANALYSIS[29]:

The Chemical analysis was done at Biochemistry Lab, National Institute of Siddha, Chennai-47..

Procedure for Chemical analysis of unpurified and purified raw drug Gaantham.

Table 1:Experimental procedures of Chemical analysis

S.No	EXPERIMENT	OBSERVATION	INFERENCE
1.	Appearance of sample	Dark Orange in colour	
2.	**Test for Silicate:** A little (500mg) of the sample is shaken well with distilled water. A little(500mg) of the sample is shaken well with con. HCl/Con. H_2So_4	No Sparingly soluble	Absence of Silicate
3.	**Action of Heat:** A small amount (500mg) of the sample is taken in a dry test tube and heated gently at first and then strong.	White fumes evolved	Presence of Carbonate
4.	**Flame Test:** A small amount (500mg) of the sample is made into a paste with con. HCl in a watch glass and introduced into non-luminous part of the Bunsen flame.	Bluish green flame appeared.	Presence of Copper
5.	**Ash Test:** A filter paper is soaked into a mixture of sample and dil. cobalt nitrate solution and introduced into the Bunsen flame and ignited.	No Yellow color flame appeared	Absence of Sodium

Preparation of extract:

5gm of Gaantham powder is weighed accurately and placed in a 250ml clean beaker and 50ml of distilled water was added with it. Then it was boiled well for about 10 minutes. Then it was allowed to cool and filtered in a 100ml volumetric flask and made up to 100ml with distilled water.

S.No	EXPERIMENT	OBSERVATION	INFERENCE
Test For Acid Radicals			
1	**Test For Sulphate:** 2ml of the above prepared extract is taken in a test tube to this added 2ml of 4% dil ammonium oxalate solution.	No Cloudy appearance present	Absence of Sulphate
2	**Test For Chloride:** 2ml of the above prepared extract is added with 2ml of dil.HCl is added until the effervescence ceases off.	NO Cloudy appearance present	Absence of Chloride
3	**Test For Phosphate:** 2ml of the extract is treated with 2ml of dil.ammonium molybdate solution and 2ml of con.HNO_3.	No Yellow precipitate present	absence of Phosphate
4	**Test For Carbonate:** 2ml of the extract is treated with 2ml dil. magnesium sulphate solution.	Presence of cloudy appearance	Presence Of Carbonate
5	**Test For Nitrate:** 1gm of the substance is heated with copper turning and concentrated H_2SO_4 and viewed the test tube vertically down.	No Brown gas is evolved	absence of Nitrate

6	**Test For Sulphide:** 1gm of the substance is treated with 2ml of con. HCL.	NoRotten Egg Smelling gas is evolved	Absence of Sulphide
7	**Test For Fluoride & Oxalate:** 2ml of extract is added with 2ml of dil. Acetic acid and 2ml dil.calcium chloride solution and heated**.**	No Cloudy appearance	Absence Of fluoride and oxalate
8	**Test For Nitrite:** 3 drops of the extract is placed on a filter paper, on that-2 drops of dil.acetic acid and 2 drops of dil.Benzidine solution is placed.	No Characteristic changes present	Absence Of Nitrite
9	**Test For Borate:** 2 Pinches (50mg) of the substance is made into paste by using dil.sulphuric acid and alcohol (95%) and introduced into the blue flame.	No Bluish green color flame appeared	Absence Of Borate
Test for Basic Radicals			
1	**Test For Lead:** 2ml of the extract is added with 2ml of dil.potassium iodine solution.	NO Yellow Precipitate is obtained.	Absence of Lead
2	**Test For Copper:** One pinch (50mg) of substance is made into paste with con. HCl in a watch glass and introduced into the non-luminuous part of the flame.	Blue color precipitate is formed.	Presence Of Copper

3	**Test For Aluminum:** To the 2ml of extract dil.sodium hydroxide is added in 5 drops to excess.	No Yellow color appearance	Absence of Aluminum
4	**Test For Iron:** a. To the 2ml of extract add 2ml of dil.ammonium solution. b. To the 2ml of extract, 2ml thiocyanate solution and 2ml of con HNo3 is added.	Brown precipitate is formed Red color appearance	Iron present
5	**Test For Zinc:** To 2ml of the extract dil.sodium hydroxide solution is added in 5 drops to excess and dil.ammonium chloride is added.	Nonwhite precipitate is formed	absence of Zinc
6	**Test For Calcium:** 2ml of the extract is added with 2ml of 4% dil.ammonium oxalate solution.	Cloudy appearance or white precipitate formation is present	Presence Of Calcium
7	**Test For Magnesium:** To 2ml of extract dil.sodium hydroxide solution is added in drops to excess.	White precipitate is obtained	Presence of Magnesium
8	**Test For Ammonium:** To 2ml of extract 1ml of Kessler's reagent and excess of dil.sodium hydroxide solution are added.	No Brown color is appeared	Absence Of Ammonium

9	**Test For Potassium:** A pinch (25mg) of substance is treated with 2ml of dil.sodium nitrite solution and then treated with 2ml of dil.cobalt nitrate in 30% dil.glacial acetic acid.	No Yellowish precipitate is obtained.	Absence of Potassium
10	**Test For Sodium**: 2 pinches (50mg) of the substance is made into paste by using HCl and introduced into the blue flame of Bunsen burner.	No Yellow color flame appeared	Absence of Sodium
11	**Test For Mercury**: 2ml of the extract is treated with 2ml of dil.sodium hydroxide solution.	Yellow precipitate is obtained	Presence of Mercury
12.	**Test For Arsenic:** 2ml of the extract is treated with 2ml of dil.sodium hydroxide solution.	Brownish red precipitate is obtained	Presence of Arsenic
Other constituents			
1	**Test For Starch :** 2ml of extract is treated with weak dil.iodine solution	No Blue color formation	absence of starch

2	**Test For Reducing Sugar:** 5ml of Benedict's qualitative solution is taken in a test tube and allowed to boil for 2 minutes and added 8 to 10 drops of the extract and again boil it for 2 minutes. The color changes are noted.	Brick red color developed	Presence of reducing sugar
3	**Test For The Alkaloids**: a. 2ml of the extract is treated with 2ml of dil.potassium iodide solution. b. 2ml of the extract is treated with 2ml of dil.picric acid.	Reddish brown precipitation appears Yellow precipitation appears	Presence Of Alkaloid
4	**Test For Tannic Acid:** 2ml of extract is treated with 2ml of dil.ferric chloride solution.	No Black precipitate is obtained	Absence of Tannic acid
5	**Test For Unsaturated compound** To the 2ml of extract 2ml of dil. Potassium permanganate solution is added.	No Potassium permanganate is decolourised	Absence of unsaturated compound
6	**Test For Amino Acid:** 2 drops of the extract is placed on a filter paper and dried well. 20ml of Biurette reagent is added**.**	No Violet color is developed	Absence of amino acids
7	**Test For Type of Compound:** 2ml of the extract is treated with 2 ml of dil.ferric chloride solution.	No Specific color formation	Phenols absent

4.4.2. QUANTITATIVE ANALYSIS[32]:

The following quantitative analyses were done at SAIF, IITM, Chennai.

4.4.2. a) INDUCTIVELY COUPLED PLASMA OPTICAL EMISSION SPECTROMETRY(ICP-OES):

Perkin Elmer Optima 5300 DV was used for standard ICP-OES analysis. The Emission spectrometry is based on the principle that atoms or ions in an excited state tend to revert back to the ground state and in so doing emit characteristic wavelength and intensity of that light is proportional to the concentration of that particular element in the sample solution. ICP-OES is widely employed for the estimation of metals and metalloids at trace, minor and major concentrations. The elemental composition of a sample is often an important part of the information needed to assess its properties.

Principle:

In this technique, the high temperature plasma source atomizes the sample and excites the atoms resulting in emission of photons. The atoms of each element in the sample emit specific wavelength of light. The emission spectrum from the plasma is dispersed by an optical spectrometer, so that intensities of the individual wavelength can be measured. The number of photons emitted is directly proportional to the concentration of the element. The photon may be detected either sequentially or simultaneously. Quantitative analysis is achieved by measuring the intensity of these specific wavelengths and after performing the calibrations using known standards

ICP-OES operating conditions:

Rf frequency : 40 M Hz

Range : 165-782 nm

Detection limit : Upto ppm level using SCD detector

Sample required:

Sample required is about 10-20 mg for solids and approximately 25 ml for liquids samples should be non-explosive and non-corrosive.

Sample preparation:

- Weigh 0.25 g of test sample and transfer into a linear provided with the instrument
- Slowly add 9 ml of Nitric acid or Sulphuric acid such that no piece of sample sticks on the slide
- Mix thoroughly and reacting for few minutes
- Place the liner in the inner jacket
- Close the screw cap hand-tight in clockwise direction
- Seal the vessel and place the rotor fixed in microwave
- Set the temperature to 180ºC for 5 minutes, hold at 180ºC for atleast 10 minutes.
- Allow the vessels to cool down to a vessel interior temperature below 60ºC and to a vessel surface temperature (IR) below 50ºC before removing the rotor
- The digested sample was made upto 100 ml with Millipore water
- If visible insoluble particles exists, solution could be filtered through whatmann filter paper
- Transfer the digested solution into plastic containers and label them properly.

4.4.2. b) FOURIER TRANSFORM INFRARED SPECTROSCOPY (FTIR)

Fourier transform infrared spectroscopy(FTIR) is a technique which is used to obtain an infrared spectrum of absorption or emission of a solid, liquid, or gas. An FTIR spectrometer simultaneously collect high spectral resolution data over a wide spectral range. This confers a significant advantage over a dispersive spectrometer which measures intensity over a narrow range of wavelength at a time.

The term Fourier transform infrared spectroscopy orginates from the fact that a Fourier transform (a mathematical process) is required to convert the raw data into the actual spectrum.

Sample preparation:

The standard to prepare solid sample for FTIR spectrometer is to use KBr.

- About 2 mg of sample and 200 mg KBr are dried and ground.
- The particle size should be unified and less than two micrometres.
- Then, the mixture is squeezed to form transparent disc which can be measured directly.
- For liquids with high boiling point or viscous solutions, it can be added in between two NACL pellets. Then the sample is fixed in the cell by skews and measured.
- For volatile liquid sample, it is dissolved in CS2 OR CCL4 TO FORM 10% solution.
- Then the solution is injected into a liquid cell for measurement.

4.4.2. c) X-RAY POWDER DIFFRACTION (XRD)

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

Crystalline substances act as three-dimensional gratings for X-ray 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 by tube, filtered to produce momochromatic radiation, collimated to concentrate, and directed toward the sample. The interaction of the incident rays with the sample produces constructive interference (and a diffracted ray) when conditions satisfy Bragg'S law (ny =2d sin 0). 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 20 angles, all possible diffraction peaks to d-spacing allows identification of the mineral because each mineral has a 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.

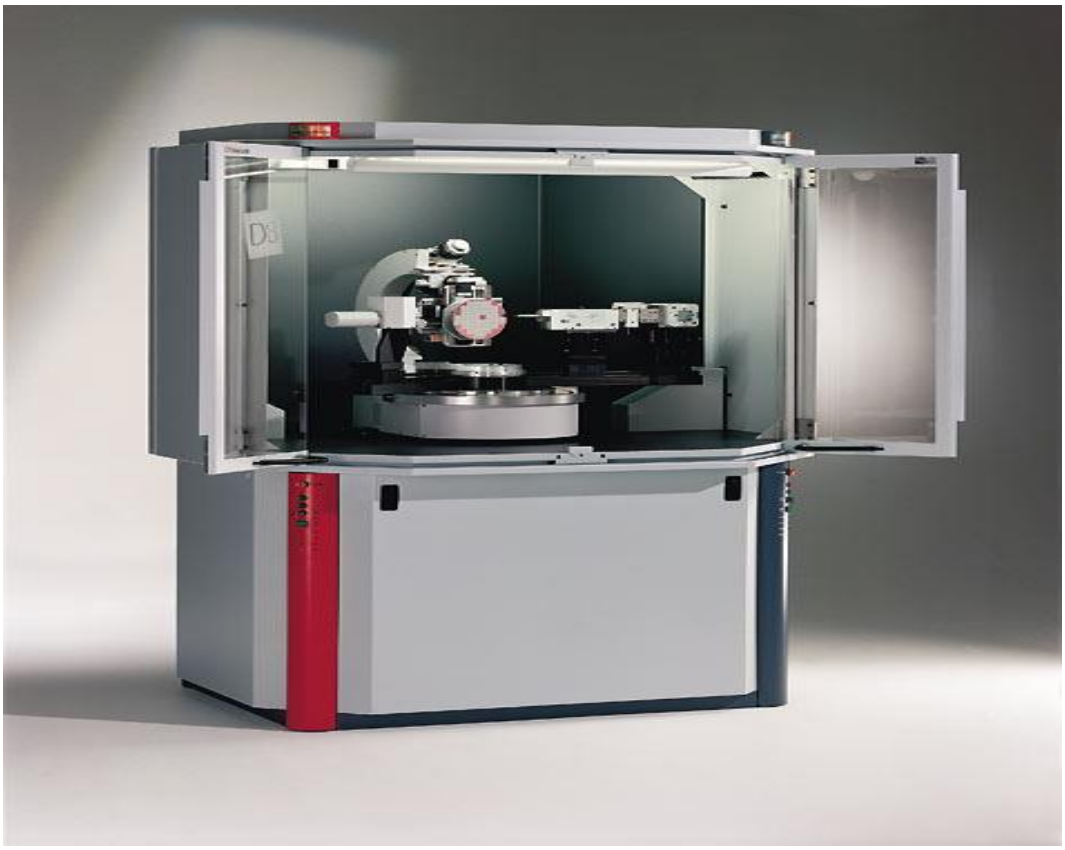
Sample required:

25gm to be submitted.

Sample preparation:

- Approximately 1gm is kept as a reference, 5gm is taken for sample preparation and the remainder is used for preparation of decalcified, fractioned 2-20µ and less than 2µ samples.
- Sample is disaggregated in waring blenders with 250ml hot distilled water until no lumps of sediment are visible.

- The sample is centrifuged and the wash-water is decanted.
- Then the sample is allowed to dry and disaggregated manually with a mortar and pestle.
- Coarse grained sample is reduced to silt size.
- Then it is placed in mortar and pestle grinders and heat generated grinding done under butanol for 2 hours.
- After grinding, butanol is evaporated under heat lamps.
- The ground sample is treated with trihexylamine acetate.
- Then the sample is pressed into sample holder.



4.4.2. d) GAS CHROMATOGRAPH - MASS SPECTROMETER (GC-MS)

Agilent Model 8890 GC System with Single Quadrupole Mass Spectrometer (5977B MSD) analyzer is used for the separation and identification of thermally stable volatile compounds. The GC consists of Split / Splitless (SSL) injectors and capillary columns for different applications. NIST spectral library search is also available.

Major Specifications:

GC oven temperature : Near ambient -450°C

ChromatographicPerformance:

Area repeatability :<0.5%

Retention time repeatability :<0.008%

Inlet Split ratio : 7500:1

Mass filter : Heated monolithic hyperbolic quadrupole

Ionization modes : Electron Impact(EI) and Chemical Ionization(CI)

Mass Range : (m/z) 1.6 −1,050 amu

Mass resolution : Unit mass

Mass Accuracy : 1 µL injection of 100 a pg/µL OFN standard scanning from 50.350 u will give its monoisotopeat m/z 271 ±0.005

Spectral Accuracy : 1 µL injection of a 100 pg/µL OFN standard scanning from 50.350 u will give 99.0% spectral accuracy

Ion source temperature : 150 -350°C

QuadrupoleTemperature:106-200°C

Detector Triple-Axis Detector with high energy dynode and long life electron multiplier

Accessories/Attachments:

Auto liquid sampler with 50 vial capacity

Capillary Columns: Polar Columns (DB-WAX) & HP-5 MS UI

Spectral Library and Database:: licensed NIST 2017 Library

Software : Open Lab CDS 2.5 version

Sample Requirements:

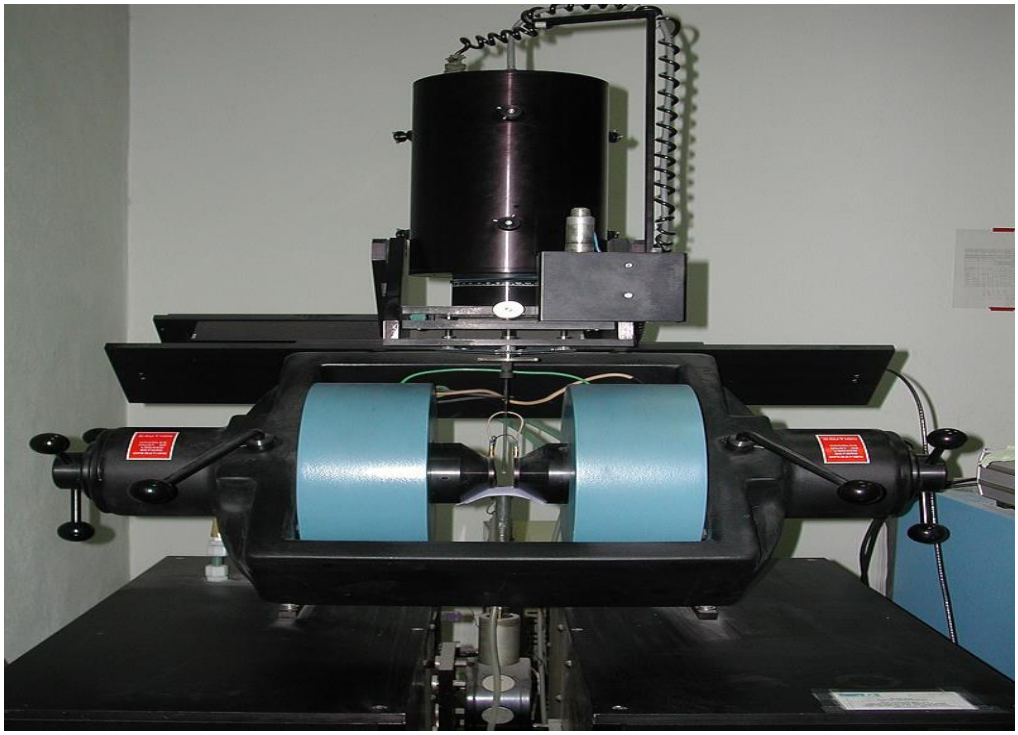
Powder samples: 5-10 mg

Liquid samples: 0.2-1ml

4.4.2. d) VIBRATING-SAMPLE MAGNETOMETER (VSM)

A vibrating-sample magnetometer (VSM) (also referred to as a Foner magnetometer) is a scientific instrument that measures magnetic properties based on Faraday's Law of Induction. A sample is first placed in a constant magnetic field and if the sample is magnetic it will align its magnetization with the external field. The magnetic dipole moment of the sample creates a magnetic field that changes as a function of time as the sample is moved up and down. This is typically done through the use of a piezoelectric material. The alternating magnetic field induces an electric field in the pickup coils of the VSM. The current is proportional to the magnetization of the sample the greater the induced current, the greater the magnetization. As a result, typically a hysteresis curve will be recorded and from there we can deduce the magnetic properties of the sample being measured.

It measuring the magnetic moment and coercivity of thin films or studying the magnetic properties of liquids, powders, or bulk samples, the MicroSense VSMs will give you the easiest and most accurate magnetic measurements.



5.RESULTS

5.1QUALITATIVE ANALYSIS

5.1.1ORGANOLEPTIC EVALUATION[31]

Table .1: Organoleptic evaluation of Gaantham before and after purification.

S.NO	PHSICO CHEMICAL PARAMETERS	UNPURIFIED GAANTHAMS 1% in w/w mg/g	PURIFIED GAANTHAMS2% in w/w mg/g
1	Colour	Tawny brown	Peanut brown
2	Odour	Odourless	Odourless
3	Nature	Fine powder	Fine powder

5.1.2PHYSICO CHEMICAL ANALYSIS[35]:

Table no.2: Result of Physico-chemical analysis of Gaantham before and after purification with root juice of Ponnavari.

S.NO	PHYSICO-CHEMICAL PARAMETER	BEFORE PURIFICATION % in w/w (mg/g)	AFTER PURIFICATON % in w/w (mg/g)
1	**Appearance**	Tawny brown color fine powder	Peanut brown color fine powder
2.	**pH at 25º C (1% w/v solution)**	6.42	5.40
3.	**Loss on Drying at 105ºC**	0.6366%	0.1186%
4.	**Total Ash**	93.97%	67.8%
5.	**Acid Insoluble Ash**	89.9%	58.5%
6.	**Water Extractive**	0.1604%	1.22%
7.	**Alcohol Soluble Extractive**	0.0940%	1.94%

5.1.3. BIOCHEMICAL ANALYSIS

Table no.3: Result of chemical analysis of Gaantham before and after purification.

Table no.3.1:

S.NO	Experiment	Sample 1	Sample 2
1	Solubility	+	+
2	Action Of Heat	-	-
3	Flame Test	-	-
4	Ash Test	-	-

Table no.3.2: Test for acid radicals

1	Test For Sulphate	-	-
2	Test for chloride	-	-
3	Test for phosphate	-	-
4	Test for carbonate	-	-
5	Test for nitrate	-	-
6	Test For Sulphide	-	-
7	Test for fluoride & oxalate	-	-
8	Test for nitrite	-	-
9	Test for borate	-	-

Table no.3.3: Test for basic radicals

1	**Test for lead**	**-**	**-**
2	**Test for copper**	**-**	**-**
3	**Test for aluminium**	**-**	**-**
4	**Test for iron**	**+**	**+**
5	**Test for zinc**	**-**	**-**
6	**Test for calcium**	**-**	**-**
7	**Test for magnesium**	**-**	**-**
8	**Test for ammonium**	**-**	**-**
9	**Test for potassium**	**-**	**-**
10	**Test for sodium**	**+**	**+**
11	**Test for mercury**	**-**	**-**
12	**Test for arsenic**	**-**	**-**

Table no.3.4: Miscellaneous

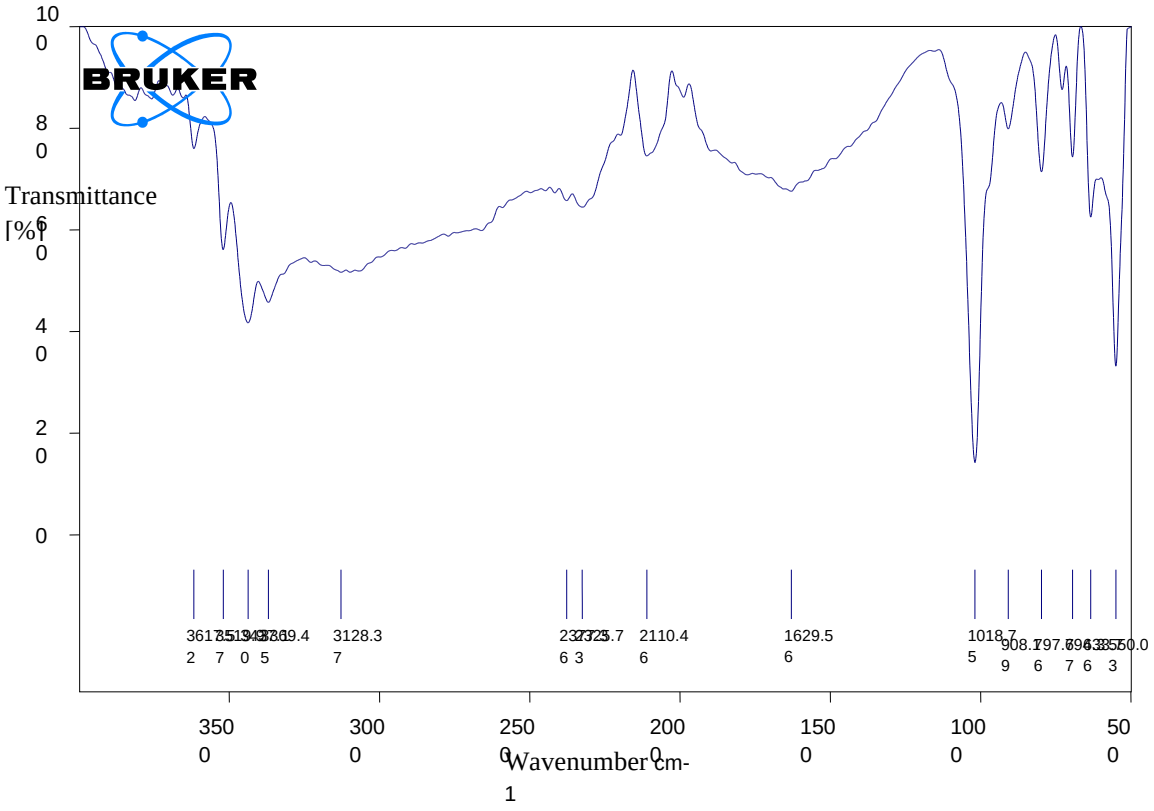
1	**Test for starch**	**-**	**-**
2	**Test for reducing sugar**	**-**	**-**
3	**Test for the alkaloids**	**-**	**-**
4	**Test for tannic acid**	**-**	**-**
5	**Test for unsaturated compound**	**-**	**-**
6	**Test for amino acid**	**-**	**-**
7	**Test for type of compound**	**-**	**-**

5.2. QUALITATIVE ANALYSIS:

5.2.1. Fourier Transform Infra Red Spectroscopy (FTIR)

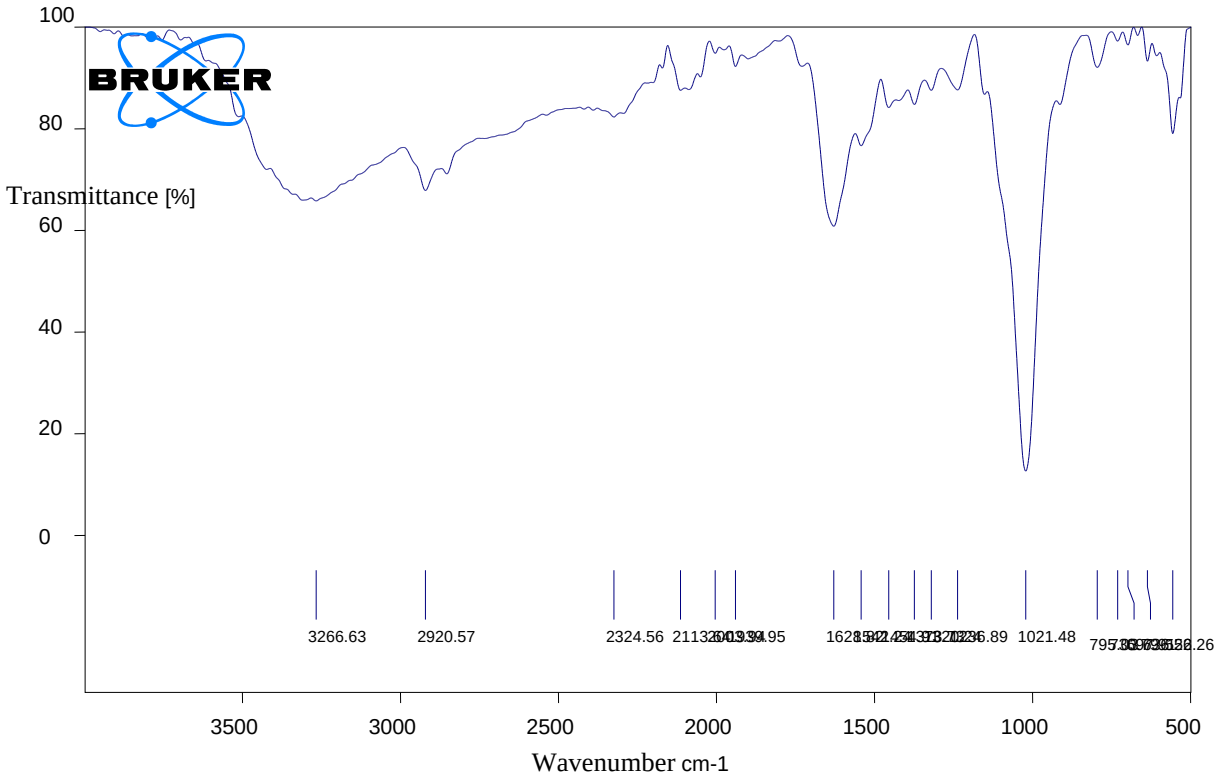
GRAPH: 1(A)

Characteristic IR absorption frequencies of Organic Functional Groups for unpurified raw drug GAANTHAM.



GRAPH: 1(B)

Characteristic IR absorption frequencies of Organic Functional Groups for purified raw drug GAANTHAM.



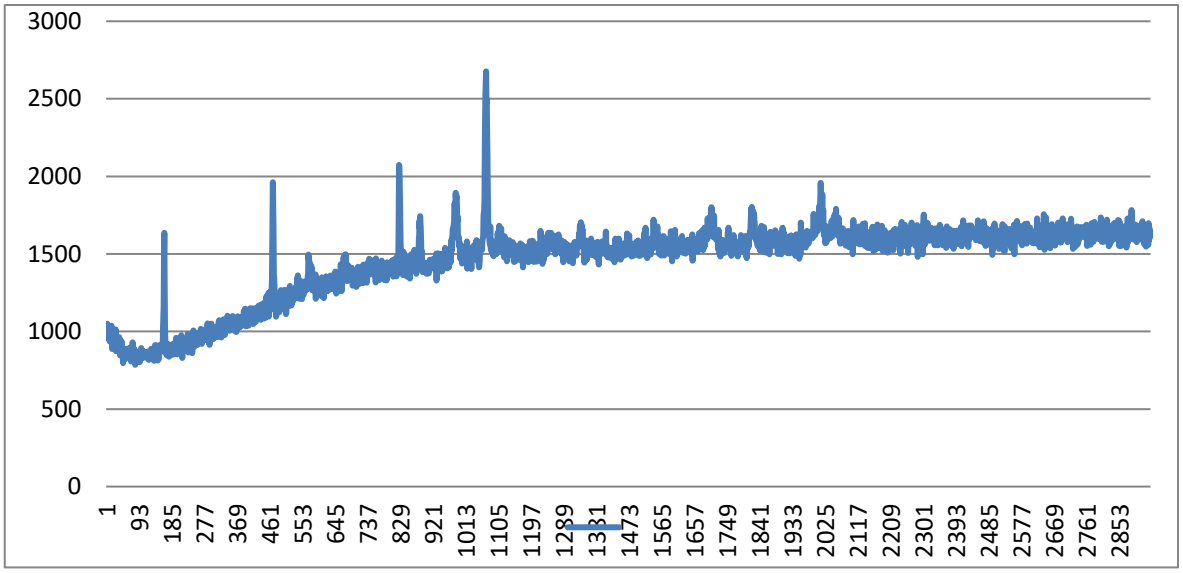
Result Analysis Interpretation[33]:

- The FT-IR spectra show peaks at 3519, 3437, 3266 and 3120, 2920 corresponding OH and C-H bands are present in both materials confirmation of both of Magnetite (Fe_3O_4) and maghemite (Fe_2O_3) is more amount of OH functional group present.
- The IR bands at 2377,2325,2324,2115,2110 and 1625,1542,1528 cm^{-1} characteristics of alkynes and carbonyl groups like C=O, COOH groups respectively.
- The peak located at 1021 and 1018 cm^{-1} arises from C-O stretching frequency. Further, peaks at 908,797,785,730 cm^{-1} may associate with stretching vibration of the alkyl halide.
- The well-known peak arises of 636,633,556 and 550 low intense bands was showing that the formation of Fe-O bond.

5.2.2. X-ray Diffraction (XRD)

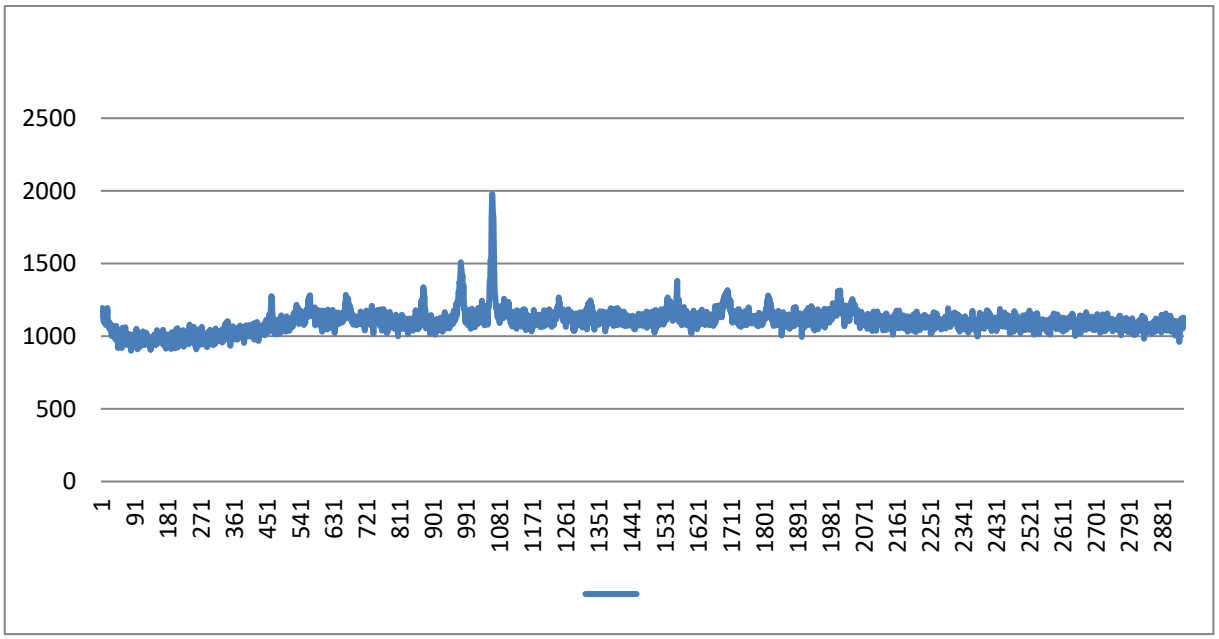
GRAPH: 2 (A)

Graph showing peaks of crystalline phase of unpurified raw drug GAANTHAM.



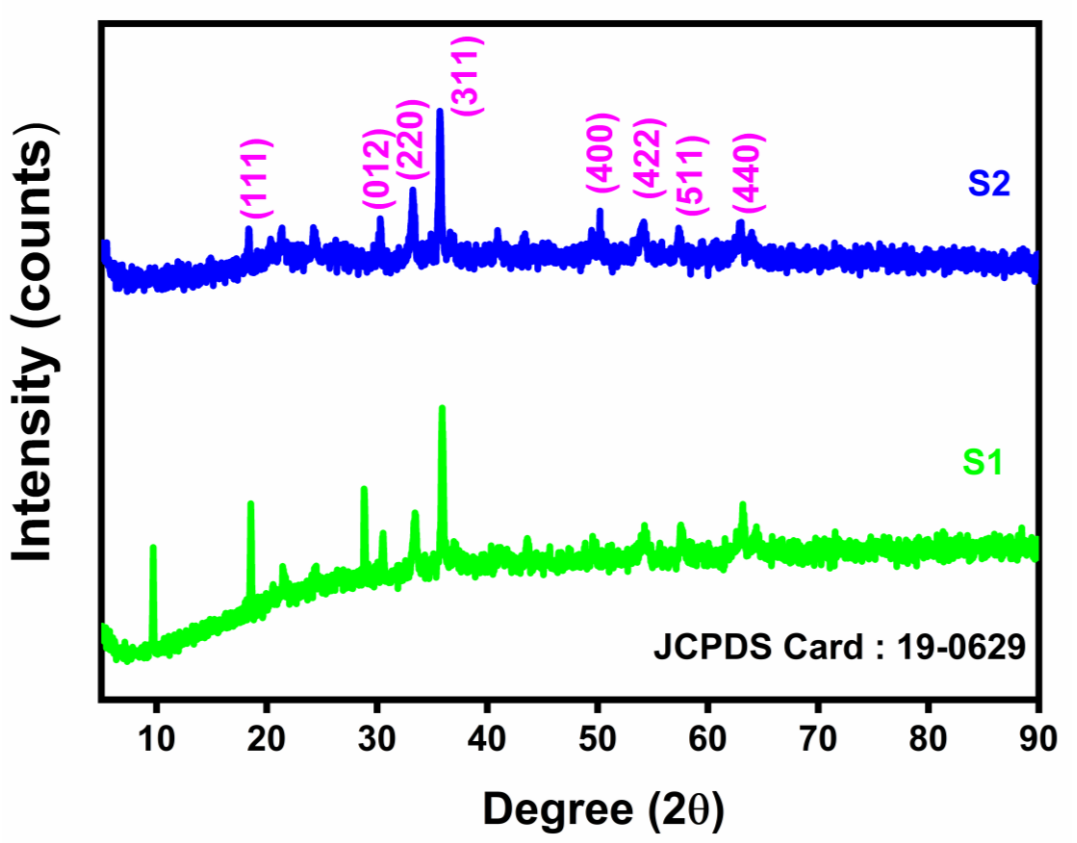
GRAPH: 2(B)

Graph showing peaks of crystalline phase of purified raw drug GAANTHAM.



GRAPH. 3(C):

Diffractogram for Purified and Unpurified raw drug of Gaantham.



Result analysis of XRD Pattern[36]:

- Using a Bruker D8 diffractometer and Cu K (1.5406 °A) radiation as an X-ray source, the XRD pattern was recorded at a scan rate of 1 min^{-1} in the 2-theta range from 5^{o} to 90^{o}.
- The X-ray diffraction method was used to examine the phase purity and crystallinity of the produced magnetite Fe_3O_4 nanocomposites.
- In comparison to JCPDS: 19-0629, The phase purity of magnetite spherical nanoparticles was determined using X-ray diffraction patterns.
- Peaks at 19.01, 28.23, 30.4, 32.8, 35.5, 43.3, 53.5, 57.1 and 62.7 in X-ray diffraction corresponding to diffractions of the crystal planes of Bragg (220), (311), 222), 400, 422), 511), and 440 are all in agreement with the standard.

- These XRD presented clearly in S2 samples without other peaks which is revealed high purity and crystallinity of the samples.
- The average particle size was estimated from XRD data using Scherrer equation

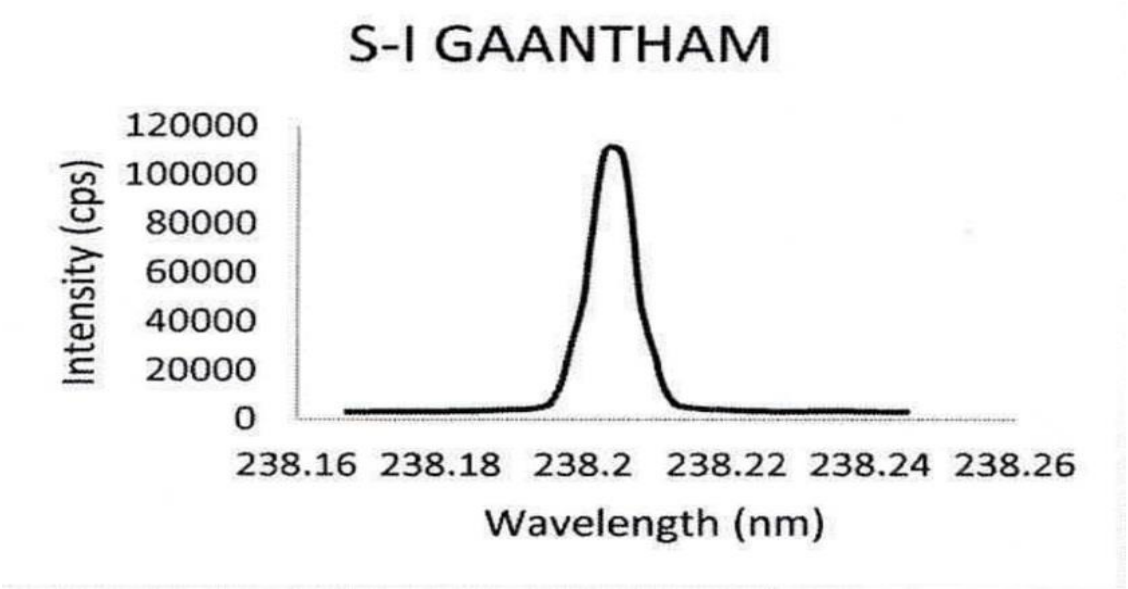
$$\boldsymbol{D = \frac{K\lambda}{\beta\, cos\theta}}$$

- where D is the average particle size, K the dimensionless shape factor whose typical value is about 0.9, λ the X ray wavelength used in XRD (Cu Kα = 1.5405A), β the broadening of the observed diffraction line at half the maximum intensity in radians, and θ the Bragg angle.
- The average crystallite size of samples S1 and S2 was deduced to be impure and purified samples, respectively.
- The average particle size of S2 purified magnetite Fe_3O_4 nanocomposites, implying that solvents played a role of a surfactant to some extent and contributed to the reduction of the nanoparticle size and reduce the unwanted impurities.

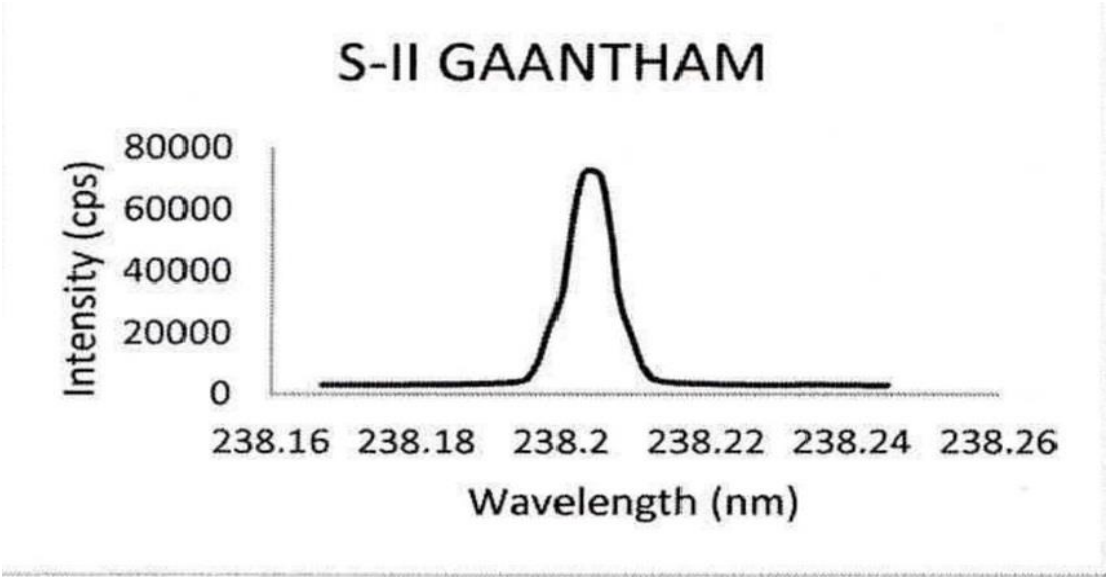
ICP-OES:

For before and after purification of Gaantham with root juice of Ponnavarai.

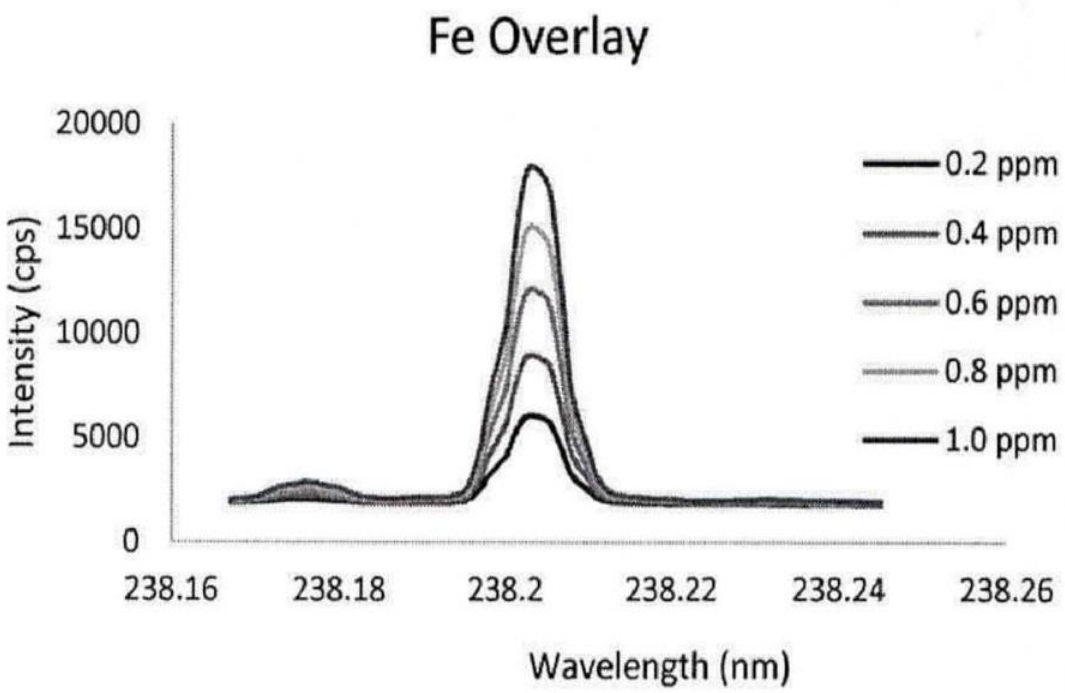
GRAPH3 (A): Report of unpurified Gaantham (S-I)



GRAPH 3(B): Report of unpurified Gaantham (S-II)



GRAPH 3(C): STRANDARD OVERLAY



Result analysis of ICP-OES[43]:

Table no:3 Result of Quantitative analysis by ICP-OES for both unpurified and purified raw drug Gaantham

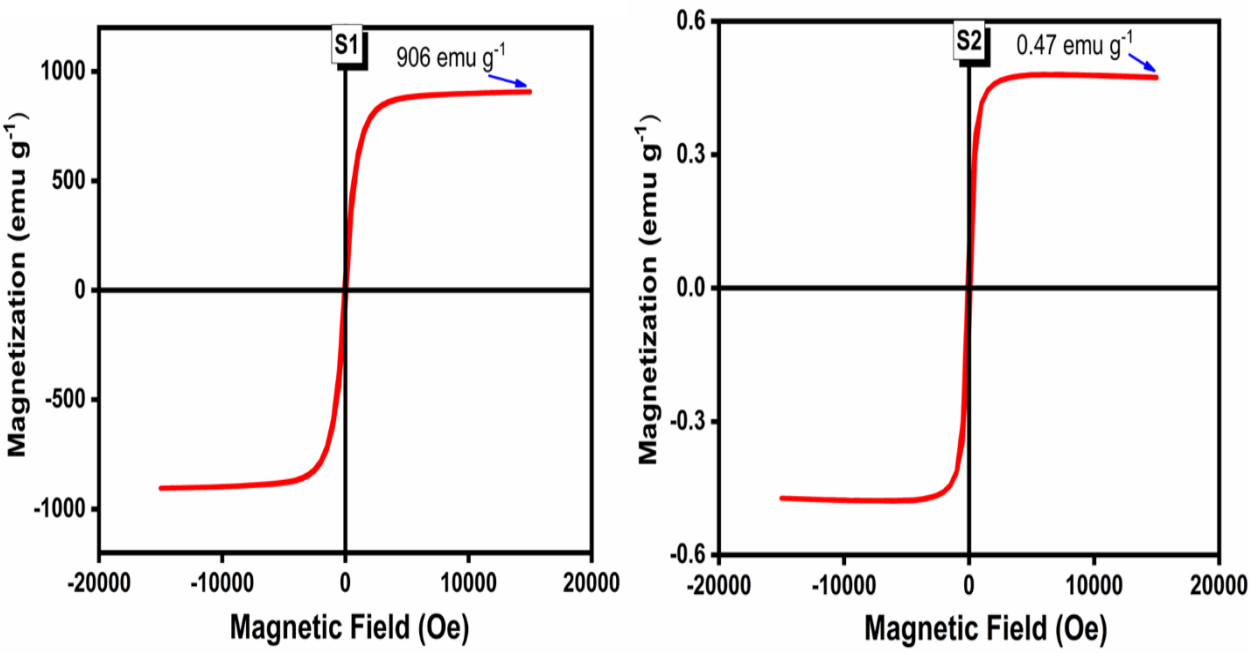
ELEMENT	**WAVE LENGTH In nm**	**BEFORE PURIFICATION In mg/L(PPM)**	**AFTER PURIFICATION In mg/L(PPM)**
Iron	238.204	13.16%	8.38%

Analysis of unpurified and purified raw drug Gaantham showed that the presence of physiologically important mineral iron which is reduced after Purification process.

5.2.4.VIBRATING SAMPLE MAGNETOMETRY (VSM):

GRAPH 4: Hysteresis loop of Unpurified (S_1) and Purified(S_2) Gaantham

The graph shows Magnetic characterization of Gaantham before and after purification.



The hysteresis loop is done using a vibrating sample magnetometer (VSM) Lakeshore VSM 7410S at room temperature.The saturation magnetization (M_s) and the coercive field of the unpurified and purified magnetite samples are 906 and 0.47 emu g^{-1}indicating high saturation magnetization and super paramagnetic behavior.

Result analysis of VSM[41]:

- According the magnetic saturation increases with increasing particle size regardless of crystal structure and particle shape.
- By exceeding the critical size of magnetite, the M_s and H_c decrease with increasing particle size.the increase in the size of unpurified magnetite compared to purified magnetite, the magnetic saturation of cubic particles is also higher.
- Therefore, higher particle size of magnetite presented in unpurified magnetite due to magnetic saturation is also higher.
- Magnetic properties as a result of changes in external magnetic fields, which is described by the hysteresis curve.
- The hysteresis curve shows the relations between magnetization (M) and the external magnetic field (H).
- According to the size, shape, degree of crystallinity, and the oxidation state of nanoparticles determine the magnetic properties.
- The results indicated that the magnetic saturation of purified magnetite is less than that of unpurified ones, which is consistent with the results of the present research.

5.2.5 GAS CHROMATOGRAPHY-MASS SPECTROSCOPY(GCMS):

GC-MS Analysis of the whole root extract of *Cassia occidentalis* was performed using the equipment Agilent GC 8890-MSD 5977B. The identified of the organic constituents were based on NIST Library and obtained the results have been tabulated[30].

GRAPH 5: Peaks of GC-MS chromatogram

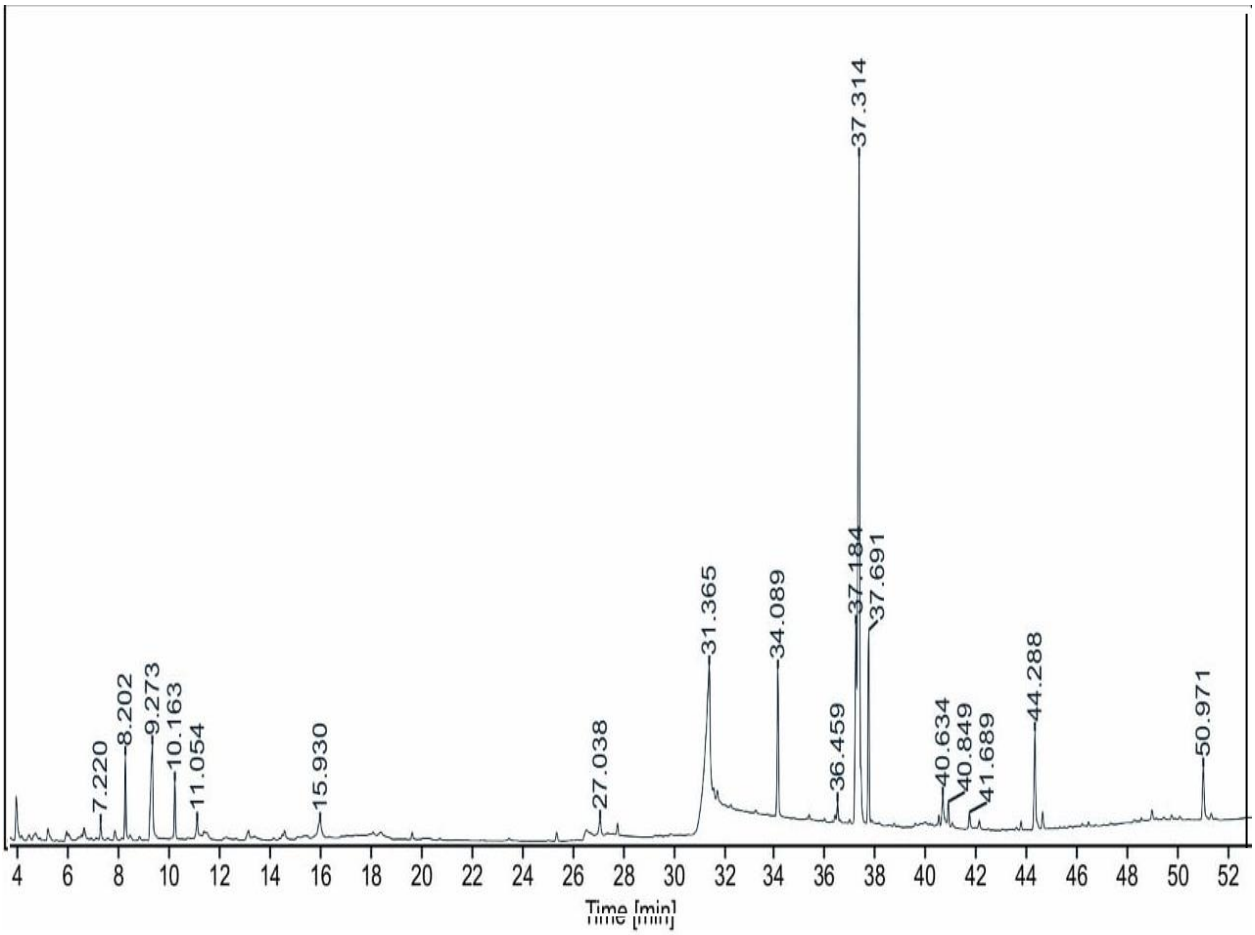


TABLE 4: Pytochemical constituents of root extract of *Cassia occidentalis.*

S.No	RT(Min)	Name of the compound	Molecular Formula	Molecular weight	Peak area%
1	7.22	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl	$C_8H_8O_4$	144.12	0.65
2	8.20	Cyclopentanecarboxylic acid, 2-oxo-, ethyl ester	$C_8H_{12}O_3$	156.18	2.85
3	9.27	5-Hydroxymethylfurfural	$C_6H_6O_3$	126.11	6.24
4	10.16	1,3-Cyclohexanediol, 2-methyl-2-nitro-, monoacetate (ester), [1s-(1α,2β,3α)]-	$C_{12}H_{22}O_2$	198.30	1.97
5	11.05	4-Hydroxy-2-methylpyrrolidine-2-carboxylic acid	$C_{14}H_{17}NO_5$	279.29	1.26
6	15.93	d-Mannose	$C_6H_{12}O_6$	180.15	1.91
7	27.03	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256.40	1.14
8	31.36	cis-13-Octadecenoic acid	$C_8H_{34}O_2$	282.46	21.64
9	34.08	Glycidyl palmitate	$C_{19}H_{36}O_3$	312.50	5.46
10	36.45	2,3-Dihydroxypropyl elaidate	$C_{21}H_{40}O_4$	356.50	0.75
11	37.18	Butyl 9,12-octadecadienoate	$C_{22}H_{40}O_2$	336.12	7.80
12	37.31	9-Octadecenoic acid (Z)-, oxiranylmethyl ester	$C_{21}H_{38}O_3$	338.50	31.48
13	37.69	Glycidol stearate	$C_{21}H_{40}O_3$	340.50	6.40
14	40.63	9-Octadecenoic acid (Z)-, 2-hydroxy-1-(hydroxymethyl)ethyl ester	$C_{21}H_{40}O_4$	356.50	1.70
15	40.84	9-Octadecenoic acid (Z)-, oxiranylmethyl ester	$C_{21}H_{38}O_3$	338.50	0.90
16	41.68	Hexadecanoic acid, 1-(hydroxymethyl)-1,2-ethanediyl ester	$C_{35}H_{68}O_5$	568.90	0.80
17	44.28	9-Octadecenoic acid, 1,2,3-propanetriyl ester, (E,E,E)-	$C_{57}H_{104}O_6$	886.00	4.36
18	50.97	Oleic acid, 3-(octadecyloxy)propyl ester	$C_{39}H_{76}O_3$	593.00	2.72

Result analysis of GCMS[42]:

- GC-MS chromatogram showed peaks and a total of 18 compounds were identified in root extract of *Cassia occidentalis*.
- The mass spectra of the constituents was compared with National Institue Standard and Technology library.
- The retention time of the compounds in between 7.22 to 50.97 minute and molecular weight in between 144.2 to 593.
- Phytochemicals are produced by plants are used to treat various metabolic, immunological and neurological disordersin human.
- The Phytochemical constituants identified were Cyclopentane carboxylic acid, Hexadecanoic acid, Octadecenoic acid, Glycidol stearate, Oleic acid, Cyclohexanediol, Hydroxymethylfurfural Glycidyl palmitate.
- These are responsible for one of the Pharmacological activity of *Cassia occidentalis*.

DISCUSSION:

An ancient Siddha system comprises Holistic medicine which emphasizes the maintenance of relaxed mind and body Harmony[(1)]. Nowadays Siddha system is facing difficulties in proper purification and preparation of its unique medicine. According to Siddha text, mineral drug purification is the process for removing impurities and toxins[(2)].

The drug Gaantham(*Magnetic oxide of iron*) is of mineral origin, selected for Standardization of purification process. The method of purification with root juice of Ponnavarai(*Cassia occidentalis*) was selected from the Siddha literature "Theran yemaka venpa[(7)]".

Metals and minerals are held in hand to hand in Siddha Pharmaceuticals with suitable as well as various process of purification. Gaantham contains a large number of essential minerals and unwanted substances in it. Therefore it has to be purified before using for therapeutic purpose.

Gaantham is also included in the following preparations like Rasa ganthi mezhugu, Van mezhugu, Pattu karuppu, Kushtagaja kesari, Thiriloga ratchamani, Vishnu chakkara mathirai, Aya gantha chanda marutha chenduram and Vatha ratchasan[(10)]. Magnetic oxide of Iron has a therapeutic potency in the treatment of vatha disease, anaemia, dropsy, jaundice, ascites, leucorrhea, eye diseases. Purification of Gaantham is recommended before its application in the pharmaceutical preparation as mentioned in the Siddha literature.

Standardization is a process which maintain consistency in the claimed efficacy of a product and its batch-to-batch reproducibility. The increasing use of traditional therapies demands more scientifically sound evidence for the principles behind therapies and for effectiveness of medicines[(3)]. For the purpose of Standardization, the powdered samples of both unpurified and purified Gaantham were taken and labeled as such and the following analysis has been chosen.

Physico-chemical analysis

Chemical analysis

Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES)

Fourier Transform Infra Red Spectroscopy (FTIR)

X-Ray Diffraction (XRD)

Gas chromatograph - mass spectrometer (GC-MS)

Vibrating sample magnetometry (VSM)

The colour of the drug changes from tawny brown to peanut brown by purification. There is no considerable change in odour and nature of the substance remains in powder form.

The **Physico-chemical analysis** of drug Gaantham before and after purification reveals the following results.

The pH of the drug Gaantham before purification was 6.54, which is slightly acidic. The pH of the raw drug Gaantham after purification was changed to 5.40, which is more acidic. In oral administration, the acidic nature of the drug enhances rapid absorption in the stomach[38].

The loss on drying test is to determine to measure the amount of water and volatile matter in a sample when the sample is dried under the specified conditions. Moisture is one of the major factors responsible for the detoriation of the drugs and formulations. Low moisture content is always desirable for higher stability of the drugs . The percentage of loss on drying of raw drug Gaantham before and after purification was changed from 0.6366 % w/w to 0.1186 %w/w. The drastic change in loss on drying from before to after purification process depicts the extensive shelf life of the drug[12].

The Ash limit tests are to determine the measure the amount of the residual. A high ash value is an indication of contamination, substitution, adulteration or carelessness in preparing the drug and the less Total ash value indicates the purity of the drug[12].

The Total ash values of Gaantham for before and after purification process was 93.97%w/w and 67.8%w/w respectively. As the Total ash value is much reduced in after purification, it implies that the inorganic constituents are much reduced after purification.

The acid - insoluble ash limit test is to measure the amount of ash insoluble to diluted hydrochloric acid. Acid-insoluble ash value of Gaantham before and after purification was 89.9%w/w and 58.5 %w/w respectively. This indicates the greater

physiologic availability of the drug and also indicates the purity of the drug after purification.

Extraction value determines the amount of active constituents in a given amount of the formulation when extracted with a solvent media such as water and alcohol. The water soluble and alcohol soluble extract values provides indication of the extent of polar and non-polar compounds respectively[29]. The extract value of water is changed from 0.1604 %w/w to 1.22%w/w during purification. It indicates that water solubility is increased after purification. The extract value of Alcohol is changed from 0.0940 %w/w to 1.94 %w/w. There is a reducing Alcohol extract value in after purification, which indicates that the alcohol solubility is increased. Water solubility is significant for orally administered drugs for quick disintegration and dissolution in the gastrointestinal fluids which is fulfilled when medicine preparations of Gaantham are internally administered.

The **Chemical analysis** of the drug before and after purification shows the presence of iron and sodium.

Iron is a mineral that our body need for many functions. Iron is part of hemoglobin, enzymes and many other protins. It helps muscles store and use oxygen.

Sodium requires to conduct nerveimpulses, contract and relax muscles and maintain the proper balance of water and minerals[45].

The **Inductively Coupled Plasma Optical Emission Spectrometry[43] (ICP-OES)** analysis of raw drug Gaantham before and after purification showed that the presence of physiologically important mineral iron.

The **Fourier Transform Infra Red Spectroscopy (FTIR)** analysis of Gaantham purified with root juice of Ponnavari shows the presence of vibrational band observation of OH and C-H bands in both materials confirmation of both of Magnetite (Fe_3O_4) and maghemite. The well-known peak arises of 636,633,556 and 550 low intense bands was showing that the formation of Fe-O bond. Also shows the presence of functional groups such as alkynes and carbonyl groups like C=O, COOH groups, alkyl halide[33]. The functional groups are added after the purification process and responsible for the therapeutic effects of Gaantham as per literature.

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The **X-ray Diffraction(XRD)** method was used to examine the phase purity and crystallinity of the produced magnetite Fe_3O_4 nano composites. The analysis of the drug samples shows intensity peaks of various places. The peaks were identified as crystalline peaks. These The average crystallite size of samples S1 and S2 was deduced to be unpurified and purified samples, respectively. The average particle size of S2 purified magnetite Fe_3O_4 nanocomposites, implying that solvents played a role of a surfactant to some extent and contributed to the reduction of the nanoparticle size and reduce the unwanted impurities. XRD presented clearly in S2 samples without other peaks which is revealed high purity and crystallinity of the samples[33].

Gas Chromatography-Mass spectroscopic analysis was done in the *Cassia occidentalis* root extract for the presence of compounds responsible for one of the pharmacological properties. GC-MS chromatogram showed peaks, a total of 18 compounds were identified when the mass spectra of the constituents was compared with National Institue Standard and Technology library. The compounds identified were Cyclopentane carboxylic acid, Hexadecanoic acid, Octadecenoic acid, Glycidol stearate, Oleic acid, Cyclohexanediol, Hydroxymethylfurfural Glycidyl palmitate. These compounds are responsible for its therapeutic uses[42].

Vibrating sample magnetometry (VSM) is a tool that measures the magnetic properties of Gaantham before and after purification The saturation magnetization (M_s) and the coercive field of the unpurified and purified magnetite samples are 906 and 0.47 emu g^{-1}indicating high saturation magnetization and superparamagnetic behavior. Magnetic saturation increases with increasing particle size regardless of crystal structure and particle shape. Therefore, higher particle size of magnetite presented in unpurified magnetite due to magnetic saturation is also higher than purified magnetite. It shows particle size was reduced after purification and also the magnetic property was reduced in Gaantham. This may important for its therapeutic use and safety[41].

SUMMARY:

Siddha system of medicine emphasis, before going to medicine preparation every raw drug must be purified. The concept of *Suddhi (*purification) in Siddha is not only a process of detoxification, but also a process to enhance the potency and efficacy of the drug. There is no scientific evidence what all the changes occur during the purification process are.

The Purification method of the chosen drug had been selected from the Siddha literature "Therayar yemaka venpa". The classic method of purification was said by the famous Siddhar Therayar who is known for his excellence in various realm of Siddha medicine.

In this study, 200gm of raw drug Gaantham(Magnetic oxide of iron) was procured from renowned country drug shop in Krishnagiri district. The authentication for raw drug was obtained from siddha central research institute, Chennai- 06. Ponnavari root was collected near the institute at Tamparam sanatorium and the authentication was obtained from National institute of Siddha, Chennai-47.

Then the raw drug was divided into two equal quantities of 100gm. Both part of the raw drug powdered well. One part of the raw drug was taken and kept as such labelled as unpurified Gaantham (S_1). The other part of the raw drug Gaantham was subjected to purification procedure.

Taken 600 grams root juice of Ponnavarai(*Cassia occidentalis*) in a pot add 100grams of Gaantham, kept it in the sunlight for a day. Doing this procedure for 10 days, then keep it dry for next 2 days without letting the juice. Repeat the whole procedure for 2 times and wash Gaantham thoroughly to get purified form of Gaantham. Then it was labelled as purified drug Gaantham (S_2). The qualitative and quantitative analyses were done for both the samples of unpurified and purified raw drug Gaantham

The physico-chemical analysis of the purified Gaantham reveals state of better absorption in the intestine, higher stability, purity, and Water solubility.

The chemical analysis shows the presence of physiologically important metals and minerals such as iron and sodium.

The results of ICPOES analysis indicates the presence of increased concentration of physiologically important minerals.

The results of FTIR analysis show the presence of Fe-O, alkynes and carbonyl, alkyl halide functional groups which are responsible for the therapeutic effect of Gaantham.

The XRD analysis results depicts clearly that the crystalline phase is increased with increase in intensity, which indicates that purified Gaantham is attributed for better bioavailability and dissolution rate.

The VSM analysis results shows that there is a strength of magnetic property of Gaantham decreased after Purification. Lower particle size of magnetite presented in purified magnetite and the magnetic saturation is also lower. This may important for its safety.

The GCMS analysis results shows that there is the presence of 18 compounds in root extract of *Cassia occidentalis* and responsible for its pharmacological activity.

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CONCLUSION:

The following inferences are drawn based on qualitative and quantitative analysis of before and after purification of Gaantham (Magnetic oxide if iron) with root juice of Ponnavari (*Cassia occidentalis*).

After purification the total ash value and moisture content are reduced, which denotes the impurities are removed and the shelf life is increased.

Increased Crystalline nature and decreased magnetic property and particle size in purified Gaantham which enriches better bioavailability and dissolution of the drug. Also shows the presence of physiologically important mineral iron. Ponnavarai root has more than fifteen pytochemical constituents, it may enchange the mineral Gaantham during purification process.

The present study of purification process of Gaantham the impurities are removed and the quality of the mineral is improved. Thus the purification turns the Gaantham in to a therapeutic valuable mineral. Therefore the purified drug when used in medicine preparation may increase the efficacy and potency of the medicine.

The changes found in after purification of Gaantham(Magnetic oxide of iron) indicates the necessity of purification. This purification process of Gaantham with root juice of Ponnavarai(*Cassia occidentalis*) can be set as one of the standard purification process of Gaantham.

So the purification process is essential for any drug of Metal and Mineral origin before using them in the pharmaceutical preparations. If it is properly done as per Siddha literature including preparation of medicine, it will be highly beneficial for mankind.

Therefore it can be concluded that after the purification of Gaantham, through the above purification Method, has more efficacy and fulfill the therapeutic effects.

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NATIONAL INSTITUTE OF SIDDHA, CHENNAI – 600047

BOTANICAL CERTIFICATE

Certified that the following plant drug used in the Siddha formulation process **"Purification of Gaantham"** taken up for Post Graduation Dissertation studies by **Dr.E.Selvasankari** M.D.(S), III year, Department of Nanju Maruthuvam, 2022, are identified through Visual inspection, Experience, Education & Training, Organoleptic characters, Morphology, Micromorphology and Taxonomical methods as

Cassia occidentalis Linn. (Caesalpiniaceae), Root

MEDICINAL BOTANY CHENNAI 600 047 National Institute of Siddha

Certificate No: NISMB5252022

Date: 27-05-2022

Authorized Signatory

Dr. D. ARAVIND, M.D.(S), M.Sc.,
Assistant Professor
Department of Medicinal Botany
National Institute of Siddha
Chennai - 600 047, INDIA

AUTHENTICATION CERTIFICATE

Certificate No: Gun/Aut/001/22 **Date: 03.05.2022**

Certified that the following minerals/ metals/ animal products used in the Siddha, ***Purification of Gaantham*** taken up for the Post Graduate Dissertation study by **Dr. E. SELVASANKARI,** Department of Nanju Maruthuvam, National Institute of Siddha, Chennai-47 is correctly identified and authenticated through visual inspection/ experience, organoleptic characters, morphology,etc.

1. ***GAANTHAM*** **– Magnet**

03/05/2022

Head of the Department

Chennai-47

03.05.2022

प्रो.डॉ.आर. मीनाकुमारी / Prof. Dr. R. Meenakumari
निदेशक / Director
राष्ट्रीय सिद्ध संस्थान / National Institute of Siddha
आयुष मंत्रालय, भारत सरकार
Ministry of AYUSH, Govt. of India
ताम्बरम सानटोरियम, चेन्नै-600 047.
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SASTRA

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THINK MERIT | THINK TRANSPARENCY | THINK SASTRA

CERTIFICATE

This is to certify that Dr./Shri/Smt./ E.SELVASANKARI *of* NATIONAL INSTITUTE OF SIDDHA, CHENNAI *has participated in the two days training programme on* **"Standardization and Scientific Validation techniques in understanding the Safety and Toxicity of Herbo-metallic Preparations"** *organized by the Centre for Advanced Research in Indian System of Medicine (CARISM), SASTRA Deemed To Be University, Thanjavur on 11th and 12th March 2022.*

Prof. P. Brindha
Coordinator
CARISM

Dr. S. Sriram
Convener

Prof. R. Chandramouli
Registrar

The Tamil Nadu Dr.M.G.R. Medical University

69, Anna Salai, Guindy, Chennai - 600 032.

This certificate is awarded to Dr. E. SELVASANKARI

for participating as Resource Person / Delegate in the 34th Workshop on

"How To Do a Good Dissertation & Publish? (Research Methodology and Biostatistics)"

(Virtual mode) for AYUSH Post - Graduates & Researchers organized by the

Department of Siddha, The Tamil Nadu Dr.M.G.R. Medical University

from 26 - 07 - 2021 to 30 - 07 - 2021.

Dr.N. KABILAN
PROFESSOR & HEAD, DEPT. OF SIDDHA

Dr.M.B. ASWATH NARAYANAN
REGISTRAR

Dr.SUDHA SESHAYYAN
VICE-CHANCELLOR

NATIONAL INSTITUTE OF SIDDHA
Ministry of AYUSH, Government of India
Tambaram Sanatorium, Chennai- 600 047

CERTIFICATE

Workshop on
Basic Research Techniques & Practices of Laboratory Animal Care

24 - 28 February, 2020

This is to certify that ..... Dr. E. Selvasankari .....

has participated as Trainee in the Workshop on Basic Research Techniques & Practices of Laboratory Animal Care on 24 - 28 February, 2020 at National Institute of Siddha, Chennai - 47.

Dr.V.Suba
Organising Secretary

Dr.B.R.Senthilkumar
Co - Ordinator

Prof.Dr.R.Meenakumari
Chairperson / Director