

**PHYSICOCHEMICAL CHARACTERIZATION OF A SIDDHA FORMULATION -
*VEDIUPPU CHENDHURAM***

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Summary

Vediuppu Chendhuram (VC) is a traditional Siddha medicinal preparation using to treat Neerkattu and Neererichal. This biomedicine is synthesized through special oxidation of *Vediuppu* as narrated in the text *Anubhoga Vaithiya Navaneetham*. Physicochemical characterization of VC was carried out using qualitative biochemical analysis and modern techniques such as Fourier transform infra-red spectroscopy, inductively coupled plasma analysis and scanning electron microscopy. The study showed that the raw material *Vediuppu* procured from Nagercoil country drug store is a preferred source and purification by Cow's urine shows constituents of organo-mineral matrix containing potassium nitrate. The potassium nitrate transform to a stable oxide form during the process of *Chendhuram* formation and forms the main component form of VC. The repeated trituration by onion leaf juice and heat treatment does result in conversion to oxide form in the finished product VC. The organic content of processed material degraded gradually. Physical and chemical evaluation revealed that VC is a light golden colour powder, slight alkaline nature and having solubility in water and Hcl with stabilized particle size distribution of 5µm. A clearly identifiable fraction of VC particles were below 50 nm. The presence of nanosized particles in VC might impart the therapeutic property of this medicine. Trace elemental analysis of VC revealed that heavy metals like arsenic, cadmium, mercury and lead were below the deduction limit. Further, elemental analysis of VC revealed the presence of minerals like sodium, potassium, sulphur, phosphorus and calcium under acceptable limits at the prescribed dose of VC.

Keywords: Siddha, *Vediuppu*, *Chendhuram* preparation, Heavy metals, Nano particles.

1. Introduction

Our world is made up of five basic material elements and the worldly objects are classified into two, namely movable and immovable objects. The above concept has rightly declared by an old wise Tamilian as follows:

“Classifying all movable and immovable things
Within the classification of five material elements....”

The Earth revolves bearing all these objects. The Sky provides space to accommodate the objects while the Water, the Fire and the Air bring them up and protect. Both movable and immovable objects may be classified under the following three major divisions: 1. Mineral Kingdom, 2. Herbal Kingdom, 3. Animal Kingdom. Mineral objects are 220 in total and these can be classified into four kinds, viz., 1. Metals (Ulogangal) - 11, 2. Salts (Karasarangal) - 25, 3. Arsenic compounds (Padanangal) - 64, 4. Secondary minerals (Uparasangal) – 120. Among Karasarangal, *Vediuppu* – Potassium nitrate, a fire based Salt element has been used as an ingredient for the preparation of various Siddha medicinal formulations. Even though, these are under practice for long time, there are no standard documents to reveal the safety and quality of *Vediuppu* based formulations. To achieve this point, we took a single *Vediuppu* based formulation - *Vediuppu Chendhuram* (VC) and physicochemical characterization of VC were studied. This is the initial step to carry out the standardization of this traditional formulation. In Siddha system of medicine, metals and minerals are not ingested in their raw form. These are rendered fit for human consumption by specialized traditional techniques. Probably, some unidentified complexes are formed with the herbal ingredients during trituration and pudam process. These need to be identified and chemically characterized. By establishing the physicochemical properties, it is easy to study the drug absorption and transport processes which influences on drug delivery process. Moreover, we can create the standard parameters of physical properties, chemical constituent's concentration and its form and specification limits for the purity.

Among 32 forms of Internal medicines illustrated in Siddha Materia medica, *Chendhuram* form of medicine has a key role because of its advantages rather than other such as deep penetration, rapid action, efficacy in minimal dosages, long shelf life, no adverse interactions with Herbal drugs, usefulness in obstinate and incurable diseases, wide spectrum of therapeutic indications for tonic, rejuvenating and curative purposes and lack of adverse effects if properly made and finished. Generally, *Chendhuram* means Red Oxide form of medicine which is prepared by making the purified metallic substances or arsenical compounds as an ingredients into red coloured powders by the process of burning, frying or insulating or keeping them in specialized pudams by grinding them with decoctions, ceyaneers (Pungent liquid), juices, etc. *Vediuppu Chendhuram* is made by pudam process by triturating *Vediuppu* with herbal juices. **Reasons for purification & detoxification process of ingredients:** Looses its original identity (as toxic material) and get converted to a fine powder by pudam process chemically oxides or sulphides. These powders acted upon by Gastro Intestinal juices and absorbed very slowly. So, an only micro concentration of the minerals enters into the systemic circulation and tissues.

Rationale of *Vediuppu*: Vernacular names: Pottiluppu, Inangan, Padairasan (Commander for the war troops), Boomikoormai (Sharpness of the earth), Navacharamithru (Friend of

Ammonium chloride) (*Siddha Materia Medica*). **Scientific name:** Potassium nitrate.

Preparation: The sand containing the crude salt is placed in a mud pot. Water is added into it and mixed well and a straw is placed inside the pot and filtered. The filtrated mixture is heated to get the salt (*Siddha Materia Medica*). For medical usages, the earth containing the crude salt is dissolved in water stained and recrystallised by boiling and evaporation. The impure nitre is known as Dloah and contain about 45 – 75% of actual salt remainder being sulphate and chloride of sodium and insoluble matter. It is again dissolved and crystallized before it is sent under the name of shorakalmi refined to the bazaar for sale. (*Dr. K.M Nadkarni's Indian Materia medica*).

Properties and therapeutic uses: This salt has got demulcent, diuretic and diaphoretic action. The salt is useful in the treatment of eight types of Gunmam (Abdominal disorders), Uterus fibroids, anorexia, anaemia, urinary tract infections, dysuria, strangury, ascitis, menopausal disorders, abdominal distention and asthma. It improves fertility in women. The salt is also effective in fever, swellings, rheumatic disorders, haemorrhage, gonorrhea, eye diseases and sore throat (*Siddha Materia Medica*). Potassium nitrate acts on the vascular system and thus reduces the frequency of pulse. It is also useful in the early stages of dropsy and also in cases of small pox, measles, influenza catarrhah, gonorrhea, acute rheumatism, bleeding from lungs, stomach ulcers or other internal organs attended by fever. (*Dr. K.M Nadkarni's Indian Materia medica*)

Therapeutic dosage: 650 mg – 1300 mg. *Vediuppu chunnam* (Sublimed form) along with *Aereva lanata* increases the urinary excretion of uric acid, calcium, oxalate, phosphorus and protein in hyperoxaluric rats and also decreases the magnesium excretion without adverse effects (Selvam R et al). *Vediuppu Chendhuram* in the dosage of 520 mg -1040 mg along with water of tender coconut or juices of radish useful for the management of Neerkattu (Oliguria) and Neererichal (Burning micturition) (*Anuboga Vaithiya Navaneedham*).

Based on the literature evidences, various sources of *Vediuppu* had been collected and purified by different methods illustrated in texts. At each stages of purification, compound analyses had done. After that, the preferred *Vediuppu* was chosen and used for the preparation of *Vediuppu Chendhuram* (VC) as per literature *Anuboga Vaithiya Navaneedham*. Then, the finished product of VC was sent for elemental analysis to estimate the presence of any heavy metals and other organic and inorganic compounds.

***Vediuppu Chendhuram* had been evaluated in the following aspects**

- Analysis the compounds present in before and after purification of *Vediuppu*
- Preparation of *Vediuppu Chendhuram* as per textual method.
- Elemental analysis of *Vediuppu Chendhuram*.

2. Material and Methods

2.1 Selection and Collection of Raw Materials:

I. The four samples of *Vediuppu* were obtained from various sources viz

Sample A - Country drug store at Nagercoil, Tamilnadu.

Sample B - Country drug store at Chennai, Tamilnadu.

Sample C - Chandhanmal laboratory at Chennai, Tamilnadu.

Sample D - Stone Quarry at Dindigul, Tamilnadu.

The above samples were subjected to elemental analysis through Sophisticated analytical Instruments at IIT, Chennai such as FT-IR and ICP-OES. From that, we establish the preferred sample for the preparation of VC.



1. Plates of Raw Samples

II. Komoothiram (cow's urine) was collected from White coloured cow at Chengalpattu and it was filtered using cotton cloth.

III. Elumitchai pazha chaaru is a fresh juice obtained from the fruits of *Citrus lemon* (Family: Rutaceae). The lemon juice was filtered using cotton cloth.

IV. Muttai vellaikaru is an egg white obtained from Country hen's egg.

V. Venkaya thal chaaru is a fresh juice obtained from the leaves of *Allium cepa* (Family: Liliaceae). The onion leaves juice was filtered using cotton cloth.

2.2 Methods of purification and detoxification:

Method 1: (*Siddha maruthuva manigal.*, pg no:110)

Vediuppu 250g was purified by soaking in sufficient amount of Komoothiram and dried under sunlight --- **Sample E**

Method 2: (*Roma rishi maruthuva vaagadam.*, pg no:82)

Vediuppu 250g was purified by soaking in sufficient amount of Lemon juice and dried under sunlight --- **Sample F**

Method 3: (*Gunapadam Thathu Jeeva Vaguppu.*, pg no: 332)

Water 1lt was added to the *Vediuppu* 250g and boiled on a hearth with mild flames. The white of eggs (1 no) was added to the salt and the bubbles appearing with impure substances were removed with a wooden spoon. The ingredients were transferred to another pot, sealed with mud pasted cloth, filtered and kept in places without aeration. Next day, the water was filtered and the salt was dried under sun shade, this process was repeated for seven more times to get it purified. --- **Sample G**

2. Plates of purified samples



2.3 Preparation of *Vediuppu Chendhuram* (VC): (Anubhoga Vaithiya Navaneetham, 3rd part, pg no: 76, 77)

a. Ingredients:

- ❖ Purified *Vediuppu* (Potassium nitrate) - 250g
- ❖ *Venkaya thallin charru* (Juice of modified leaves of onion) - Sufficient amount

b. Method:

Purified *Vediuppu* was taken in a suitable mud pot then the juice of onion leaves was poured in the pot up to the level of mouth. The mouth of the pot was closed by an appropriate mud plate and it was lutened by the mud paste cloth and dried under sunlight then the lutened vessel was subjected to pudam. After the process of the pudam, the *Vediuppu* was taken from the vessel and it was grinded and triturated by the above said juice for three hours. Then, it was made into cakes and dried. The dried cake was mounted on a mud plate and closed by another appropriate mud plate and lutened by the mud paste cloth and dried under sunlight. Then this lutened vessel was subjected for pudam by using four parts weighed vessels of cow dung cake. After completion of pudam, again the same process done for another one time. At last, we got a red oxide form of *Vediuppu* (*Vediuppu Chendhuram*) -**Sample H**

Plate 3: Onion leaves



Plate 4: Finished form of *Vediuppu Chendhuram*



2.4 Physico chemical evaluation

A. Chemicals:

Analytical grade chemicals were procured from Golchha Chemicals Ltd., Jamshedpur and Himedia laboratories, Mumbai.

B. Preparation of extract for preliminary basic, acidic radicals and biochemical studies:

5g of sample was taken in a 250 ml of clean beaker and 50 ml of distilled water was added to it. Then it was boiled well for about 10 min. Then it is allowed to cool and filtered in a 100 ml volumetric flask and made up to 100 ml with distilled water. This preparation is used for the qualitative analysis of acidic/ basic radicals and biochemical constituents in it.

C. Fourier Transform - Infra Red Spectroscopy study: This was done at SAIF, IIT Madras, Chennai-36 by the instrument made from Perkin Elmer – Spectrum One. For sampling techniques, we follow KBr method. The experimental procedure is described below.

- The sample was grounded using- an agate mortar and pestle to give a very fine powder.
- The finely powder sample was mixed with about 100mg dried KBr salt.
- The mixture was then pressed under hydraulic press using a die to yield a transparent disc (measure about 13mm diameter and 0.3mm in thickness), through which the beam of spectrometer passed.

D. Inductively coupled plasma optical emission spectrometry (ICP-OES) study:

Experimental Procedure: Done at SAIF, IIT Madras, Chennai-36

Sample preparation – Microwave Digestion

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

E. Scanned Electron Microscopy analysis (SEM): To evaluate grain size, particle size distributions, material homogeneity and inter metallic distributions. The SEM is carried out by using FEI-Quanta FEG 200-High Resolution Instrument done at SAIF, IIT Madras, Chennai-36

3. Results and inferences

3.1. Finished form of Vediuppu Chendhuram (VC)

The VC was prepared following strictly the method mentioned in the Siddha text. The Sample A was preferred among four raw samples and it was purified by three methods. The Sample E which was obtained by method 1 was preferred and used for the preparation of VC. The finished VC – Sample H gave positive results to all traditional quality tests (Table-1) for *Chendhuram* as mentioned in Siddha Gunapadam literature.

3.2. Physicochemical evaluation

A. Physical and chemical properties

The result of table 2 shows that the VC is light gold in colour and it is sparingly soluble in both water and acid which indicates the presence of silicate. The pH value implicates that VC and other samples are weak alkaline substance. The preferred raw *Vediuppu* – Sample A appears dull white crystal form, but the other sample E, F, G has pale white, pale brown, white colour respectively indicating the presence of silicate. While on heating and by flame test, we infer that the entire above sample mentioned in the table did not contains Copper and Carbonate particles. But the ash test gave the result that the all sample contains Sodium. From the table 3, we infer that all samples contain Sodium, Magnesium, Calcium, Potassium and Ferrous iron. But Ammonium is present only in *Vediuppu* which is purified by Cow's urine. Toxic heavy metals such as Copper, Zinc, Arsenic, Mercury and Lead are absent in this qualitative test of all samples. The table 4 depicts that all samples contains only phosphates and nitrates as acidic radicals. The result of table 5 shows the presence of starch and tannic acid in all samples. The therapeutic valued properties of alkaloids are present in VC only.

B. Fourier Transform - Infra Red spectroscopic Studies

The result of table 6 show that Sample A constitutes alkenes, alkanes, carboxylic acids, nitro compounds, amines and aromatics as functional groups. Sample B constitutes alkenes, alkanes, ketones, α,β unsaturated aldehydes, nitro compounds, carboxylic acids, aliphatic amines, alkyl halides and aromatic compounds. Sample C has alcohols, phenols, carboxylic acids, alkenes, alkanes, aldehydes, ketones, nitro compounds, aliphatic amines, alkylhalides and aromatics as functional group. Sample D has alcohol, phenols, carboxylic acids, alkanes, alkynes, primary amines, nitrocompounds. Cow's urine constitutes alcohols, phenols, alkynes, alkenes and arenes group. Lemon juice has aliphatic amines, carboxylic acids, aldehydes and aromatic compounds, alkynes and tri alkyl groups. Onion leaf juice constitutes alcohols, alkanes, amides, aldehydes, ethers, mono alkyl compounds as functional groups. The result of tables 7 shows the functional groups present in the samples. Sample E constitutes alcohols, phenols, alkanes, alkenes, carboxylic acids, phosphine, disulphide, aldehydes, ketones and aliphatic compounds. Sample F has amines, amides, alkanes, carboxylic acids, aromatic nitro and phosphine groups. Sample G has alkanes, alkenes, carboxylic acids, silane, esters, aromatic nitro, phosphine and aliphatic

amine groups. Sample H (VC) constitutes alkanes, alkenes, amides, aliphatic amines, alkyl halides, esters, aromatic nitro and phosphorus groups.

C. Inductively Coupled Plasma Optical Emission Spectrometric studies

The result of table 8 shows that all raw samples have the presence of Potassium as major constituent, Arsenic and Lead as trace amount. Among that, Sample A and B have high concentration of Potassium but least concentration of Arsenic and Lead. The result of table 9 shows that the sample after purified using Cow’s urine, Lemon juice and Egg white has the presence of Sodium, Potassium, Sulphur, Phosphorus, Calcium and Iron. But heavy metals such as Arsenic, Cadmium, Mercury and Lead are below the detection limit. Sample E has high concentration of essential minerals important for biological metabolism when compared with sample F and G. Further, this table depicts that the finished medicinal sample VC has heavy metal concentration under the detection limit and has required concentration of nutritional essential minerals. The concentrations of metals present in the sample E are decreased in processing and in end stage of prepared VC.

D. Scanned Electron Microscopic studies:

The plate 5 shows that the particles are stabilize, have irregular morphology and distributed in near nano range. VC has the particle size of 5µm.

Plate-5: SEM image of Sample H – VC

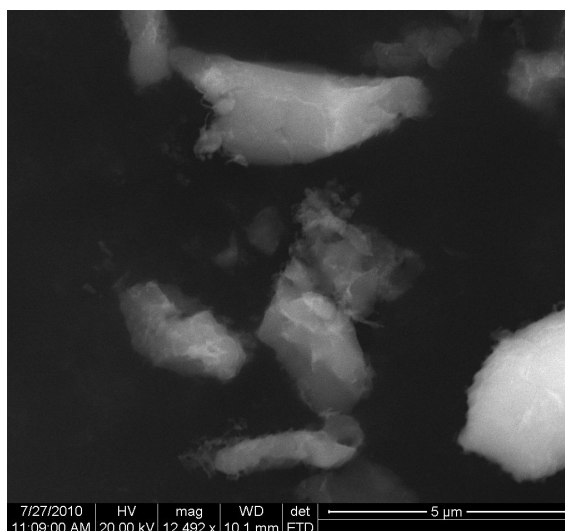


Table 1: Traditional Tests for formation of *Parpam*

S.No	Test
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- 01 Red in colour without any shiny appearance
 02 Tasteless and odourless
 03 Did not regain luster on heating again at same temperature
 04 Sample floats on water. Did not immediately immersed in water
 05 Not translucent
 06 Impinged in the papillary ridges when the sample rubbed in between Index finger and thumb

Table 2: Physical and chemical properties

S.No	Procedures	Sample A BP*	Sample E AP*	Sample F AP**	Sample G AP***	Sample H VC*
1.	Appearance & Colour	Crystalline, Dull white	Crystalline, Pale white	Crystalline, Pale brown	Crystalline, White	Fine powder, Light gold
2.	Solubility in water and Hcl	Sparingly soluble	Sparingly soluble	Sparingly soluble	Sparingly soluble	Sparingly soluble
3.	pH value	7.5-8.0	7.6-8.1	7.1-7.8	7.7-8.2	7.8-8.2
4.	Action on heat	No white fumes	No white fumes	No white fumes	No white fumes	No white fumes
5.	Flame test	No bluish green flame	No bluish green flame	No bluish green flame	No bluish green flame	No bluish green flame
6.	Ash test	Yellow flame	Yellow flame	Yellow flame	Yellow flame	Yellow flame

BP*- Before purification, AP*- After purification using Cow's urine,

AP**- After purification using Lemon juice, AP***- After purification using Egg white, VC*- Finished form of Vediuppu Chendhuram

Table 3: Test for Basic radicals

S.No	Procedures	Sample A BP*	Sample E AP*	Sample F AP**	Sample G AP***	Sample H VC*
1.	Test for Ammonium	-	+	-	-	-
2.	Test for Sodium	+	+	+	+	+
3.	Test for Magnesium	+	+	+	+	+
4.	Test for Aluminium	-	-	-	-	-
5.	Test for Potassium	+	+	+	+	+
6.	Test for Calcium	-	+	-	-	-
7.	Test for Ferrous iron	+	+	+	+	+
8.	Test for Copper	-	-	-	-	-
9.	Test for Zinc	-	-	-	-	-
10.	Test for Arsenic	-	-	-	-	-
11.	Test for Mercury	-	-	-	-	-
12.	Test for Lead	-	-	-	-	-

Table 4: Test for Acidic radicals

S.No	Procedures	Sample A BP*	Sample E AP*	Sample F AP**	Sample G AP***	Sample H VC*
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1.	Test for Sulphate	-	-	-	-	-
2.	Test for Chloride	-	-	-	-	-
3.	Test for Phosphate	+	+	+	+	+
4.	Test for Flouride & Oxalate	-	-	-	-	-
5.	Test for Nitrate	+	+	+	+	+

BP*- Before purification, AP*- After purification using Cow's urine,
 AP**- After purification using Lemon juice, AP***- After purification using Egg white, VC*- Finished form of Vediuppu Chendhuram

Table 5: Other constituents

S.No	Procedures	Sample A BP*	Sample E AP*	Sample F AP**	Sample G AP***	Sample H VC*
1.	Test for Starch	+	+	+	+	+
2.	Test for Reducing sugar	-	-	-	-	-
3.	Test for Alkaloids	-	-	-	-	+
4.	Test for Amino acids	-	-	-	-	-
5.	Test for Tannic acids	+	+	+	+	+
6.	Test for type of compounds	-	-	-	-	-

Table 6: FT –IR analyses of Raw Samples (Before purification) and other ingredients

Frequency, cm-1	Raw Samples				Cow's urine	Lemon juice	Onion leaf juice
	A	B	C	D			
3500–3200 (s,b)	-	-	+	+	+	+	-
3400–3250 (m)	-	-	-	-	-	-	+
3300–2500 (m)	+	+	+	-	-	-	-
3100–3000 (s)	+	+	+	-	-	-	-
3100–3000 (m)	+	+	+	-	-	-	-
3000–2850 (m)	+	+	+	+	-	+	+
2830–2695 (m)	-	-	+	-	-	-	-
2260–2100 (w)	-	-	-	+	+	-	-
1760–1665 (s)	+	-	+	-	-	-	-
1760–1690 (s)	+	-	-	-	-	-	-
1740–1720 (s)	-	-	-	-	-	+	-
1730–1715 (s)	-	-	-	-	-	+	-
1715 (s)	-	-	+	-	-	-	-
1710–1665 (s)	-	+	-	-	-	-	-
1680–1640 (m)	-	-	-	-	+	-	-
1650–1580 (m)	-	-	-	-	+	-	+
1600–1585 (m)	-	-	-	+	-	-	+
1500–1400 (m)	-	-	-	-	-	+	+
1370–1350 (m)	+	+	+	-	-	-	-
1360–1290 (m)	+	+	+	-	-	-	-
1320–1000 (s)	-	-	-	-	-	+	+
1300–1150 (m)	-	-	+	-	-	+	+
1250–1020 (m)	-	+	+	+	-	+	+
1000–650 (s)	+	+	+	+	-	+	+
950–910 (m)	-	-	-	-	-	+	+
910–665 (s, b)	+	+	+	+	+	+	+

900–675 (s)	+	+	+	+	+	+	+
850–550 (m)	+	+	+	+	+	+	+
700–610 (b, s)	-	-	-	-	-	+	+
690–515 (m)	-	-	-	-	-	+	+

Table 7: FT –IR analyses of Samples after purification and *Vediuppu Chendhuram*

Frequency, cm–1	Sample E AP*	Sample F AP**	Sample G AP***	Sample H VC*
3500–3200 (s,b)	+	+	-	-
3400–3250 (m)	-	-	-	+
3300–2500 (m)	+	-	+	-
3100–3000 (s)	-	-	+	-
3100–3000 (m)	-	-	+	-
3000–2850 (m)	+	+	+	+
1760–1665 (s)	+	-	-	+
1760–1690 (s)	+	-	-	+
1750–1735 (s)	+	-	+	+
1740–1720 (s)	-	+	+	-
1730–1715 (s)	-	+	-	-
1680–1640 (m)	+	+	+	-
1650–1580 (m)	-	-	-	+
1600–1585 (m)	-	-	-	+
1550–1475 (s)	+	+	-	-
1500–1400 (m)	-	-	-	+
1370–1350 (m)	-	-	+	+
1360–1290 (m)	-	+	+	+
1250–1020 (m)	+	-	+	+
1000–650 (s)	+	+	+	+
950–910 (m)	-	-	-	-
910–665 (s, b)	+	+	+	+
900–675 (s)	+	+	+	+
850–550 (m)	+	+	+	+

AP*- After purification using Cow’s urine,

AP**- After purification using Lemon juice, AP***- After purification using Egg white, VC*- Finished form of *Vediuppu Chendhuram*

Table 8: ICP-OES analyses of Raw Samples (Before purification)

Element	Raw Samples							
	A (17.35mg/25ml)		B (16mg/25ml)		C (18.10mg/25ml)		D (17mg/25ml)	
	Mean(mg/L)	Wt%	Mean(mg/L)	Wt%	Mean(mg/L)	Wt%	Mean(mg/L)	Wt%
K	688.35	98.3	628.12	98.30	704.412	97.30	660.25	97.30
Fe	BDL	-	BDL	-	BDL	-	BDL	-

Zn	BDL	-	BDL	-	BDL	-	BDL	-
As	70.00	1.00	64.10	1.00	14.10	2.0	62.10	2.0
Sn	BDL	-	BDL	-	BDL	-	BDL	-
Pb	35.00	0.5	32.00	0.5	7.00	0.7	25.00	0.5

Table 9: ICP-OES analyses of Samples after purification and *Vediuppu Chendhuram*

Element	Samples after purification			
	Sample E Mean (mg/L)	Sample F Mean (mg/L)	Sample G Mean (mg/L)	Sample H (VC) Mean (mg/L)
Na	5.250	0.280	0.180	1.698
P	25.90	15.60	5.10	4.081
S	15.10	5.10	2.10	5.321
K	728.210	708.20	688.20	117.25
Ca	20.07	10.17	80.17	5.092
Fe	1.670	0.670	0.120	-
As	BDL	BDL	BDL	BDL
Cd	BDL	BDL	BDL	BDL
Hg	BDL	BDL	BDL	BDL
Pb	BDL	BDL	BDL	BDL

4. Discussion

The *Vediuppu Chendhuram* is used as diuretic drug in the treatment of impaired renal functions under Siddha medicine. Most of the literature evidences show that the *Vediuppu* has good effect on renal disorders such as Neerkattu, Neererichal, etc (*Siddha Materia medica*). This *Vediuppu* belongs to the Salt kingdom and used as ingredient in several formulations. Among those formulations, this *Vediuppu* formulation (VC) with the composition of purified *Vediuppu* and onion leaf juice has been chosen for the present study. Because this formulation is under practice for long time and the ingredients of this formulation is available in plenty and cheap, we chose to analyze its elemental constituents. Focusing this, we underwent the study.

Preparation of *Chendhuram* is a very complex procedure. However, this process has been followed strictly until today for maintaining the safety, quality and efficacy of the product. Procuring the *Vediuppu* from four different sources such as Sample A from country drug store at Nagercoil, Sample B from country drug store at Chennai, Sample C from Chandhanmal Chemical lab at Chennai, Sample D from Stone Quarry at Dindigul. The FT-IR study (Table - 6) revealed that the functional group such as alkanes, alkenes, primary and secondary amines, aromatic and nitro compounds, alkyl halides in all samples. Carboxylic acid is present in sample A, B and C. Carbonyl groups are present in sample A and C. Alcohol and Phenol groups are present in sample C and D. Aldehydes and Ketone are present only in sample C. The Sample A only constitutes major functional groups. The ICP-OES study (Table - 8) showed that sample A had high concentration of Potassium and traceable amount of Arsenic and Lead. Among the four raw samples, the FT-IR and ICP-OES study strongly insisted that sample procured from Nagercoil (Sample A) was suitable for preparing *Vediuppu Chendhuram*. This *Vediuppu* is a dull white, crystalline salt and sparingly soluble in both water and HCl. Its pH value ranges from 7.5 to 8.0. Apart from the presence of Potassium nitrate, some essential therapeutic compounds such as Sodium, Magnesium, Ferrous iron, Starch and tannic acid. But toxic heavy metals are not present in this sample (Table – 2, 3, 4 & 5).

The *Vediuppu* was purified by three different methods such as by using Cow's urine, Lemon juice and Egg white. Soaking of *Vediuppu* in Cow's urine for one day resulted in pale white colour with addition of Ammonium, Phosphorous, Sulphur, Calcium, Ferrous iron, Phosphine and disulphide group rather than purification by other method (Table 1-6). Heavy metals like Arsenic, Cadmium, Mercury and Lead were below the deduction limit. This purified *Vediuppu* soaked in Cow's urine was taken for *Chendhuram* process (Table 9).

Vediuppu Chendhuram, the process of deep oxidation of *Vediuppu* triturated by onion leaf juices sealed in earthen pots was carried out in a traditional furnace (Pudam) narrated in the literature *Anuboga Vaithiya Navaneedham*. Onion leaf juice has the presence of alcohol, aldehydes and ether group. During the oxidation, the product obtained contained the oxide form of Potassium nitrate. The high temperature inside the sealed earthen pots supports the conversion of Potassium nitrate into Potassium oxide, which should result into a high concentration of Potassium oxide in the final product. The final products has the properties of no luster, fills the finger lines when taken between index finger and thumb, floats on water, easily soluble in water and HCl and did not regain luster on heating again. The bio chemical study revealed the presence of potent therapeutic valued alkaloids in the absence of ammonium. The scanning electron micrograph (Plate 5) revealed size stabilization of particles on process and the presence of nanosized particles. Nanosized particles can attach with the cell surface and can diffuse readily inside the cells. Thus, the size of particle is able to influence the efficacy. The ICP analysis revealed heavy metals like arsenic, cadmium, mercury and lead in *Vediuppu Chendhuram* were below the deduction limit (Table 9). It was also observed that potassium, sodium, sulphur, phosphorus and calcium were in reduced concentration compared to the purified *Vediuppu*. This was obtained by continuous triturating using onion leaf juice and on oxidation process. From all the observations, it can be concluded that repeated trituration and oxidation cycles definitely impart specific physicochemical characters to *Vediuppu Chendhuram*, which might be responsible for the safety and potent therapeutic activity of this medicine.

5. Conclusion

Inspite of the long usage of *Vediuppu* in the system, the confirmation of nanoparticle size and the contents of heavy metals are under the deduction limit favours the *Vediuppu Chendhuram* as a safer drug under Siddha system.

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