

Physiochemical Characteristics of Termite Mound Clay and Potter Wasp Nest Clay used in *Ayurveda* and Traditional Medicine in Sri Lanka: A Critical Evaluation

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Abstract: *Ayurveda is a sacred precept of rule or commandments which guides about the all aspects of life. Traditional medicine is the Health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain wellbeing. Termite mound clay and potter wasp nest clay are used by Ayurveda medical practitioners and traditional medical practitioners in Sri Lanka. Classical manuscripts of Sri Lanka are enriched with traditional knowledge for the management for skin diseases, bites of bees, mosquitos, poisonous conditions, tonsillitis, edema, trauma etc. As per the reference to these manuscripts, termite mound clay and potter wasp nest clay has many therapeutic actions and uses. Therapeutic action of these two clay types are mentioned as follows; cooling and soothing effect helps to dryness of the skin, to purify the skin as scrubs, as powerful absorptive agent to treat for topical maladies. Pharmaceutical products containing these two clay types have been used for different kind of diseases in Ayurveda. Research objective of this study was to analyze physical and chemical properties of the termite mound clay and potter wasp nest clay. Data was assimilated by using available literature surveys on physical and chemical parameter analysis tests. Clay types were collected and chemical compounds and physical properties of each sample were analyzed. Results showed different chemical compositions relevant to the zone. According to the analyzed data, the clay collected from potter wasp nests from dry zone contained water extractable P (phosphorus) 29.94 (9.40) ppm. These phosphates are readily available in plants. Further experimental and clinical studies are needed to identify the different mineral values of these different clay types.*

Key Words: Manuscripts, Physical parameters, Chemical Parameters.

1. INTRODUCTION:

Potter wasp build their nests from clay which in turn is named as potter wasp clay. In contrast, the clay used by termites to build their nests is known as termite mound clay. Several researches have been carried out in different countries on these clay types but none has been done to determine the physical and chemical values of these two types of clay relevant to soil samples obtained in Sri Lanka. Chemical composition and physical value of these two clay samples differ from other clay types. Termite mound clay and potter wasp nest clay are used by *Ayurveda* medical practitioners and traditional medical practitioners in Sri Lanka. Clay types enriched with cations are widely used as major mineral ingredients in pharmaceutical science of *Rasashastra* (alchemy), *Samhita Grantha* and *Ayurveda* pharmacopeia India and Sri Lanka. Pharmaceutical products containing these two clay types have been used for different kind of diseases in *Ayurveda*. Different types of prescriptions including these clay types are mentioned in *Caraka Samhita* ^[1]. Some articles have highlighted the medicinal use of animal products from the perception of historical literature, signifying the importance of these reports to traditional medicine ^[2]. Few Literature have been recorded that the medicinal use of insects and derived products is very common in ancient practices ^[3]. Spectroscopic data revealed the presence of SiO₂, and Al₂O₃ in appreciable quantities, while Fe₂O₃, CaO and MgO were in minor quantities in potter wasp nest clay. Infrared spectral analysis showed that nest clay samples are composite of quartz, feldspar and kaolinite. It is hard to find local research articles about physicochemical properties of these medicinally important clay types.

1.1. OBJECTIVE:

Objective of this study is to analyze physical and chemical properties of termite mound clay and potter wasp nest clay.

2. MATERIALS AND METHODS:

The Literature study was carried out by assimilating and compiling the data from authentic textbooks, various websites and research articles. Physiochemical study was carried out on the clay types which were collected from Galle (wet zone) and Hambanthota (Dry zone) of Sri Lanka by using various standard parameters such as Litmus test, Total Ash Value and X-ray fluorescence (XRF) etc.

3. RESULT:

Acharya Caraka has mentioned a therapy named *Valmīkamṛttikādyutsādana* in sanskrit language for spasticity. One of the recipes contains termite mound clay, the root, fruits and barks of *Pongamia pinnata* (karanja) and brick made to a powder. This should be used for dry rubbing frequently, for spasticity of the thigh muscles.^[4] The physician could administer this therapy with using the root of *Withania somnifera* (Ashvaganda), *Calotropis gigantean* (Arka), *Azadirachta indica* (Nimbha) or *Cedrus deodara* (Devadara). Any one of these drugs may be mixed with honey, *Brassica campestris* Linn (Sarsapa) and termite mound clay before being used in a form of a thick paste as an external preparation for dry rubbing or massage. *Justicia adhatoda* (Vatsaka), *Ocimum sanctum* Linn (Surasā), *Saussurea lappa* (Kuṣṭa), aromatic drugs like *Erythroxylum monogynum* (agil), *Zanthoxylum alatum* (tumburu), *Moringa oleifera* (śigru), *Capparis spinosa* (himsrā), root of *Calotropis gigantean* (Arka), termite mound clay and *Ocimum basilicum* (Kuteraka) should be made to a paste by adding yoghurt and rock salt. A physician conversant with the line of treatment may administer this paste for external application for the cure of spasticity of the thighs.^[5] The drug formulation mentioned in Ola leaf manuscript in Sri Lanka (Books series of *talpate piliyam*) states the paste of sulphur (Gandaka), cinnamon bark (tvak) and termite mound clay obtained from the top of the ant hill better to cure different types of abscess (Arbudha).^[6] In addition to, it has mentioned purified mercury (*rasadiya*), fruit of *Cinnamomum camphora* (tvak), worm casts (*Panu pas*), powder of brick powder ground with the juice of *Caryota urens* (Hoajavrikṣa) used for disease called yaws.^[7] According to *Acharya Suśruta*, application of a paste of termite mound clay made with cow urine acts as an antidote for bees and mosquito bites.^[8] Traditionally, clay minerals are mixed with water and used for cosmetic and skin protective purposes. According to literature review common composition of normal clay sample was 20.16% of Alumina (Al_2O_3), 0.59% of Calcium Oxide CaO, 7.47 of Iron Oxide Fe_2O_3 , 0.73% of Magnesium Oxide MgO, 55.65% of Manganese Oxide MnO_3 , 15.43% of other elements. Likewise, Termite clay and Potter wasp clay enriched with soluble salt, exchanging basic cations, and calcium carbonate were compared to the adjacent topsoil.^[9] Four clay samples from each geographical areas of Galle (wet zone) and Hambanthota (dry zone) were collected. (Figure 1).



Figure 1: Map of Sri Lanka: Galle (wet zone) and Hambanthota (Dry zone)

- **Tests for analyze physical and chemical parameters:**

Litmus test, Determination of pH, moisture percentage, and Total Ash Value were done for physical parameter analysis. In order to detect the chemical compositions of the wasp nests and Termite mound clay samples were analyzed by X-ray fluorescence (XRF). The harvested wasp nests were pulverized into fine powder and then passed through a 2 mm sieve prior to any analysis.

- **Determination of pH value:**

- **Litmus test**

pH value of each sample was tested and the test was repeated for three times and an average value was obtained.

➤ **Moisture percentage**

The samples were measured once obtained and then they were measured after leaving them in the oven to dry. The reduction in mass was obtained which was considered equivalent to the amount of moisture in the sample.

➤ **Ash value**

The ash value was calculated based on the relationship that the total ash content equals to the weight of the ash divided by the weight of the original sample multiples by 100%

Table 1: Analyzed report of physical properties of Clay from Dry and Wet Zone

Type of Clay	Litmus test	pH	Moisture percentage	Ash value
Termite mound clay (Dry Zone)	Blue litmus turns to red	4.2	13%	0.34%
Termite mound clay (Wet Zone)	Blue litmus turns to red	4.7	20%	0.39%
potter wasp nest clay (Dry Zone)	Blue litmus turns to red	5.1	1.3%	0.25%
potter wasp nest clay (Wet Zone)	Blue litmus turns to red	5.5	2.3%	0.27%

Termite mound clay and potter wasp nest are show different chemical composition according to the zone. Indirectly it relates to the therapeutic action.

Table 2: Analyzed report of clay collected from Dry Zone

Sample name	Extraction with water	Extraction with carbonate	Extraction with Sulphuric acid
Potter wasp nest clay (dry)	29.94(9.40)	28.28(7.06)	3835.66(2211.18)
Termite mound clay (dry)	59.88(3.93)	244.51(49.39)	6694.94(35.28)

According to this analysis potter wasp nest clay collected from dry zone contained water extractable P (phosphorus) 29.94(9.40) ppm. These phosphates are readily available in plants. Sodium carbonate extractable P was 28.28(7.06) ppm. Termite mound clay contained 59.88(3.93) ppm of water extractable P (readily plant available P), 244.51(49.39) ppm of readily available P and phosphate bound to aluminum, iron hydroxide or calcium carbonate (sodium carbonate extractable P).

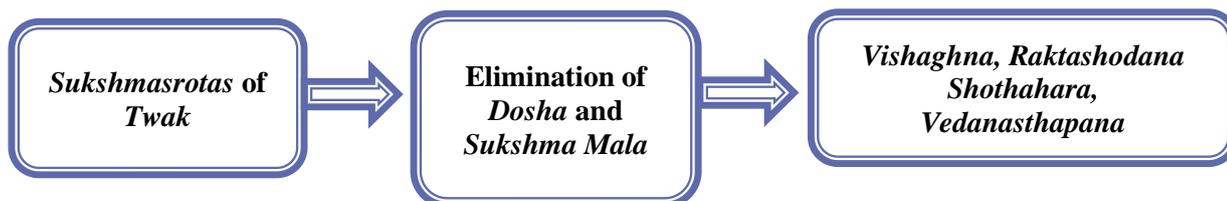
Table 3: Analyzed report of clay collected from Wet Zone

Sample name	Extraction with water	Extraction with carbonate	Extraction with sulphuric acid
Potter wasp nest clay (wet)	296.06(32.93)	*652.03	**
Termite mound clay (wet)	26.61(4.70)	196.27(9.41)	1215.90(214.06)

Potter wasp nest clay collected from the wet zone gave 296.07(32.93) ppm of readily plant available P (water extractable P). *652.03ppm of readily available P and phosphates bound to aluminum, iron hydroxide or calcium carbonate. Termite mound clay contain 26.61(4.70) ppm of readily plant available P. 196.27(9.41) ppm sodium carbonate extractable P and 1215.90(214.06) ppm of sulphuric extractable P.

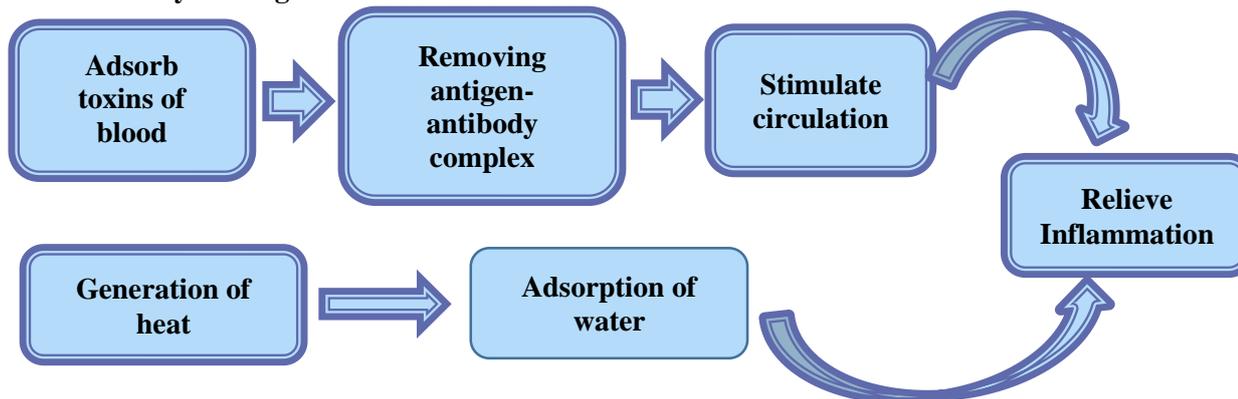
4. DISCUSSION:

Possible Pathway of drug distribution and function: according to Ayurveda



Properties of these clay move through the *Sukshmasrotas of Twak* and eliminate the vitiated *Dosha* and *Sukshma Mala* by exerting the actions of *Vishaghna, Raktashodana, Shothahara* and *Vedanasthapana*.

Possible Pathway of drug distribution and function:



These clays are capable of adsorbing toxins when applied topically from skin. Also they can exert heat and adsorb extra water in the circulation. Both ways can stimulate circulation and reduce inflammation. These adsorptive and absorptive properties claim to be the reason for healing variety of tropical diseases. Thus, absorption or adsorption capacity can be intention of using termite mound clay and potter wasp nest clay for curing edema by Sri Lankan traditional practitioners. As per the data revealed from different research articles and events of history, it indicates that Termite mound clay and Potter wasp nest clay are used for treat the diseases in different circumstances due to their significant medicinal values. Even though they have used these two clay types as treatment, sufficient research has not been conducted to evaluate their physical and chemical values. In this study, clay samples were selected from the wet and dry zones of Sri Lanka. Wet zone termite mound clay sample recorded a higher moisture content (20%) compared to the potter nest wasp sample obtained from the wet zone. The pH value of potter wasp nest clay was small percentage higher than the pH value of termite mound clay sample which was selected from wet zone. According to analysis potter wasp nest clay collected from dry zone contain water extractable P (phosphorus) 29.94 (9.40) ppm. By this study it was made clear that termite mound clay contains the highest value of readily plant available P 59.88 (3.93) ppm.

5. CONCLUSION:

Termite mound clay is more acidic than Potter wasp clay and out of the two samples, the samples in the dry zone are comparatively more acidic. Also, the termite mound clay has a higher moisture percentage than potter wasp clay. Other than that, the ash value of the termite mound clay is higher than that pf potter wasp clay. It was unable to find research articles about the reason of using potter wasp nest clay and termite mound clay by Sri Lankan traditional physicians and Ayurvedic medical practitioners. Traditional physicians use these recipes on the basis of their indigenous knowledge and clinical practices in Sri Lanka.

REFERENCES:

1. Trikamji, Y. (2009). Caraka Samhita of Agnivesha revised by Charaka & supplemented by Dridhabala with Ayurveda Dipika commentary by Chakrapani data. *Chikitsa Sthana*, Chapter 27. (pp. 615) Varanasi, Chaukhamba Surabharati Prakashana.
2. Antonio, R. L., Kozasa, E. H., Galduróz, J. C. F., Dorjee, Y., Kalsang, T., Norbu, T., & Rodrigues, E. (2013). Formulas Used by Tibetan Doctors at Men-Tsee-Khang in India for the Treatment of Neuropsychiatric Disorders and Their Correlation with Pharmacological Data. *Phytotherapy Research*, 27(4), 552-563.
3. Rodrigues, E., Lago, J. H., Santos, J. D. F., & Bitencourt, A. L. V. (2018). Nests of “caba-leão” wasps (*Sceliphron* sp., Sphecidae) used in traditional medicine by riverine communities of the Jaú and Unini Rivers, Amazon, Brazil: ethnopharmacological, chemical and mineralogical aspects. *Revista Brasileira de Farmacognosia*, 28(3), 352-357.
4. Trikamji, Y. (2009). Caraka Samhita of Agnivesha revised by Charaka & supplemented by Dridhabala with Ayurveda Dipika commentary by Chakrapani data. *Chikitsa Sthana*, Chapter 27. (pp. 615) Varanasi, Chaukhamba Surabharati Prakashana.
5. Trikamji, Y. (2009). Caraka Samhita of Agnivesha revised by Charaka & supplemented by Dridhabala with Ayurveda Dipika commentary by Chakrapani data. *Chikitsa Sthana*, Chapter 27. (pp. 615) Varanasi, Chaukhamba Surabharati Prakashana.
6. Editors, (1994), *Talpate piliyam*, Part 6, Department of Ayurveda, Colombo. (pp. 22)
7. Editors, (1994), *Talpate piliyam*, Part 6, Department of Ayurveda, Colombo. (pp. 45)
8. Trikamji, Y. (2009). *Susruta Samhita*, revised by Susruta commentary of Dalhana. *Kalpa Sthana*, Chapter 8, (pp. 589) Varanasi, Chaukhamba Surabharati Prakashana.
9. Chaolin, Fang., Varenyam.Achal.(2020). Physio-Chemical Aspects and Complete Bacterial Community Composition Analysis of Wasp Nests, *Sustainability journal*, 12, 2652, p, 3.