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ANALYSIS OF METAL CONTENTS IN THE CLAYS OF ONE HILLY AND TWO VALLEY VILLAGES OF MANIPUR

Laishram Premjit Singh[1]*, Sagolsem Lokhol Singh[2], M. Premchand Singh[3], Y. Sexona Singh[4]

*[1]Research Scholar, Arunodaya University, Arunachal Pradesh, and Asst. Prof. & Head, Department of Chemistry, South East Manipur College, Komlathabi, Chandel District, Manipur.

[2]Asso. Prof. & Head, Department of Chemistry, Thoubal College, Thoubal, Manipur (Retd.)

[3,4]Asst. Prof. Dept. of Chemistry, South East Manipur College, Komlathabi, Chandel District, Manipur.

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***Corresponding Author**

Laishram Premjit Singh

Research Scholar, Arunodaya University, Arunachal Pradesh, and Asst. Prof. & Head, Department of Chemistry, South East Manipur College, Komlathabi, Chandel District, Manipur.

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ABSTRACT

The presence of metal oxides and carbonates, either naturally occurring in the clay or added, gives distinct colours, resulting in a better pottery product. Metal oxides produced by the metals during the process of firing can give variant colours, and these metal oxides are responsible for the rich and diverse palette of colours seen in glazed pottery. With an aim at identifying the metals present in the clays used by the traditional potters for a better-looking and durable production, the investigation has been conducted. During the investigation, clay samples collected from different sites of Thongjao S/C village, Kakching District; Nongpok Sekmai Village, Thoubal District, both in valley areas and from different layers of Chandonpokpi S/T Village under Chandel District of Manipur (Hilly Area) were analyzed by using the Atomic Absorption Spectroscopy method. It was observed that there is a difference in their elemental components and also in texture, particle size, and colour. These clays have pH values ranging from 4.5 to 6.9 and are found to contain 0.67 % to 3.546 % organic carbon,

260 to 565 Kg Ha^{-1} nitrogen, 4.25 to 78.5 Kg Ha^{-1} phosphorus and 22.4 to 78.5 Kg per Hectare of potassium. Determination of contents in ppm for the metals viz Zinc (Zn), Iron (Fe), Manganese (Mn) and copper (Cu) in the different clay samples using the Atomic Absorption Spectroscopy method was performed.

KEYWORDS: Zinc (Zn), Iron (Fe), Manganese (Mn) and copper (Cu), Atomic Absorption Spectroscopy method.

INTRODUCTION

Clay refers to a naturally occurring material that is composed of fine-grained minerals. It is like plastic when wet, and it becomes hard when dried or fired. Clay minerals have been used for making construction materials, pottery, and also for therapeutic purposes since prehistoric times.[1] It is observed in the clay of Manipur that Inceptisols are the dominant soils, followed by Ultisols, Entisols, and Alfisols, occupying 38.4%, 36.4%, and 23.1% of the total geographical area of Manipur, respectively. Lake and marshy land occupy 2%. Generally, the soils have a clayey texture with grey to pale brown colour. The hill soils are rich in organic carbon (1 - 3%) in the topsoil but poor in phosphorus and potassium.

Potters are compromising traditional techniques by using modern technology. It utilizes traditional tools, such as the bottom flattener, wooden peddle, anvil, cloth, and finishing strips, and also employs improved Kilns and an electric potter's wheel.[2] The female potters excel with the naked hand in molding and peddle-beating techniques, duly decorated with cord-marked impressions on the body parts of the vessels. Both of these ceramics have been traded through Southeast Asia and beyond since Neolithic times.[3] Clays have different influences on the properties as clay minerals modify the properties of Construction materials[5,6] while the mechanism of geopolymers made from clay is not well understood.[7] Geopolymers are used as a construction material.[8] In recent years, a considerable amount of research has been done on fly ash-based geopolymers.[9]

Normally, brick manufacturers define clays based on their particle sizes. It consists mainly of fine particles of hydrous aluminum silicates and other minerals.[10] In the pressure of a small amount of Al_2O_3, SiO_2, MgO, etc., as well as organic matter, more clay minerals can be incorporated into clay.[11,12]

Clay composition also plays a big role in the application of the cosmetics industry. Clays with silicon can help in hydration, inflammation, and skin regeneration. Those with aluminum can absorb melanium and disperse pigment, while antiseptic, antibacterial, and regeneration activities were found in clays containing calcium, titanium, iron, and potassium. Most clay minerals contain a mixture of elements as Oxides, Carbonates, Kaolinite, Chlorides, and Phyllosilicates. Some clay minerals are used in toothpaste as abrasives or polishing agents or to provide desensitization. Micas, perhaps one of the better-known clay minerals, are used in makeup as lipstick and eyeshadow.

The Thongjao Schedule cast village located under Waikhong Sub-Division of Kakching District in the state of Manipur is a pottery village. Pottery is the primary occupation of the villagers, particularly the women. The present study on the operational Sequence analysis of pottery making in Nongpok Sekmai village of Thoubal District describes the process of pot making, starting from raw material, preparation of the pots, firing, and treatment after firing with colour. The pot-making processes of both Thongjao and Nongpok Sekmai are mostly the same.

The art of applying Chandon, as observed by the Manipuri meiteis, is rather an extension of the philosophical and religious beliefs. Chandan is made from natural soil in Chandonpokpi village, Chandel District, Manipur. Manipuris in the medieval period undertook the custom of applying Chandon, more specifically on the forehead, in all religious and ritual functions.

The determination of the mineral contents of Zinc, Iron, Manganese, and Copper in different clay samples is performed using Atomic Absorption Spectroscopy (AAS).

MATERIALS AND METHODS

The soil samples were collected from three locations, namely Chandonpokpi (hilly area), Thongjao, and Nongpok Sekmai (Valley areas), Manipur, India. All the samples were stored in different-colored polythene bags for further analysis.

Thangjao, a scheduled caste village located in Waikhong Sub-division of Kakching district (24 ° 48' N latitude and 93° 98' E longitude) in the state of Manipur, is a pottery village. The nearest town is Kakching, which is about 15 km from Thongjao. The soil type of Thoubal and Kakching districts generally contains loam, small rock fragments, sand, and sandy clay, and

is varied. The region experiences a subtropical climate receiving 1500 mm of annual rainfall and temperatures ranging from 10°C to 38°C.

Nongpok Sekmai is situated at a distance of about 35 km from Imphal in the Thoubal District of Manipur, India. On the western side of the village near the Gwarok hill, the occurrence of clay is an important geological feature. Women of the Nongpok Sekmai excel in the craft of pottery making. Apart from other economic pursuits, the village is segmented into three different hamlets such as Southern, Middle, and Northern. The clay deposited area is under the custodianship of a custodial Goddess called the Kamphang Lairembi Ima.

Chandonpokpi S/T village is located in the Tengnoupal district in Manipur, India. The district has a geographic area of 1,213 sq. km. The Tengnoupal district (24°19′41″N 93°59′10″E / 24.328°N 93.986°E) is situated in the southern part of Manipur, bounded by Myanmar on the east, Thoubal and Kakching districts on the west, Kamjong district on the north, and Chandel district on the west. The region experiences a subtropical climate, receiving 2000 mm of annual rainfall with temperatures ranging from 10°C to 38°C. The soil type is mostly red ferruginous, varying from fine loamy to sand in texture and deep in Soil depth.

SAMPLE PREPARATION

Clay samples were collected from different places, viz Chandonpokpi, Thongjao, and Nongpok Sekmai, with a clean small spade from 0-30 cm depth at each sample location in the month of February 2024. These samples (5 in number) were collected using gloves to avoid any kind of contamination, thoroughly homogenized to form a composite sample, air-dried, finely powdered using a mortar and pestle, kept in an oven at 70°C for 24 hours, packed in small plastic containers, and kept in a desiccator for laboratory analysis.

RESULTS AND DISCUSSIONS

The results of the determination of the Zn, Fe, Mn, and Cu in the clay soils are presented in Table 1.

SAMPLE ANALYSIS REPORT

Table: 1

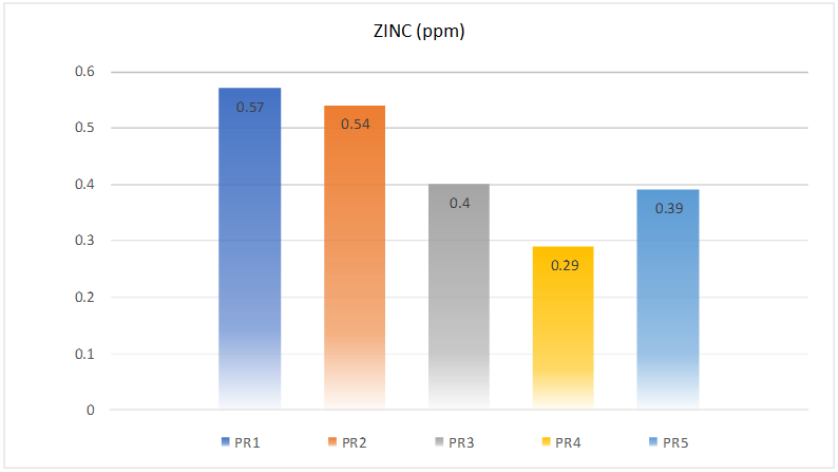
Sl. No	Sample ID	Type	Zn(ppm)	Fe(ppm)	Mn(ppm)	Cu(ppm)
1	PR1	Clay	0.57	28.00	5.93	1.23
2	PR2	Clay	0.54	42.48	6.69	1.04
3	PR3	Clay	0.40	1.81	0.38	0.04

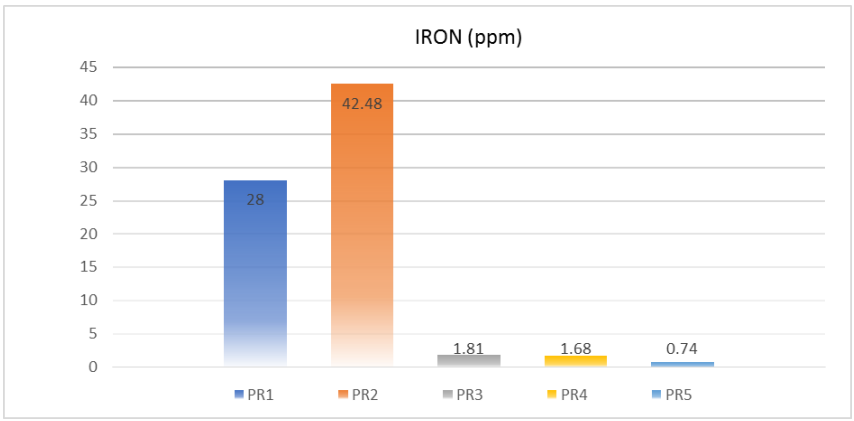
4	PR4	Clay	0.29	1.68	0.59	0.02
5	PR5	Clay	0.39	0.74	0.50	0.02

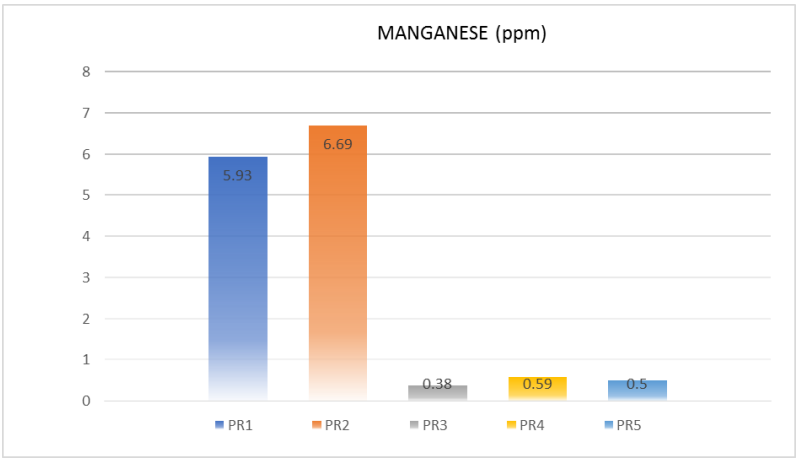
PR1= Thangjao Clay; PR2 = Nongpok Sekmai Clay; PR3 = Chandonpokpi First Layar Clay; PR4 = Chandonpokpi Second Layer Clay; PR5 = Chandonpokpi Third Layer Clay.

The samples were collected from different sites of Thongjao s/c, Nongpok Sekmai and Chandonpokpi s/t villages. The high content of Fe(28.00) and Mn(5.93) and the low content of Cu(1.23) and Zn(0.57) from the samples of Thongjao village; the high content of Fe (42.48) and Mn (6.69), the low content of Zn (0.54) and Cu (1.04) from the clay samples of Nongpok Sekmai were observed. Also, the high content of Fe(1.81), the low content of Zn (0.40), Mn (0.38) and Cu (0.04) from the Chandonpokpi first layer; the high content of Fe (1.68) and the low content of Zn (0.29), Mn (0.59) and Cu (0.02) from the second layer of Chandonpokpi while Zn (0.39), Fe (0.74), Mn (0.50) and Cu (0.02) are found as low content from the third layer of Chandonpokpi area, respectively.

Comparison of the mineral contents in the five different samples is given in Figure 1 below







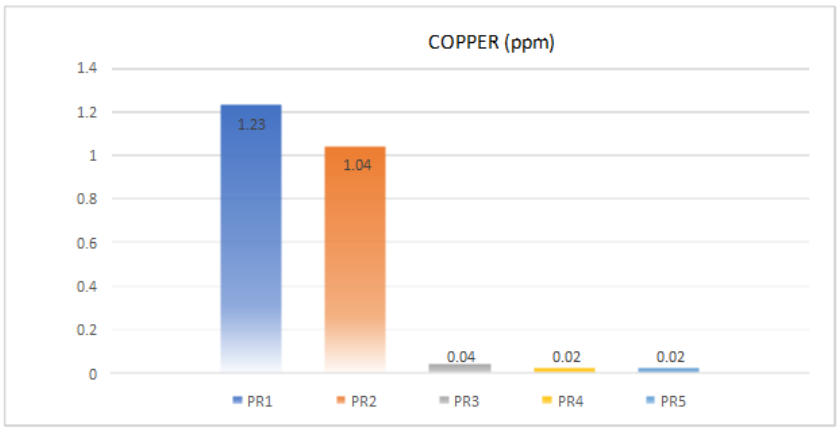


Fig. 1: Comparing the contents of Zinc, Iron, Manganese, and copper, etc. in the five samples.

Zinc possesses anti-inflammatory and antiseptic properties, and thus is widely used in various anti-acne medications and in cosmetic products designed for oily skin. It also has excellent regenerative and sunscreen properties.

Iron is the most common coloring agent in Ceramics; its Oxidation state is sensitive to the firing atmosphere, which creates a Spectrum of colors. It is antiseptic and catalyses cell renewal. Iron in clay affects its properties, including Ceramic Strength, with more iron resulting in a darker color.

Manganese can produce a protective and regenerative effect, stimulating the production of collagen and neutralizing free radicals due to its antioxidant properties. This can make the skin smoother, help regulate skin cell metabolism, cleanse the skin, and eliminate acne.

Copper is another important mineral for the skin, as its deficiency can slow down skin regeneration after damage. Skincare products with copper make the skin thicker, restore the structure of collagen and elastin fibres to make the skin firm and elastic, and speed up the healing of various skin injuries.

CONCLUSION

The clays of Thongjao S/C village and Nongpok Sekmai village are suitable for making different types of earthenware. The clays of Chandonpokpi S/T village contain minerals like zinc, manganese, copper, and iron, indicating possibilities for making skin care products. However, a detailed technical study will be needed for making it successful.

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