

# Characteristics of Kaolin Clay on Alluvial Formation Subdistrict Mataraman Based on Physical Properties and Chemical Properties

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**Abstract.** The kaolin clay deposit is found in the Quarter Alluvium Formation (Qa) which is located in the Mataraman Subdistrict and around Banjar Regency, South Kalimantan Province, with a monoclinic geological structure. The purpose of this study was to identify types of clay minerals and physical and chemical characteristics. The analytical method used in this study is the method of analysis of physical properties and chemical properties. The study area clay has physical characteristics, elastic clay, easy to form with a mixture of sand and cricket such as quartzite and white. Based on the results of XRD analysis, the types of clay minerals found were Kaolinit, Mica and Quartz, the chemical requirements of the clay of the study area could be used as material for making ceramics and pottery.

**Key words :** *Alluvium, clay, kaolin, banjar regency, ceramic*

## 1 Introduction

Mataraman Subdistrict with an area of 466,850 ha with an area morphology in the form of a weak-medium wavy plain with general slope angles approximately 10-30 ° and a difference in the relief height of a corrugated surface is estimated to be 8-15, plains of swamp land in the northern part of the region and geological conditions in the form of deposition basins containing alluvial deposits. In this area has the potential of clay excavation material that has not been used optimally, therefore with consideration of the potential economic value of the existing clay, it is necessary to study the clay. It is hoped that this research can identify the types of clay minerals and physical and chemical characteristics in the Quarter Alluvial Formation in Mataraman Subdistrict. Data on the type and characteristics of these clays can be used to increase the use value of clay. The clay comes from weathering of the earth's crust which is mostly composed of feldspatic rocks, consisting of granite and igneous rocks. The earth's crust consists of elements such as silicon, oxygen, and aluminum. In determining clay minerals can be carried out by methods based on chemical properties and methods based on physical properties with X-ray use, Sastiono (1997) and Sjarif (1991). Kaolin clay is a period of rock composed of clay material with a low iron

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content, and generally gray and white. Kaolin has a hydrous aluminum silicate composition ( $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ ), with accompanying minerals.

## 2 Methodology

Data collection regarding mineral identification and clay characteristics in the study area was carried out by conducting field observations and laboratory analysis. Megaskoping observations were carried out on samples to determine the physical properties of clay. This is done by analyzing the color, grain size, clay properties when mixed with water. Clay mineralogy is known by the analysis of X-ray Diffractometry (XRD) on 6 clay samples which are metamorphic rock. The preparation step is done by separating the clay soil sample and taking the clay fraction by centrifugal separation. XRD analysis was carried out in three treatments, namely air-dried, ethylene glycolated, and heated at  $550^\circ\text{C}$  in sequence. Geochemical analysis in the form of X-Ray Fluorescence (XRF) analysis was also carried out on clay samples. This analysis was carried out to analyze the main elements and trace elements along with their concentration on kaolin deposits using spectrometry methods. Currently XRF is the most common method of analysis in determining major elements and trace elements in rock samples.

## 3 Result and discussion

### 3.1 Physical Properties of Clays

The results of physical properties of kaolin clay samples obtained from Specific Gravity 2.56 - 2.62 gr, Water Content 11.81 - 41.43%, Atterberg Limits (Liquid Limit) 39.50 - 47.40%, (Plastic Limit) 19.54 - 24.78%, (Plasticity Index) 16.16 - 25.26%. For more details, can be seen in Table 1 and 2 below .

**Table 1.** Physical Test Results of Kaolin Clay

No	Sampel No.	CH-04	CH-06	CH-07	CH-11	DH-03	DH-08
1.	<i>Specific Gravity (gr)</i>	2.59	2.57	2.53	2.59	2.62	2.56
2.	<i>Water Content (%)</i>	25.09	11.81	25.57	32.95	35.16	23.79
3.	<i>Atterberg Limits</i>						
4.	<i>Liquid Limit (%)</i>	39.60	40.50	39.50	42.00	44.80	47.40
5.	<i>Plastic Limit (%)</i>	23.44	21.65	21.45	20.74	19.54	24.78
6.	<i>Plasticity Index (%)</i>	16.16	18.85	18.05	21.26	25.26	22.62

**Table 2.** Analysis of Sieve

No	Kode Sampel	Mesh 4	Mesh 10 – 100	Mesh 200
		Opening 4.750 mm	Opening 2.000 – 0.149 mm	Opening 0.074 mm
		Gravel (%)	Sand (%)	Silt-Clay (%)
1	CH-04	-	5.07	94.93
2	CH-06	-	4.45	95.55
3	CH-07	-	4.03	95.97
4	CH-11	-	2.06	97.94
5	DH-03	-	1.67	98.33
6	DH-08	-	2.55	97.45

The clay found in the Subdistrict of Mataraman has physical properties: grayish white, clay size, easily broken in dry conditions, in wet conditions very sticky, easy to form as desired and elastic (not easily broken and broken) In the location / field, the clay is often mixed with sandstone lithology and gravel / cricket with matrix & fragments in the form of quartzite fractions which are weathered regoliths which are deposited simultaneously with the clay as shown in Figure 1.

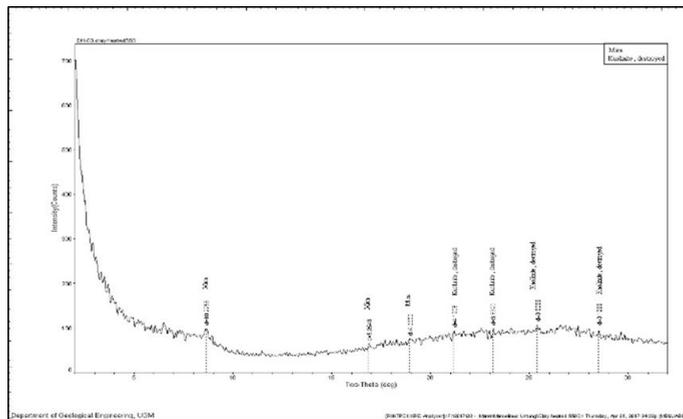
**Fig. 1.** Clay appearance in Mataraman District

Based on chemical analysis of clay, the dominant mineral content is Silica SiO<sub>2</sub> ranging from 66.02 - 85.67% and Alumina (Al<sub>2</sub>O<sub>3</sub>) ranging from 9.85 - 22.96%. While other minerals present in not too large amounts, namely: Titanium dioxide (TiO<sub>2</sub>) 0.31 - 0.93%, Ferioxide (Fe<sub>2</sub>O<sub>3</sub>) 0.33 - 0.75%, Calcium oxide (CaO) 0.12 - 14%, Magnesium oxide (MgO) < 0.01 - 0.03%, Manganese dioxide (MnO<sub>2</sub>) 0.003 - 0.007%, Sulfur Oxide (SO<sub>3</sub>) < 0.01 - 0.010%, and Loss of Ignition (LoI) 2.30 - 7.99%. On the test results all samples have the value of chemical compounds can be seen in Table 3 below.

**Table 3.** Chemical Composition of Kaolin Clay

Hole ID	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	Fe <sub>2</sub> O <sub>3</sub> (%)	TiO <sub>2</sub> (%)	CaO (%)	MgO (%)	MnO <sub>2</sub> (%)	SO <sub>3</sub> (%)	LoI (%)
CH-04	66.02	22.96	0.66	0.93	0.12	0.01	0.007	<0.01	7.99
CH-06	80.13	14.60	0.47	0.33	0.12	<0.01	0.003	0.010	3.43
CH-07	75.09	17.99	0.53	0.44	0.14	0.03	0.005	<0.01	4.61
CH-11	81.88	12.72	0.51	0.36	0.13	<0.01	0.005	<0.01	3.22
DH-03	77.26	15.90	0.57	0.44	0.14	0.02	0.005	<0.01	4.32
DH-08	85.67	9.85	0.55	0.31	0.13	<0.01	0.005	<0.01	2.30

XRD analysis is carried out by stages starting from the separation of clay fractions obtained from clay soil aggregates. Separation was carried out by centrifugation method by placing the clay fraction on the glass preparation and aerating it in air-dried air before being shot with XRD. The sample was shot back after being treated with ethylene glycol (ethylene glycolated). Finally, the sample was shot again after being heated to a temperature of 550 ° C (heated 550 ° C). The additional treatment aims to identify certain clay mineral species that do not appear in the air-dried treatment. XRD analysis using these three methods was carried out on all samples, except clay samples from Gully Pagers, which only received two treatments, namely air-dried and ethylene glycolated. The results of clay analysis using the XRD method showed that clay soil is composed of kaolinite, sericite, and smectite type clay minerals. The results of the analysis of kaolin clay samples from Pematang Danau Village showed that the mineral content of kaolin as its main mineral, while there were several samples taken, showed quartz and mica minerals. as shown in Figure 2.



**Fig. 2.** Results of the analysis using the XRD method, identifying the presence of clay minerals Kaolin, quartz and mica.

### 3.2 Use of clays

Physical characteristics of white, elastic and clay mataraman clay with clay minerals identified kaolinite, mica and quartz can generally be used in the ceramic or pottery

industry. Utilization in other industrial sectors such as paper, cosmetics and pharmaceutical industries must meet the requirements of certain chemical element components.

### 3.3 As raw material for pottery

Kaolin is a type of clay mineral commonly used as a raw material for clay pottery. The clay must be plastic enough and easy to form, easily bent and not easily broken (Smoot, 1961). [4] Mataraman clay is composed of the main minerals Kaolinite and has physical properties that meet the requirements to become raw material for earthenware. This is supported by tough and elastic physical properties. The disadvantages of mataraman clay are clay mixed with sand and gravel containing quartzite so that the grain size of the clay is not uniform. With the mixture of sand and gravel making pottery can cause cracks, it will even break the pottery that has been dried by burning. To overcome this problem the mixture of sand or gravel must be separated first before the pottery manufacturing process.

As an ingredient in the pharmaceutical and cosmetic industries According to (Carretero & Pozo, 2009) [1], kaolinite is used as a protective stomach, anti-diarrhea, anti-inflammatory, and local anesthesia. Kaolin, Smectite and Sericite can be used in the cosmetics industry.

Specific properties of clay needed in the cosmetic industry include physical properties (size and shape of clay grains), surface area, texture, color and brightness level, as well as chemical characteristics which include chemical surface area and ionic charge (Lopez-Galindo, et al 2007). [3]. Clay minerals that can be used in the paper industry are Kaolin. Kaolin can be used as a coating material and filler, if it has a high level of brightness and a low level of abrasion (Ciulli, 1996). [2]

## 4 Conclusion

Mataraman clay is found in geological conditions with undulating plain morphology, as an alluvial deposit in the Quarter Alluvium (Qa) with a monoclinic geological structure. Clay with white physical characteristics, elastic clay is easily formed and mixed with sand and cricite. Quartzite form. Based on the results of the analysis, the types of clay minerals found are Kaolint, Mica and Quartz, The clay can be used as a material for making pottery. The clay cannot be used in other industries such as pharmaceuticals, cosmetics and paper because it does not meet the requirements of chemical levels.

## References

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