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THE USE OF ZEOLITE CLAY TO PRODUCE A SOLID POTTERY OBJECT

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Conclusion:

This research includes the use of a natural raw material available in Iraq, which is the Iraqi Zeolite clay, this kind of clay exists in Al Najaf area specifically within Bahr Al-Najaf in the production of a strong and solid pottery objects that can be used in ceramic artistic products, where the effect of some additives on the properties of Zeolite has been diagnosed, which can lead to future technical and industrial applications of the country, three models of Zeolite clay have been prepared in proportions (90% - 80% - 70%) with two types of additives: Iraqi Kaolin clay (Kaolin) found in the Western Sahara of Iraq and sodium carbonate. (Na2CO2), the samples were burned at temperatures (1000-1100-1200 C). Several properties were studied in this research, including the test of shrinkage after heating and fracture resistance and compressive strength. It was found that the addition of Kaolin and sodium carbonate improves the qualities of the Zeolite clay, since Kaolin clay has a high density and few pores, when added to the Zeolite of low density due to the large number of pores and its large size, it modified the qualities of Zeolite, as well as the sodium carbonate has melted the bonds that shape Zeolite and made it possible to produce a solid clay object that could be used in ceramic and art products.

Chapter 1

Research Problem:

In all scientific fields, we find that there is a need for development, change and research in order to get new and diverse technologies that are in the interest of scientific research.

In the field of pottery, our ancestors in ancient Iraq practiced this material for an intellectual and symbolic purpose due to the great role played by these techniques in showing the aesthetic and expressive materialistic of the material.

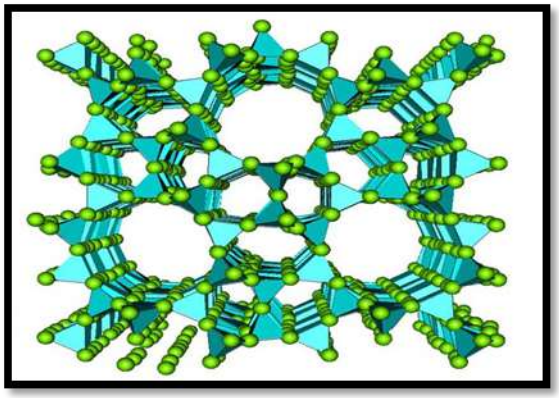
The ancient Iraqi artist used clay in preserving food and making statues for the purpose of worship, as well as for aesthetic purposes and decoration, and the Iraqis inherited them to this day, and for the frequent and frequent use of this clay, it became necessary to search for other materials that serve the aesthetic and industrial side available locally and in abundant quantities, so the artist seeks to find various and new materials Therefore, the contemporary potter tends to constantly adjust the specifications of his clays according to his needs and production requirements, seeing the recipient of criticism, analyzing and accepting them, as is the case with the sculptor and painter by introducing various and different techniques and additions to keep pace with the advanced leaps in the field of different arts.

When we traced the diverse and sophisticated experiences of the peoples of the Near East in discovering various materials and how to adapt them to make various artistic forms, we find that there is a great and remarkable scientific development in this field specifically in China, and one of the most important of these materials used in the field of pottery is Metal Zeolite, which is distinguished by its bright colors such as white, green, yellow and red, as well as its relatively light weight compared to other types of clays used in addition to that the ease of forming and adapting them according to the artist's desire because of their plasticity and porosity, in addition to their high temperature tolerance, and this in itself gives them another important characteristic, which is the ability to industrial investment and use in ceramic industries and even the possibility of manufacturing porcelain. Therefore, the research problem can be summed up in the following question: Can local Metal Zeolite be used in the field of pottery and ceramic production?

Importance of research:

The current research sheds light on a type of clay minerals, the importance of which lies in not being scientifically or technically surrounded by it, which is Metal Zeolite, thus making it surrounded by mystery about its suitability for use in the field of pottery and ceramics.

Figure (1-2)



Research Objectives:

Producing artistic and industrial ceramics from local and economic materials available in Najaf Governorate.

Chapter 2

Metal Zeolite: The discovery of Metal Zeolite is due to the Swedish scientist (Alex Frederick Kronstedt in 1756) when materials from a mine in Sweden were heated to 200 degrees Celsius, and a large amount of water vapor was absorbed from the Metal and it was called Metal Zeolite.Since (Zeo) means boiling, and (lite) means stone in the Greek language, meaning (boiling stone)

Kronstedt explained that the metal is formed from volcanic rocks when there is an alkaline groundwater reaction that leads to the crystallization of Metal, Zeolite is formed in nature as a result of a chemical reaction between volcanic glass and salt water at temperatures suitable for natural reactions ranging between (55-27) degrees Celsius and an alkaline degree within the limits of (10-9)As nature takes (50,000-50) years to complete the reaction producing zeolite,Metal Zeolite is characterized by its light weight and low density due to the large number of cavities in it, as shown in Figure (2-1), which increases the efficiency of the ion exchange of metal with ketones in the soil or the environment, so it is used as a soil conditioner and a purifier for wastewater as well as used to control heavy metals and nuclear materials, toxic materials, pesticides and pathogens, in addition to being used as a filter.

The zeolite mineral belongs to the category of minerals known for its wide pores, and it can be made from rice husks because it contains a high percentage of silica. Silica can be extracted as sodium silicate when decomposing at high temperatures to form rice husk ash, and the silica is separated from the rice husk by solvents.

The mineral zeolite has a positive effect on the environment through purifying wastewater, depending on the adsorption process related to the density of charge, the ion diameter and the effectiveness of ions, as it reduces its toxicity and pathological damage in the bodies of living organisms, and that the zeolite mineral enters into several applications, including gas adsorption and natural gas separation treating sewage and drinking water.

Al-Najaf Sea Depression in Iraq:

The Najaf Sea Depression is considered one of the most important features that were formed by the geological tectonic movements during the last two eras of the third geoglyphic time of the Earth’s age, as that period witnessed the activity of tectonic movements that gave rise to various geotectonic phenomena in Iraq, including mountains, hills, depressions and lakes,Al-Najaf Sea Depression is an example of this, as it is located astronomically between two latitudinal circles (-31.30-32.10) north, and longitudes (-43.30-44.30) east,It is geographically located in the province of Najaf in central Iraq and extends longitudinally from the north of Najaf to the southwest of the city of Al-Hirah, and within the transitional zone between the ancient and stable western plateau and the newly established sedimentary plain, which was formed from the sediments of the Tigris and Euphrates rivers, which is located close to it, bounded on the west by the western desert known as the northern desert (the Badia of Najaf) and on the east by cities and districts of Najaf, Al-Hirah and Al-Mashkhab, It varies in width, reaching from the southeast (16

km), while shrinking from the middle to (10 km), and its total area is (366 km), equivalent to (1800 miles) (40 miles long) (and 30 miles wide).

Kaolin: It has the advantage of being in the form of white or creamy soft lumps and it is one of the remaining clays characterized by medium plasticity, and a relatively large grain size free of alkali as well as the iron content is low up to (2%), so its color is slant to white Even after burning, of course Kaolin clay can withstand high temperatures (1780 ° C),

It is resistant to sudden thermal changes and has a small shrinkage factor, and it is one of the high quality clays widely used in the pottery industry.

The Kaolin deposits are located in western Iraq and around the city of Rutba in Al-Kaara Depression (50) km north of Al-Rutba. It is also found in Al Husniyat, where there are large quantities of these clays and are used in the manufacture of white cement, refractories and ceramics, and Kaolin is preferred in pottery because of its whiteness.

Sodium Carbonate: It is a chemical compound with the formula (Na2CO3) and it is also called by the common name Soda ash or washing soda. It exists in the normal form in the form of white powder, its solutions in water are alkaline, and it dissolves in water, and it can be found naturally as a metal or manufactured from different materials.

Chapter 3

Approach used:

The experimental method was used, which is the most accurate type of scientific research because it is based on scientific experiment that reveals the causal relationships between the factors involved and influencing them, the descriptive analytical approach is added to achieve the research objectives.

Research Society:

It is all kinds of clay models in research that have been burned in an electric oven.

Selection of clays:

Zeolite clay was chosen because the local soil used in pottery industry has a chemical composition and Metal is similar in the results of the microstructure, Kaolin steric system, and the chemical formula Metal Zeolite as in Table (3-1).

Table (3-1)

Γ0TAL	L.o.i	K_2o	Na_2o	Mgo	Ca0	Tio_2	Fe_2o_3	Al_2o_3	Sio_2	P_2o_5
100	15.20	3.38	0.12	3.43	8.84	0.97	7.27	14.39	45.25	0.03

As this causes fundamental changes in the microscopic spatial structure at a temperature of (1000-1100 -120 C) Table (3-2) shows the chemical analysis of the Zeolite clay according to the examination of the Iraqi Geological Survey.For the sake of accuracy, a sample was taken and a chemical analysis was conducted on it, and there was a slight difference due to the area from which this clay was taken.

Table(3-2)

1200 C	1100 C	1000 C	Na_2CO_3	Kaolin	Zeolite	Sample
		*		10	90	1
	*			10	90	2
*				10	90	3
		*	10		90	4
	*		10		90	5
*			10		90	6
		*	10	10	80	7
	*		10	10	80	8
*			10	10	80	9
		*	15	15	70	10
	*		15	15	70	11
*			15	15	70	12

To ensure the validity of this clay and to know its chemical and physical specifications, its tolerance to temperatures, and its containment of quantities of various oxides, substances and coloring oxides, the chemical analysis of the clay applied to the research was performed at the University of Babylon - College of Engineering / Department of Civil Engineering / Kaolin clay Chemical Laboratory Table (3-3).

Table (3-3)

T0TAL	L.o.i	K_2o	Na_2o	Mgo	Ca0	Tio_2	Fe_2o_3	Al_2o_3	Sio_2	Oxide
100	13	0.7	0.3	0.3	0.3	0.1	0.4	38.3	46.6	%

Preparing the clay:

The clay was prepared using the plasticizing method as (10 kg) of dry Zeolite clay and (5 kg) of Kaolin were weighed and placed in a basin, water was added to the mixture and mixed well and then left for (48) hours until the soil crumbled and dissolved, after leaving it the mixture precipitated and then the excess water is drawn.

A new percentage of water is added and mixed again for (48) hours in order for the mud to precipitate and the surplus water is withdrawn. The process is repeated again to get rid of the suspended salts and impurities. Canvas to get rid of the excess water until the mud becomes a plastic form that can be formed according to the proportions in the countries (2-3).

Preparing the forms:

A wooden mold was prepared for pressing the forms, with (1.5) cm thickness, (10) cm length and (5) cm width, placed on a wooden floor (board) in the form of tiles.

Drying the samples:

The samples were left to the next day, covered with a cloth and away from any airflow to prevent the models from drying out quickly, then were collected on top of each other covered with a cloth to avoid bending the models and left to dry completely.

Electric oven configuration:

An electric oven measuring (37 x 30 x 47) cm was used with a digital scale

Figure (1-3)

Burn Forms:

The models were heated at a temperature of (150 C) and left for (24) hours, after which the temperature of the oven was raised at a rate of (100) degrees per hour, reaching a temperature of (C1000-1100-1200) for all models, and the oven was left at this temperature for two hours.

To reach the degree of complete maturity, the oven was cooled for 48 hours, and then the samples were taken out and made sure that they were free from any traces of melting and warping (Figure 2-3).

Figure 2-3

Chapter 4

Discussing the results:

Through the table of mixtures and the division of models with temperature, we notice in sample no. (1) That Zeolite mineral with Kaolin gave moderate results with good hardness, as well as with models no. (2-3), no clear difference occurred except for model no. (3).where more solid and coherent in temperature (1200C), therefore it can be adopted in the ceramic industry. Moving to models (4-5-6), when mixing Zeolite with (Na2CO3), the results were also moderate in terms of hardness and strength. Model No. (4) Was the best due to ripening at a temperature of (1000C). In models (7-8-9), the zeolite was treated with Kaolin as well as Sodium Carbonate in the mixture. The results were very good in terms of solidity and fusion clearly, and the emergence of coherent and reliable models according to the Iraqi Quality Control Measures.

In models (10-11-12), it was also very good in terms of thickness, durability, and hardness. Model No. (10-11) was stronger, especially at temperature of (1000 C), which means that the addition of additives to Zeolite clay led to modification of properties and qualities, and make it an important material to be used in pottery and ceramics industry, in addition agriculture and livestock.

Chapter 5

Conclusions:

1- Pottery from Zeolite clay can be produced at high and low temperatures.
2- The use of additives led to the modification of Zeolite clay specifications.
3- High temperature did not significantly affect the nature of the Zeolite clay.

Recommendations:

1- Using other materials and mixing them with Zeolite clay and following up the variables that occur on the clay.

Suggestions:

1- Using other kinds of clay than Kaolin, such as Red clay, and mixing it as an additive to Zeolite clay.

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