The potential of Libyan clay in ceramic industries (in two regions: Ashkeda - Tarout)

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An introduction:

The land of the Libyan state has remained a virgin land that contains in its interior many different raw materials. These raw materials have not been utilized from most of the sites in the applied side in the field of ceramics, such as the use of these raw materials in the manufacture of glass paint or in the manufacture of the ceramic body, which is essential for the manufacture of ceramics.

Clay is considered one of the basic materials needed in ceramic production, as it is considered the basis upon which that body depends, and through the specifications of these clay (such as the degree of plasticity, the amount of impurities, the high percentage of kaolin, the ratio of molten materials) can determine the type of ceramic body to be manufactured and the appropriate temperature. It has forming methods that are in line with the specifications of clay.

Research problem:

Through studying the geological survey of the Industrial Research Center in Tripoli, the researcher found:

١ .The mud sites in Libya are many and in separate places and in large quantities also suitable from the mining side, but they are not used in any industry, especially the ceramic industries, which helps to transform the country from the rentier economy based on a single income, to the industrial economy and the hands-on Libyan.

٢ .There is currently in Libya a college specialized in the manufacture of ceramics, but it relies on a place that is mostly based on one place to cover its needs (Ghayyan city muds), which drains the raw materials of the place in addition to the distance from these colleges, which causes exorbitant costs in the transportation of these materials and this is considered an obstacle also during manufacturing.

Research importance:

The importance of the research is summarized in shedding light on the clay in southern Libya, where it is considered regions (Akkdeh, Tarot) that are important sites that contain large quantities of ceramic clay, that are being different in their types (kaolin, earth clay) and thus this is beneficial to the various ceramic industries of various production (Such as refractory porcelain, or porcelain, etc.

DOI: 10.21608/mjaf.2020.36476.1734

Research objectives:

The research objectives are summarized in:

١ .Obtaining local clay suitable for ceramic production.

٢ .Learn about the potentials of the used physical clays.

.٣ Encouraging locally made ceramics, honing students' skills and developing their capabilities.

٤ .This research serves those interested in this field, also nurtures Libyan libraries.

.٥ Creating local experiences that serve the ceramics industry.

Key words:

kaolin, ground mud, specific density, porosity, plasticity.

Clays:

"It is the name usually given to most of sedimentary rocks that are derived from primary rock changes [1], and it consists of inorganic earth materials in the form of loose sediments consisting of particles of dimensions less than 0.05 mm, and does not depend on the chemical composition of the material by itself [7], it is a sheet structure mineral, consisting of aqueous aluminum silicate Al2O3.2SiO2.2H2O, which adheres, and acquires the plasticity property when mixed with water and solidifies, and its chemical and physical properties change after burning] [4.

The origin of clay:

Clay is a ceramic material because it contains metallic and non-metallic elements in its composition, it is mainly composed of a hundred aluminum silicates with some impurities such as iron oxides, calcium, magnesium and alkalis like sand, mother residues and some organic materials, and clay is a ground material that comes from primary rocks, such as granite rocks that consist mainly of Rock minerals such as feldspar, quartz, and mica. These natural rocks have been decomposed over time due to erosion factors (water, wind, and associated chemical changes [3.([

Classification and types of clay:

Clay classification: clays are classified based on their origin and use, or both. The geologist depends on an origin and has been classified into:

1. Primary Clay

٢ .Secondary Clay

١ The primary clay: formed from the fragmentation and conversion of rocks close to the mother rocks to clay without exposure to transport factors, i.e. they were not stirred by natural forces such as wind and water, the sizes of their granules are varied and most of them are relatively large and characterized by white color and lack of their plasticity which is one of the purest types of clays. One of such species is China Clay.

٢ .Sedimentary (secondary) clays: they are the clays that are transported from the places where the original rocks were formed by the action of water and wind. This process is carried out by transporting the clays with gravel, sand and rocks of various kinds and moving down the stream

of water transporting the clay, containing a lot of impurities such as organic materials, mineral materials such as iron, quartz, mica, alkali and carbonate that the water had washed with the current and friction during transport and its mutual interaction with the forces of erosion. The similarity in size and shape also develops a lot, and this explains the complexity of the composition or components of the secondary clays and their difference from the kaolin clay that is formed in the sites of the mother rock and without movement. Also called Secondary Clay, it is widespread in the world. This clay is distinguished by its high plasticity and ability to be formed [2.[

Natural clays, along with the clay mineral, contain other impurities resulting from either the remains of the mother rock or compounds attached to the clay when transported from the places of formation to the places of precipitation, and these impurities have a clear impact on the properties of clays, and their impact depends on- :

The nature and quantity of impurities, the size and shape of the clay granules and impurities, and the reaction conditions in terms of temperature, reaction time and oven atmosphere.

Impurities include the following- :

*Prepared clay usually contains alkali, while minerals with alkali such as feldspar and mica - usually contain an increase of alumina and silica.

*Such impurities are not harmful as long as they are allowed in the body composition.

*Alkaline earths that are usually found in small quantities in clay and in feldspar serve as fuses, and the most important impurity and special importance in clay is iron oxide.

" *Common" porcelain, which sometimes consists entirely of red clay, may contain about 10% Fe2O2 ferric oxide, and most of these quantities can interact with silica and be molten, especially in the presence of terrestrial alkali, at a relatively low temperature (about 1000 º C) and thus need a slightly higher temperature to produce a final solid product.

Titanium dioxide is another impurity commonly found in clay and helps to form crystal (as a catalyst that encourages chemical reactions), and greatly increases the chromatic effect of other mineral oxides, especially iron oxides [5] [6.[

The sites understudy for the clay:

Tarot:

Geological location and description: It is located in the northern part of the iron ore in Tawart, at a distance of 5 km southwest of the village of Katta, where it is located in the lower green clay stone member of the upper formation of iron (forming a skeleton) and is in the form of three ranges, the best of which is the upper one, which consists of predominantly gray and bluish gray clay, and it consists of kaolin metal and some elite with interfering silt and the thickness of the clay layer ranges between 1,5 - 6,6

The obtained material is the Kaolin clay- :

Kaolinite, the main mineral in the kaolin clay may be the result of the breakdown of granite rocks under high thermal conditions (Hypogenic). Although the details of chemical reactions are not entirely clear, many researchers are more convinced of the theory of the igneous emanation, which confirms that the main reaction takes place with Potash feldspar, which turns into kaolin as a result of hot acid volcanic gases (Boron, Fluor, carbon dioxide, etc. ... all of which are active means, that have led to the analysis of feldsparian rock to kaolin in deep depths,

in addition to silica and potash. As for the other elements that make up granite rock, which are quartz and mica, the degree of influence on them is negligible. However, this does not preclude the formation of small amounts of fluorspar and tourmaline compounds.

In general, whatever the origin, kaolin clay is considered one of the primary / residual clays, meaning that it was formed and settled in its original place, and this is one of its characteristics.

In Libya, Kaolin formations are found in several regions, the most important of which are- :

The deposits of Sebha region, which fall into three bands, the middle range is considered the best in terms of quality as it contains thermal and ceramic clays, and includes most of the reserves of the clays suitable for industry.

These clays were classified according to what they contain of alumina, and their thermal resistance in the first place, as well as according to what they contain of iron oxide and silica, and other physical properties, according to the following- :

Quality (W1), Kaolinite clay, white to light gray in color and with high thermal resistance, proven to be valid for the medicine industry until 1460 C.

-The quality (WSCH) is of medium thermal resistance, and the color ranges from dark gray to blue, and proved to be suitable for making refractory bricks for furnaces that have a temperature of no more than 1400º C.

Quality (W2), which has low thermal resistance, color ranges between blue and purple. It is proven to be suitable for ovens up to 1300º C.

Physical properties- :

Kaolin consists of white or oblique soft lumps of cream color, easy for fragmentation, and has a relatively low plasticity, and high thermal properties, it melts at a temperature of 1780 C. And the color tends to whiten after burning due to the low amount of iron, and therefore it is one of the most valuable clays in the ceramic industry. The granular size is relatively high compared to the spherical clay, and it does not cover a large extent. For example, kaolin particles reach 0.3 microns, but the spherical slurry particles are much smaller than that, and may reach 0.02 microns, and the distribution of kaolin particles varies depending on the ceramic body [6. [

The sample obtained conforms to the Kaolin specification (WSCH.(

Secondly, clay is confirmed.

ASKDA (A1):

Geological location and description: The clay is located near the asphalt road that connects to the city of Brak and about 5 km south of the village of Ashkeda, where the clay consists of two upper particles with a grayish-gray color and the bottom with a dark gray color, and the clay is made of kaolin metallic, where the thickness of the ore ranges from 5.4-9.6 meters and covered by some centimeters of wind sand.

-٢Akkada (B2):

Geological location and position: These clay are located approximately 5 km north of the village of Ashkeda, 1 km from the main road, and they are green and have some shades of dark yellow color. The amount of silt with red clay increases, and the thickness of the clay deposits ranges between 7-11 meters and reaches 13 Meters in the central region of the ore where it is characterized by a very large degree of softness and the degree of plasticity is high.

And materials obtained from the type of structural clays (Structural Clays) or ground mud:

We mean the clays that enter in the manufacture of construction materials such as bricks of all kinds, (and roof tiles), or what is known as tiles, and clays that go into making cement and others. They are mostly sedimentary clay that formed in different geological eras so that it became easy to classify them according to the geological formations in their places of existence such as Devon, carbon, Eocene clays ... etc.

Physical properties- :

We draw attention to the fact that some clay expands due to the presence of vehicles that release gases during the fire that lead to the explosion (Bloating). Since shrinkage during a fire usually occurs as a result of reactions related to the clay mineral, the percentage of shrinkage at a certain temperature can be associated with the percentage of materials with particles less than 2 microns.

An important feature of clay bricks is the color property after the fire. The color is closely related to the amount of iron oxide, and also depends on the degree of smoothness, the atmosphere of burning in the case of oxidation and reduction, and the degree of fire. It is also released in the presence of other compounds such as calcium and magnesium oxides (CaO, MgO). In the case of oxidation, iron gives a bright red color, which turns brown. While the color intensity fades with the presence of the aforementioned oxides (MgO, CaO), on the contrary, the color intensity increases with increasing burning temperature [6.[

The Results:

١ .The viability of Libyan raw materials for the production of ceramic objects.

٢ .The validity of clay, as confirmed (A1, B2) in low temperature ceramic objects.

.٣ The possibility of making use of Tarout clay in medium-temperature ceramics.

.٤ Obtaining graded color shades with different tractor grades.

٥ .The clay used has a high plasticity, suitable for forming in various ways in ceramic production.

٦ .Many imported products can be dispensed with using local materials.

Recommendations:

The researcher recommends the following:

١ .Using a tarot mud in refractories.

٢ .Apply glass coatings to the clay used to determine their suitability and local clay.

٣ .Experimenting with these clay on industrial ceramic production lines (porcelain, ceramic tiles) and cutlery.

٤ .By studying new sites for ceramic clay, by identifying the extent of its capabilities and relevance in ceramic production.

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