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Sultonov Shavkat Abdullayevich,
Kholov Khurshid Murodullayevich,
Navoiy State pedagogical institute

INFLUENCE OF ACID ENVIRONMENT CHANGES ON SORPTION PROPERTIES DURING CLAY POWDER PROCESSING

Abstract. Based on today's information, the areas of application of sorbents are different depending on which products are received. Sorbents are mainly used for water purification, extraction of precious metals, purification and bleaching of vegetable oils, purification of oil and petroleum products, purification and regeneration of various used motor oils, grape and wine production, air and gas purification. If you pay attention to the methods of obtaining and using sorbents, their composition will change in different ways. The cheapest and most profitable side of obtaining sorbents depends on what components are used to obtain them and the processes for their production.

Keywords: Palygorskite clay powder, porosity, sulfuric acid, grinding, bleaching, activation.

The urgency of the issue

One of the most basic and necessary ingredients for obtaining the cheapest and most convenient is the use of various clay powders found in many countries. Soils in the clay layer, which have sorbent properties, mainly have an octahedral structure. Tetrahedral clay soils are used for other purposes. In this case, it has a structured, i.e. octahedral structure, and its properties vary depending on the percentage of metals and the way they are mixed.

Another way to activate clay powders is to change the proportions of the mixed components. In this method, 10 g of clay powder is mixed with 20 ml of water and 1.5 ml of acid. The resulting mass is washed on the filter until a pH of 3.0–3.2 is reached. The washed mass is dried at a temperature of 110 degrees.

The method of obtaining a sorbent for clarification of cottonseed oil is carried out in the following sequence.

1. PP clay is crushed to a particle size of 20––25 mm, then a suspension is prepared in water in the ratio S; L = 1 : 2.2.

2. Then sulfuric acid is introduced in an amount of 15% by weight of dry clay obtained for activation. The acid concentration in the activator was adjusted to 7.5%.

3. The activation process is carried out for 1 hour at a temperature of 110–1150 C with vigorous stirring.

4. Humidity is about 9–10%.

The degree of grinding should ensure the passage of at least 94% of the sorbent through a 0044 K sieve (fraction 44 microns).

As a result of the research, it was found that the more passive the ability of clay powders to react with acid, the more it is necessary to reduce the amount of acid and increase the temperature. Also, when filtering, it is required to increase the acidity of the medium. Because during the drying process, the medium begins to move towards neutral. It can be concluded that during the drying process, reaction processes with acid take place, and porosity increases. The following table shows the number of colors of cottonseed oil, which requires 1.2 ml of clay powder.

Such results were achieved by changing the temperature, the proportions of the components and the time during the processes.

Table 1.– Results obtained when applied to cottonseed oil red 16 and blue 2

S/N	Clay powders	How many units decreased red?	How many units decreased blue?
1	pH medium 2.8	10	0.5
2	pH medium 3.2	14	1.5

Even if we increase the steps of the experiment, it has been observed that the level of porosity has changed. An increase in porosity led to an improvement in the properties of the sorbent. In this method, 10 g of clay powder is mixed with 20 ml of water and 1.5 ml of acid. The resulting mass is washed on the filter until a pH of 1.5 is reached, then dried at a temperature of 90–100 degrees. The dried mass is washed on the filter until a pH of 3.5–3.7 is reached. The washed mass is dried at a temperature of 110 degrees. The following figure shows that the sorbent obtained by us gave a very good result.

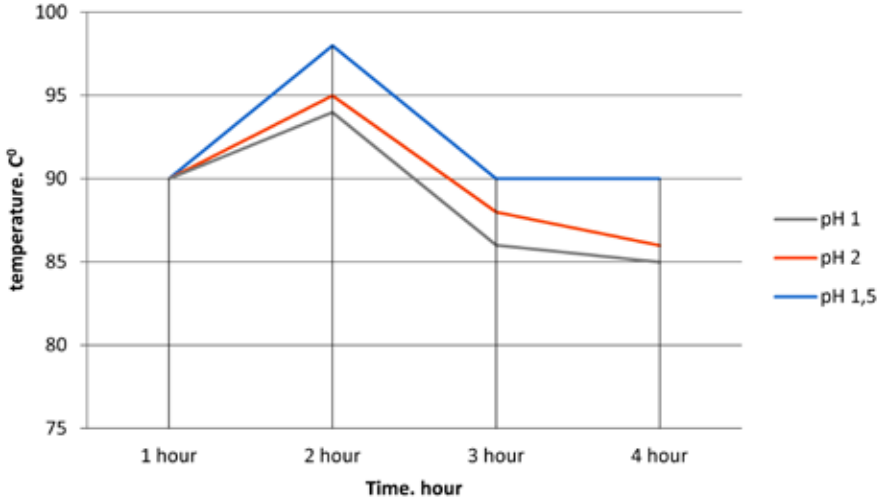

Figure 1. Influence of an acidic environment on the properties of the sorbent

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Bleached clay is a product of the decomposition of rocks (basalts, volcanic ash and ashes, as well as various mixtures) and their weathering under the influence of water, carbon dioxide and other factors. With prolonged exposure of water and substances dissolved in it to erupting rocks, alkalis, earth hydroxides and acidic iron are removed from the rocks. As a result, rocks with a loose and porous structure are formed, which have significant sorption properties. Due to the complete weathering of volcanics, typical bleached clays (bentonites, fuller's earths, etc.) containing hydroaluminosilicates of various compositions are formed.

The end products of the weathering process are low-alkali silicates (silicolite) or semioxide hydrates

(bauxites, laterites and ferrolites). The absorption capacity of bleached clays is related to their porous structure, which determines the highly developed surface and surface character. Not only adsorption, but also other sorption (capillary condensation, chemisorption) and colloid-chemical (flocculation, coagulation, etc.) processes play a role in purification.

The main task of the bleaching process is the removal of peroxides and secondary oxidation products. In addition, pigments and any system resin and soap ceramics are removed. The bleaching process is carried out under a steam/nitrogen blanket, under vacuum or in an open tank. Vacuum offers the benefits of drying oils at low temperatures, removing moisture from the clay, and preventing contact with atmospheric oxygen. This is because activated clay powders can act as an oxidation catalyst in the presence of oxygen at high temperatures. The resulting oxidation products lead to degeneration and a short service life of the end products. Typically, the bleaching process is carried out at a contact temperature of 80–120 °C and under vacuum for 20–40 minutes. During this time, the absorption of dyes by the active clay powder can be balanced with sufficient activation.

The dosage of bleaching clay may vary depending on the type of oil. In chemical cleaning usually use 0.5–2% by weight. However, 2–4% recycled primer can be used to meet final color requirements. In addition, the active clay powder dosage should be minimal to remove impurities as measured by peroxide reduction.

Typically, oil loss is caused by the sorbent used for the filtered mass. It turned out that the typical value of the retention of vegetable oil is about 40%. This value can be reduced to 20–30% by an appropriate intermediate process such as using steam or nitrogen at the end of the filtration. They estimate that for every 100 kg of freshly processed clay flour, 2–4 kg of oil is lost. The fine particle size of clay powders gives good polishing results. However, filtration rate and oil retention can be adversely affected. Thus, efficient filtration, short filtration times and minimization of oil retention on the filter cake are essential. Bleaching clays typically contain 5–18% moisture. If the removable sorbent is completely dried before use, its structure will be destroyed, and the polishing ability will decrease due to a decrease in surface area.

In addition, when hot oil is added to the clay, the adsorption capacity of the acid-activated clay powder decreases. This is due to the fact that the moisture in the sorbent is very quickly displaced and causes the destruction of the structure of the clay powder. Acid-activated clay should be added to vacuum-dried clarified oil at 80 °C, then quickly brought to operating temperature and kept at this temperature for a sufficient time for maximum bleaching.

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