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Bleaching Of Fatty Acids With Obtained Adsorbents

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Annotation. This article presents the results of the adsorptive purification of fatty acids from dyes by the obtained clay adsorbents. It was determined that phospholipids, which are classified as nonionic surfactants, exhibit the highest sorption activity. On the contrary, gossypol and its derivatives show the least. An intermediate position is occupied by palmitic and linoleic acids, which are found in large quantities in cotton soap stock. It was found that the sorption activity of phospholipids with an increase in the temperature of the process of purification of fatty acids in cotton soap stock are arranged in the following order of decreasing:
phosphatidylcholines>phosphatidylserines>phosphatidylethanolamines>phosphatidic acids, etc.

Keywords: fatty acids, adsoobent, kaolin, gossypol, chloraphyll, purification, phosphotides, bleaching.

1. INTRODUCTION

Fatty acids are valuable products that are used in various areas of the national economy. One of their sources is alkaline refining waste of vegetable oils, the so-called soap stocks, which are concentrated aqueous solutions of soaps and organic impurities. The qualitative and quantitative composition of soap stocks depends on the refined oil type [1,2].
The existing technology for separating fatty acids from soap stock consists in the soaps decomposition with sulfuric acid, acidic sulfate waters separation and washing the fat phase from inorganic substances [3,4]. The decomposition process features, the sulfuric acid consumption, and the quality indicators of the finished product depend on the soap stocks composition.
The resulting crude fatty acids are used as such and after distillation. Wastewater is neutralized with soda and discharged into open areas or into the general sewage system.
This technology disadvantages are the increased, compared to stoichiometric, sulfuric acid and soda costs, as well as the harmful substances presence entering the environment in the sodium sulfate and water-soluble organic impurities form, in addition, the distilled fatty acids color of cotton soap stock has a dark color, which limits the area their application.
Fatty acids obtained from cotton soap stock - a waste from the refined oils production contain a significant amount of accompanying and coloring substances, i.e. phosphatides, gossypol, chlorophyll and their derivatives, which worsen the commercial properties of the obtained acids.

In order to reduce the content of undesirable substances, the raw fatty acids of the cotton soap stock are distilled, where bottoms are formed, i.e. gossypol resin, which is used in various sectors of the economy [5,6].

Unfortunately, the fatty acids of cotton soap stock do not always meet the standard requirements, especially in the content of coloring pigments, etc.

2. RESEARCH METHODOLOGY

Their residue in fatty acids reduces the hydrogenation rate of unsaturated acids, impairs the resulting surfactants whiteness and accelerates their oxidation process with active oxygen, which creates an unpleasant odor and deterioration of the resulting cosmetics [6].

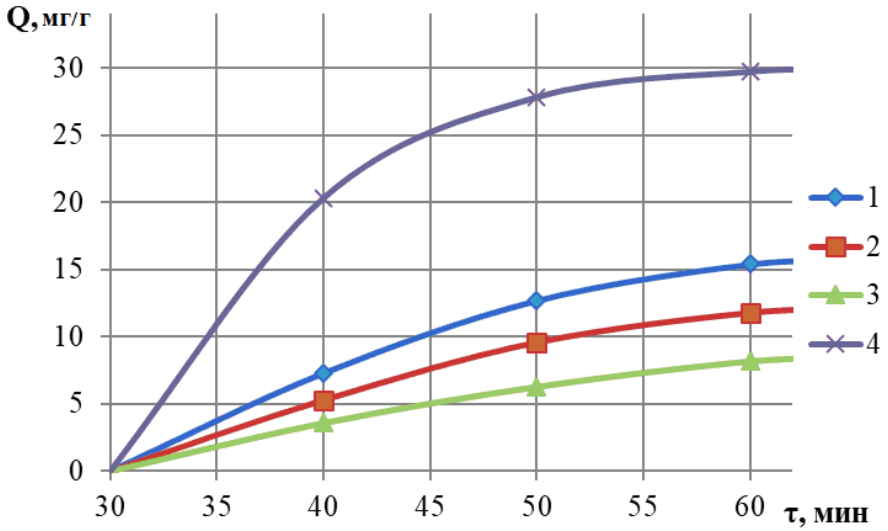
By the contact method [3] we studied the fatty acids mixture purification of cottonseed soap stock with thermo activated kaolin adsorbent obtained from enriched kaolin of Angren deposit at a special laboratory installation.

In the first experiments, we studied the sorption capacity of the selected adsorbent of the main components of crude fatty acids in cotton soap stock at 70°C, the intensity of phase mixing equal to 200 rpm. The amount of added adsorbent was 3% of the total weight of fatty acids.

3. DISCUSSION

The experimental results are shown in Fig. 1.

Figure 1 shows that the greatest sorption activity (curve 4) is shown by phospholipids, which are classified as nonionic surfactants. On the contrary, gossypol and its derivatives show the least (curve 3). An intermediate position is occupied by palmitic and linoleic acids, which are found in large quantities in cotton soap stock.



1- palmitic acid; 2- linoleic acid;
3- gossypol and its derivatives; 4-phospholipids

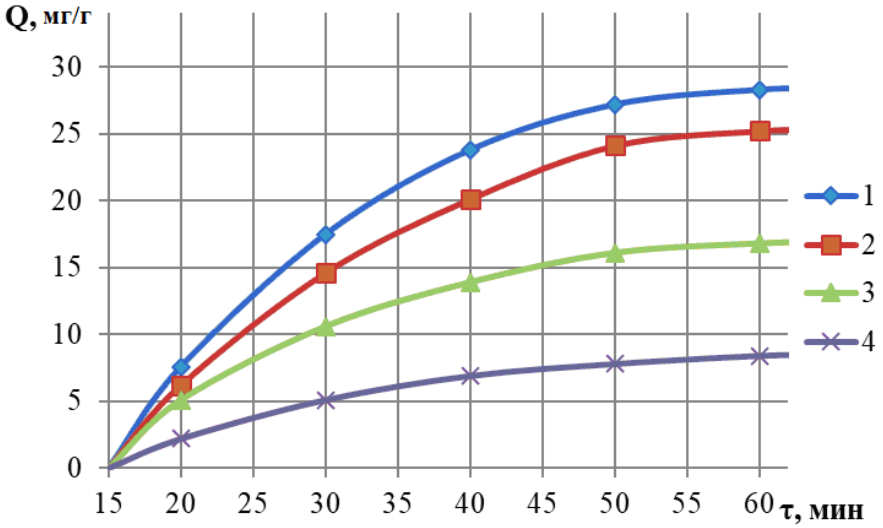
Fig. 1. The sorption activity changes of fatty acid components depending on the contact cleaning time.

Hence, the raw fatty acids components of cotton soap stock in sorption activity are arranged in the following decreasing row: phospholipids > palmitic acid > linoleic acid > gossypol and its derivatives.

It is known that the phospholipids nature also affects the adsorption activity of clay, in particular kaolin, adsorbents.

Taking this into account, we have studied the kinetics of various sorption types of phospholipids by thermoactivated kaolin adsorbents of Angren deposit. The experiments were carried out at 70°C and the phase intensity mixing equal to 200 rpm. In this case, the amount of the introduced adsorbent was 3% of the crude fatty acids weight.

Figure 2 illustrates the study results.



1-phosphatidcholine; 2-phosphatidylethanolamine;
3-phosphatidylinositol; 4-phosphatide acid

Fig.2. The sorption activity changes of kaolin adsorbent depending on the nature of phospholipids

Figure 2 shows that phosphatidylcholine (curve 1) and phosphatidylethanolamine (curve 2) exhibit the highest sorption activity, which are an order of magnitude more absorbed by the thermally activated kaolin adsorbent of Angren field. On the contrary, the most important are phosphatidylinositol (curve 3) and phosphatide acid (curve 4), which are poorly absorbed by the above mentioned adsorbent.

Of course, the fatty acids sorption kinetics depends on this process temperature, which, with an increase, decreases their viscosity and surface tension, and also increases the sorption activity of the used adsorbent. At the same time, one should not forget about the temperature range boundaries. An increase in temperature above 80°C greatly increases the peroxide values of fatty acids. Conversely, a decrease in temperature below 50°C promotes a fatty mass formation that is difficult to sorption purification.

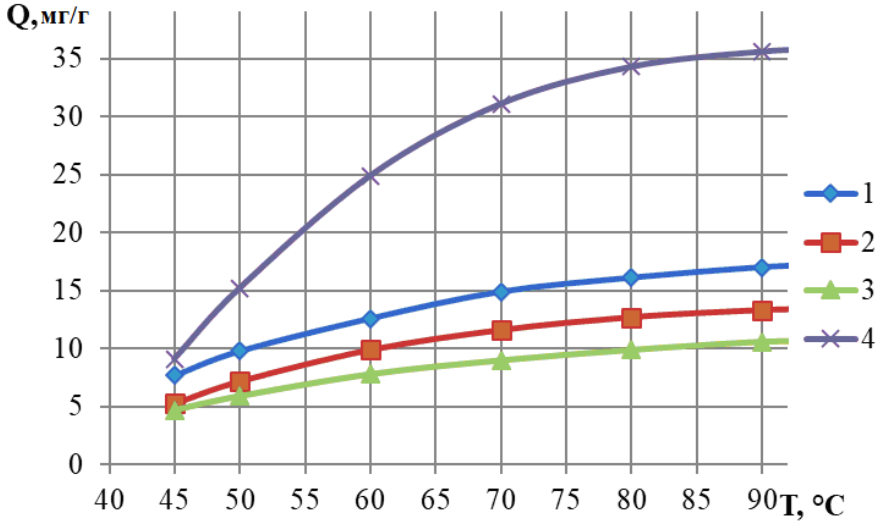
Therefore, the optimum temperature choice for fatty acids purification on a thermally activated kaolin adsorbent is considered important both from the point of view of economics and to ensure the resulting product quality.

In laboratory conditions, we studied changes in the sorption activity of fatty acid components in cotton soap stock, depending on the cleaning process temperature. The amount of kaolin adsorbent was 3% of the total weight of crude fatty acids, and the purification time was 60 minutes. The mixing intensity of the phases was 200 rpm.

The experimental results obtained are illustrated in Fig. 3.

Figure 3 shows that with an increase in the of fatty acids cleaning process temperature in cotton soap stock, the sorption activity of almost all components increases. In this case, phospholipids are most intensively absorbed (curve 4) on the kaolin adsorbent. According to the effect of temperature on the raw fatty acids components sorption in cotton soap stock, the

following decreasing series can be made: phospholipids>palmitic acid>linoleic acid> gossypol and its derivatives.



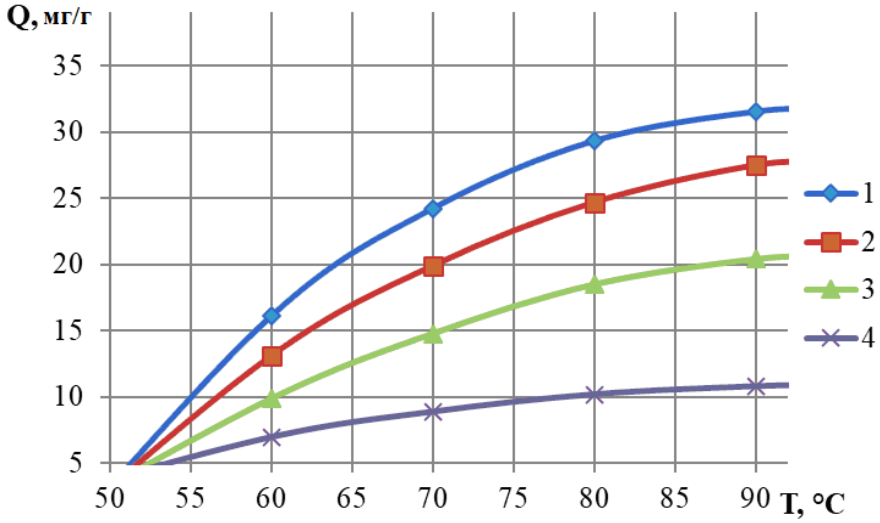
1- palmitic acid; 2- linoleic acid;
3- gossypol and its derivatives; 4- phospholipids

Fig. 3. The sorption activity changes of thermally activated kaolin adsorbent of Angren deposit depending on the fatty acid components purification process temperature of cotton soap stock.

Temperature affects the sorption activity of phospholipids in different ways, which is associated with their chips and molecular structure. Cottonseed oil contains up to 50% phosphatidylcholines, up to 27% phosphatidylserines, up to 31% phosphatidylethanolamines and up to 16% phosphatidic acid. All these phospholipids differ in structure and molecular properties.

We have studied the change in the sorption activity of phospholipids depending on their purification process temperature. The experimental conditions were consistent with previous studies. The experimental results are shown in Fig. 4.

Figure 4 shows that with an increase in temperature, almost all studied phospholipids increase sorption activity. After 70°C, the activity growth begins to stabilize somewhat. In sorption activity, phospholipids with an increase in the temperature of the fatty acids purification process in cotton soap stock are located in the following decreasing row: phosphatidylcholines>phosphatidylserines>phosphatidylethanolamine > phosphatide acid etc.



1- phosphatidcholine; 2-phosphatidylethanolamine;3-phosphatidylinositol;
4- phosphatidic acids

Fig. 4. The sorption activity change of phospholipids depending on the temperature of the fatty acids purification process in cotton soap stock on the kaolin adsorbent of Angren deposit

4. CONCLUSION

Thus, the studies carried out showed that the fatty acids components of cotton soap stock are sorbed on the thermally activated kaolin adsorbent of Angren deposit in the following decreasing order: phosphatidylcholines> phosphatidylethanolamines> phosphatidylserines> phosphatidic acids etc. Saturated fatty acids (for example, palmitic - C16: 0 and stearic acid - C18: 0) are adsorbed more than unsaturated (linoleic - C18: 2, linolenic - C18: 3 and oleic - C18: 1) acids. All this should be taken into account when developing a technology for the adsorptive purification of fatty acids on clay adsorbents.

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