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Physical-Chemical Properties of Thermoactivated Defecate for Purification of Acid Waste Waters

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***Abstract:** In this work, we studied the physicochemical properties of thermally activated defecate at 650°C and studied their neutralizing and adsorption properties in the treatment of acidic wastewater. It was found that after heat treatment at 650°C the main functional groups of the defect, i.e. CaCO3 practical has not changed.*

***Keywords:** Defecate, thermal activation, functional groups, coal, activation, reagent.*

I. INTRODUCTION

Currently, environmental pollution is strongly affecting the state of water sources. Every year, sanitary requirements for the quality of wastewater treatment are increasing. The variety of industrial production, a huge number of source, intermediate and final substances used and obtained in technological processes, cause the formation of various amounts of wastewater contaminated with organic and inorganic substances. In addition, wastewater may contain colloidal impurities, as well as suspended (coarse and finely dispersed) substances, the density of which can be more or less than the density of water. In some cases, wastewater contains dissolved gases. Most often, wastewater is a complex system containing mixtures of various substances. Oil and fat industry enterprises generate wastewater as a result of the washing of crude oils and fats. In this case, acidic and alkaline wastewater is released, as well as condensation water, characterized by an unpleasant odor. In their composition they contain fatty acids. Sources of effluent formation are both the regeneration of fatty acids from spent liquors and the hydrogenation of fats in the process of hydrogen purification [1]. The treatment of such wastewater with activated carbons and their regeneration are expensive processes. Cheaper and more affordable could be a sorbent obtained on the basis of industrial waste, which has a high sorption capacity and low cost. At the same time, large-scale waste is generated in a number of industrial plants, the physicochemical properties of which allow them to be classified as promising for use in the water treatment process. In the production of sugar from sugar beets at the saturation stage, i.e. purification of diffusion juice from non-sugars using lime, a defecate is formed containing-75% $CaCO_3$., up to 22% organic matter and representing a finely dispersed system with a moisture content of up to 30% and a particle size of 5...30 mkm [2].

The original defecate (ID) contains organic impurities. As a working hypothesis, it was suggested [2] that, under certain conditions, the oxidation of organic substances can be reduced not to complete combustion, but to the stage of carbonization, i.e. producing carbon particles formed on the surface of $CaCO_3$. Since finely dispersed carbon has high adsorption properties, it can be assumed that the thermally modified defect obtained in this way can exhibit the properties of a sorbent that can be used for wastewater treatment. Thus, the development of methods for producing an effective sorbent from the calcium-containing waste of the sugar industry (defecate) and the study of its colloidal chemical properties is very relevant.

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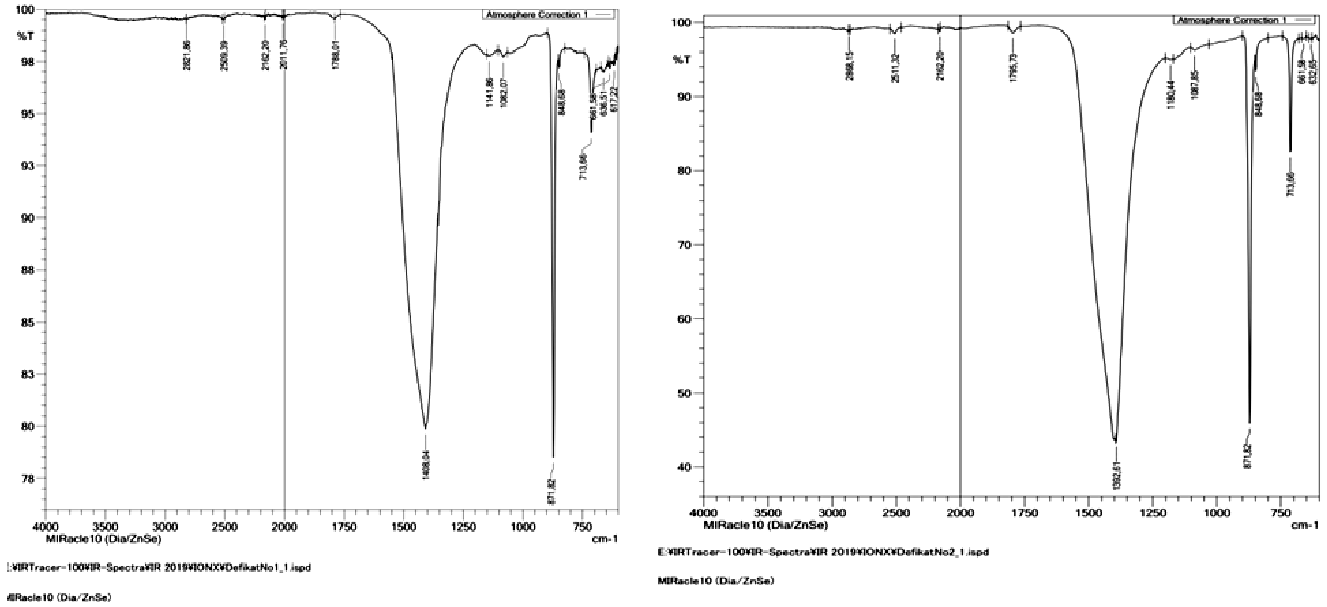
II. MATERIALS AND METHODS

To this end, the objects of our research have taken samples of the defecate of the joint venture of JSC “Khorezm Shakar” and the polluted wastewater of JSC “Urgench Yog’-moy whose environment was pH-1,3. The IR spectrum was recorded on a computer-controlled IRTracer-100 apparatus (Shimadzu, Japan).

III. DISCUSSION OF RESEARCH RESULTS

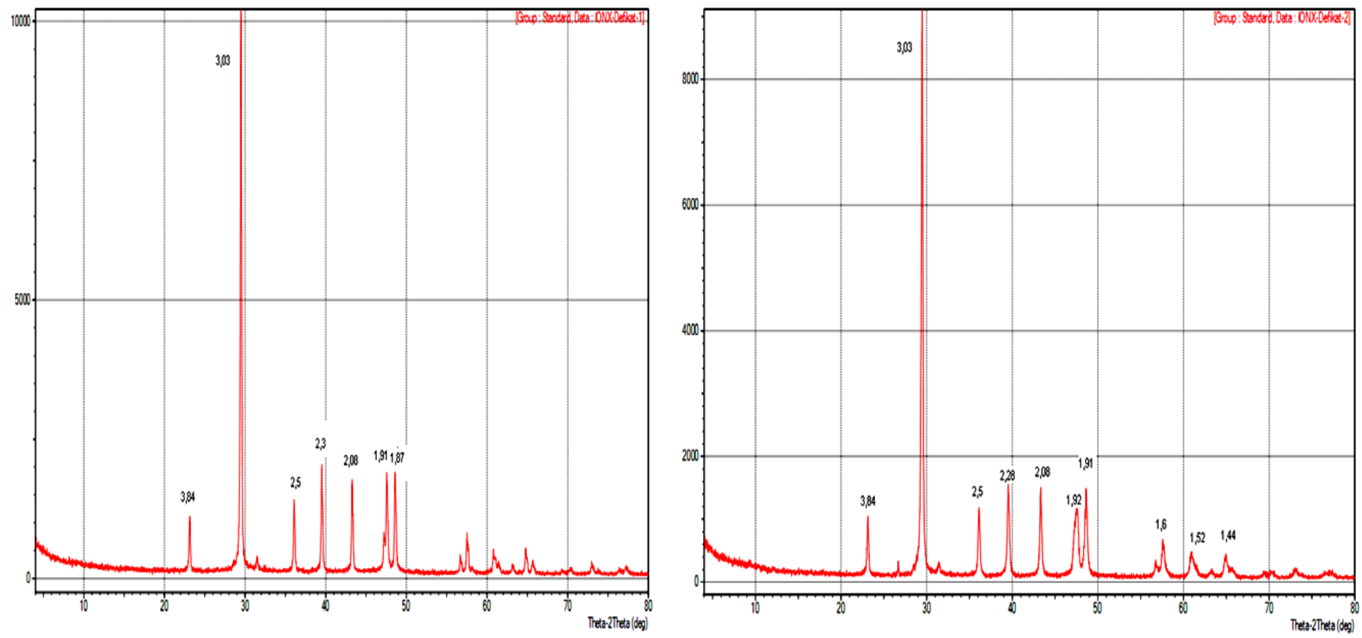
In works [3,4], physicochemical parameters of selected samples were thoroughly studied. Neutralization studies have shown [5] that the defecate in the initial state neutralizes well, but the defecate consumption is very huge. In order to reduce costs and improve the cleaning properties of the defecate, heat treatment was carried out. For this, thermal activation was performed at different temperatures [6]. The best samples of defecate obtained were examined on the IR spectrum, which was recorded on a computer-controlled IRTracer-100 apparatus (Shimadzu, Japan). IR-Fourier spectrometer IRTracer-100-high sensitivity of the spectrometer (signal-to-noise ratio 60000:1) allows the analysis of trace amounts of impurities in various samples, despite the low intensity of the bands of interest in the spectrum.

The spectral resolution of IRTracer-100 equal to 0,25 sm-1 provides high accuracy for the quantitative identification of bands in the spectrum, especially in the case of gaseous compounds. The system for optimizing the operation of the interferometer in combination with internal self-diagnostics ensures stable operation of the device. The fast scan mode makes it possible to register up to 20 spectra per second, which is especially important when studying the kinetics of fast reactions, the course of which can take several seconds.



a) б)

Fig. 1. IR spectra of the defect: a) defecate (initial); b) defecate-650°C



a) б)

Fig. 2. Defectograms of the defect: a) defect (initial); b) defecate-650 °C

From the works [7] and based on the IR spectrum of the initial and heat-treated defecates, one can see that the composition contains organometallics of which shows the spectra (400-900 sm-1), R-O-O-R (830-890 sm-1), C-O-C (900-1200 sm-1) and -C=O (1400-1800 sm-1), -C≡C-, (2100-2300 sm-1) from carboxyl groups.

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After thermal activation of the defecate, organic compounds and metals form salts and therefore, even after thermal activation, specific changes are not visible.

Further, the identification of the samples was carried out on the basis of diffraction patterns, which were recorded on a XRD-6100 apparatus (Shimadzu, Japan), controlled by a computer. CuKα radiation (β filter, Ni, 1.54178 current and tube voltage regimes of 30 mA, 30 kV) and a constant detector rotation speed of 4 deg/min in increments of 0,02 deg were used. (ω/2θ coupling), and the scanning angle varied from 4 to 80°

From Fig 2. it is seen that after heat treatment at 650°C the main composition of the defect, i.e. $CaCO_3$ practical has not changed. The obtained initial and thermally activated samples of the defect carried out the treatment of acidic wastewater. The results are shown in table. 1.

Table 1
The results of acid wastewater treatment with initial and thermally activated defecate

Defecate amount,% / Reagent type	1,5	1,7	2,5	3,5	10	15	17
Original defect	1,1	1,2	2,1	2,7	5,2	5,7	6,4
Thermally activated at 650^{0}C	1,2	2,2	3,4	4,4	6,9	8,2	8,8
Sodium carbonate (control)	1,4	1,8	2,4	5,8	8,9	12,2	12,6

As can be seen from the table.1 consumption when using the initial defecate for neutralization is 17%, thermally activated with a defect-10% while sodium carbonate is 3,3%. Purification with sodium carbonate is certainly economically advantageous, however, since sodium does not dissolve in water and remains in its composition, which, after discharge into the soil, leads to its salinization. Therefore, the choice of more harmless reagents and thereby returning it for technical needs is very relevant. As can be seen, from the results of cleaning with the initial defect, the consumption is very large, however, with a thermally activated defect at 650oC its consumption can be reduced to 10%. At the same time, it was found that thermally activated defecate neutralizing acidic wastewater also brightens from a cinnamon-yellow hue, which is important for wastewater treatment. This can be explained by the fact that during thermal activation from 500°C to 650°C after charring of the organic part, carbonization occurs on the surface of the defect. Therefore, thermally activated defecate works as a neutralizing reagent and as a clarifying carbon adsorbent, which is necessary for the treatment of acid wastewater.

Figure 3. shows images of an electron microscope brand NLCD-307V. In which it is seen that after purification with a thermally activated defecate, the water is much purified than with the original defect and sodium carbonate (control)

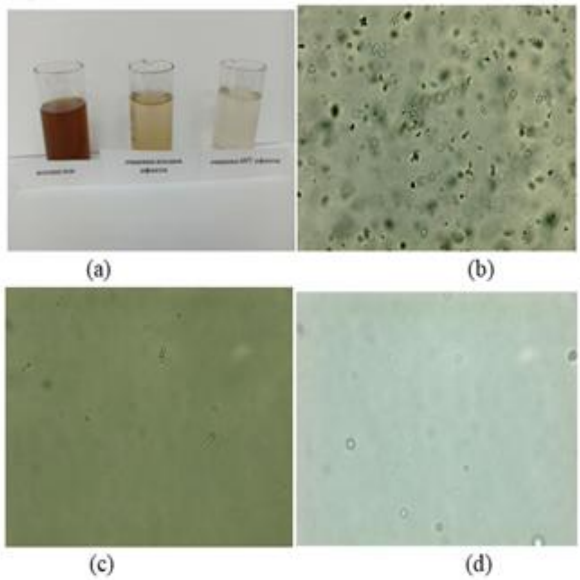

Figure 3. Results of wastewater before and after treatment with the original and thermally activated defecate

a - general view of wastewater; b-source type of wastewater; c-purified by the original defect; d-purified heat-activated defecate

The obtained images once again prove that the defect after thermal activation cleans the MPC to the required standards.

IV. CONCLUSION

Thus, IR spectra show that after thermal activation of the defect at 650oC the functional groups practically do not change. However, during thermal activation, the initial defect is carbonized due to the combustion of the organic part. This shows that after thermal activation, the defecate works as a neutralizing reagent and as a carbon adsorbent, which gives effective wastewater treatment.

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