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CREATION OF EFFECTIVE COAGULANTS FROM INDUSTRIAL WASTE

Alumina production is one of the largest in the field of non-ferrous metallurgy, as demand for aluminum products is increasing every year. However, the formation of a large amount of associated waste (red mud) during such production leads to the need for their utilization. One possible way of recycling red mud is to use it as a raw material to create coagulants for wastewater treatment.

To evaluate the potential possibility of the red mud for using as a coagulant for water treatment, by energy-dispersive X-ray spectroscopy (EDX) on a Zeiss EVO 50 scanning electron microscope (Oxford Instruments, United Kingdom), the composition of averaged red mud sample of the Mykolaiv Alumina Plant was investigated (Table).

Table – Results of EDX analysis of red mud of Mykolaiv Alumina Plant

Element	O	Fe	C	Al	Na	Ti	Si	Ca
%	40,1–61	10,8–45,6	6,9–9,7	5,1–6,6	4,3–5,6	1,7–3,6	2,5–4	1,6–2,9

The results of the analysis indicate the presence in the red mud of the following components: Fe, Al, Ti, Ca, i.e., red mud can be used as secondary raw material to create coagulants.

The method of obtaining new coagulants was the acid activation of red mud under different conditions: at acid activation temperatures of 100, 150, 200, 250, 300 and 350 °C; mass ratio of acid and red mud 0.5:1, 1:1 and 2:1; duration of acid activation 15, 30, 45 and 60 min.

Checking the effectiveness of the obtained coagulants was carried out on model water containing the dye active bright blue HF, 10 mg/l.

It was established that samples of coagulant, obtained by the weight ratio of acid to the mass of red mud 1:1, are more effective because at the same dose of coagulant achieved a higher degree of discoloration of model water. Samples obtained at 100 °C exhibit poorer coagulation properties, due to, probably, incomplete conversion of the red mud components to the active (Figure 1).



Figure 1 – The influence of excess acid in the synthesis of coagulants on the effectiveness of their usage

It was found that the acidic activation temperature of the red mud significantly affects the efficiency of the obtained coagulant. The obtained coagulant at a temperature of 250 °C is effective and has stable characteristics because the degree of dye removal reaches 95 % and is almost independent of the duration of acid activation (Figure 2).

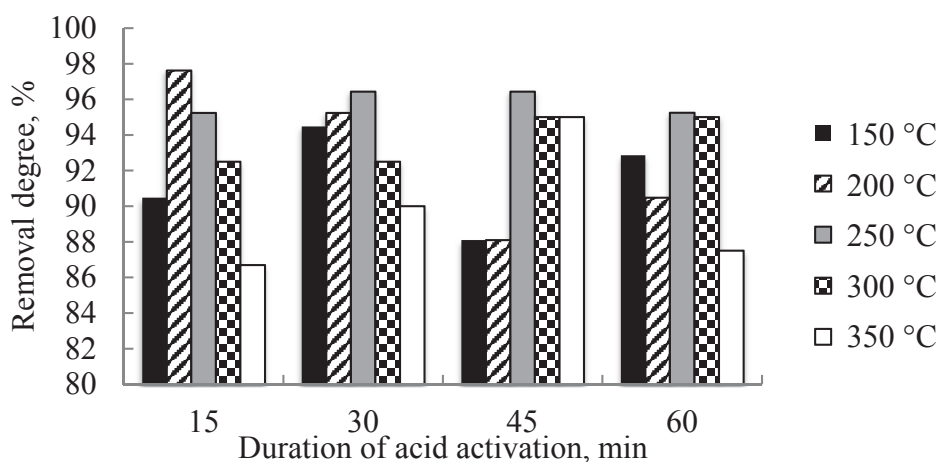


Figure 2 – The influence of the temperature regime of acid activation on the efficiency of the coagulant usage at a different duration of coagulation

It was found that with increasing temperature from 100 to 350 °C, the content of the Fe varies from 240 to 350 mg/g of the coagulant, which has a positive effect on the quality of the obtained product. It was established with increasing samples processing temperature, the content of the main components in the coagulants increased due to the evaporation of moisture.

Therefore, red mud is a promising secondary raw material for the creation of coagulants for wastewater treatment.