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The effect of treatment conditions in rotor-pulsation apparatus on the removal of hemicelluloses from wheat straw

The production of ethanol from lignocellulosic raw materials is complicated by the presence of hemicellulose and lignin in it, which interfere with the action of cellulolytic enzymes. The removal of lignin and hemicellulose before enzymatic hydrolysis of lignocellulose is highly necessary because it increases the digestibility of cellulose [1].

The main parameters that determine the effectiveness of pretreatment of lignocellulosic raw materials for hydrolysis are temperature, alkali concentration, and processing time [2]. But it should be noted that the mixing of materials and mass transfer plays a significant role in the physicochemical processing of raw materials [3].

The aim of the work was to determine the degree of hemicelluloses removal from wheat straw during alkaline pretreatment in a rotor-pulsation apparatus.

Results and discussion. Pretreatment with an alkaline dispersion of wheat straw leads to an increase in the amount of removed hemicelluloses in the entire range of alkali concentrations. An increase in alkali concentration leads to an increase in the amount of removed hemicelluloses by 31.4 % for 2 % NaOH solution and 41.89 % for 4 % NaOH. Lowering the temperature to 90°C leads to a decrease in the amount of removed hemicelluloses to 14 % at 1 % NaOH, and 28.8 % at 2 % NaOH. The treatment at a temperature of 90°C for 60 minutes leads to a significant increase in the amount of removed hemicelluloses, namely, at 1 % NaOH concentration, the amount of removed hemicelluloses was 24.2 %, at 2 % — 43.4 %, and at 4 % — 64.6 %.

Conclusions. As a result of the work, it was determined that the treatment of the alkali dispersion of wheat straw in the rotor-pulsation apparatus is due to a complex of physical effects on the raw material leads to an increase in the amount of removed hemicelluloses, which together with the lignin allows increasing the contact area of cellulose with cellulolytic enzymes at the stage of hydrolysis.

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