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EXPERIMENTAL STUDIES ON THE INFLUENCE OF TECHNOLOGICAL PARAMETERS ON THE DELIGNIFICATION OF WHEAT STRAW

Dr. Sci., Professor Obodovych O.M.¹, PhD Pereiaslavl'tseva O.O.¹,

PhD Stepanova O.E.¹, PhD Sheiko T.V.²

¹Institute of Engineering Thermophysics of the National Academy of Sciences of Ukraine

²Institute of Food Resources of the National Academy of Agrarian Sciences of Ukraine

Abstract: *The paper presents the results of experimental studies of the influence of technological parameters of preliminary preparation of wheat straw for hydrolysis in a rotary-pulsation apparatus on the process of lignin removal. It was determined that increasing the initial temperature of the mixture from 18°C to 90°C allows to increase the yield of lignin by 2 times.*

Анотація: *В роботі представлено результати експериментальних досліджень впливу технологічних параметрів попередньої підготовки пшеничної соломи до гідролізу в роторно-пульсаційному апараті на процес видалення лігніну. Визначено, що підвищення початкової температури суміші з 18°C до 90°C дозволяє у 2 рази збільшити вихід лігніну.*

KEYWORDS: WHEAT STRAW, HYDROLYSIS, ROTARY-PULSATION APPARATUS, LIGNIN.

КЛЮЧОВІ СЛОВА: ПШЕНИЧНА СОЛОМА, ГІДРОЛІЗ, РОТОРНО-ПУЛЬСАЦІЙНИЙ АПАРАТ, ЛІГНІН.

The use of renewable energy sources, in particular the use of bioethanol as a component of motor fuels, is becoming increasingly popular in Ukraine. Depending on the raw material from which bioethanol is produced, it is classified into a product of the first, second, third and fourth generations. The raw materials for the production of second-generation bioethanol are lignocellulosic materials, such as straw, wood

and agricultural waste. Due to the complex structure and inflexible nature of lignocellulosic biomass, a mandatory stage of its processing is the stage of its preliminary preparation for hydrolysis. At this stage, cellulose, lignin, furfural and hemicelluloses are isolated.

One of the ways to increase the efficiency of pretreatment of lignocellulosic raw materials is to use thermophysical effects that occur during the movement of viscous fluid in rotary-pulsation devices.

The purpose of this work was to determine the influence of the technological parameters of the preliminary preparation of wheat straw for hydrolysis in a rotary-pulsation apparatus on the process of lignin removal.

Materials and methods. Wheat straw, previously crushed in an electric chopper and finely crushed in a disintegrator, was used as the material.

Results and discussion. The effect of the initial temperature of the alkaline solution on the yield of lignin: straw concentration 12% wt.; rotor rotation speed – 47,75 rpm; alkali concentration – 1% wt.; treatment duration – 70 min.

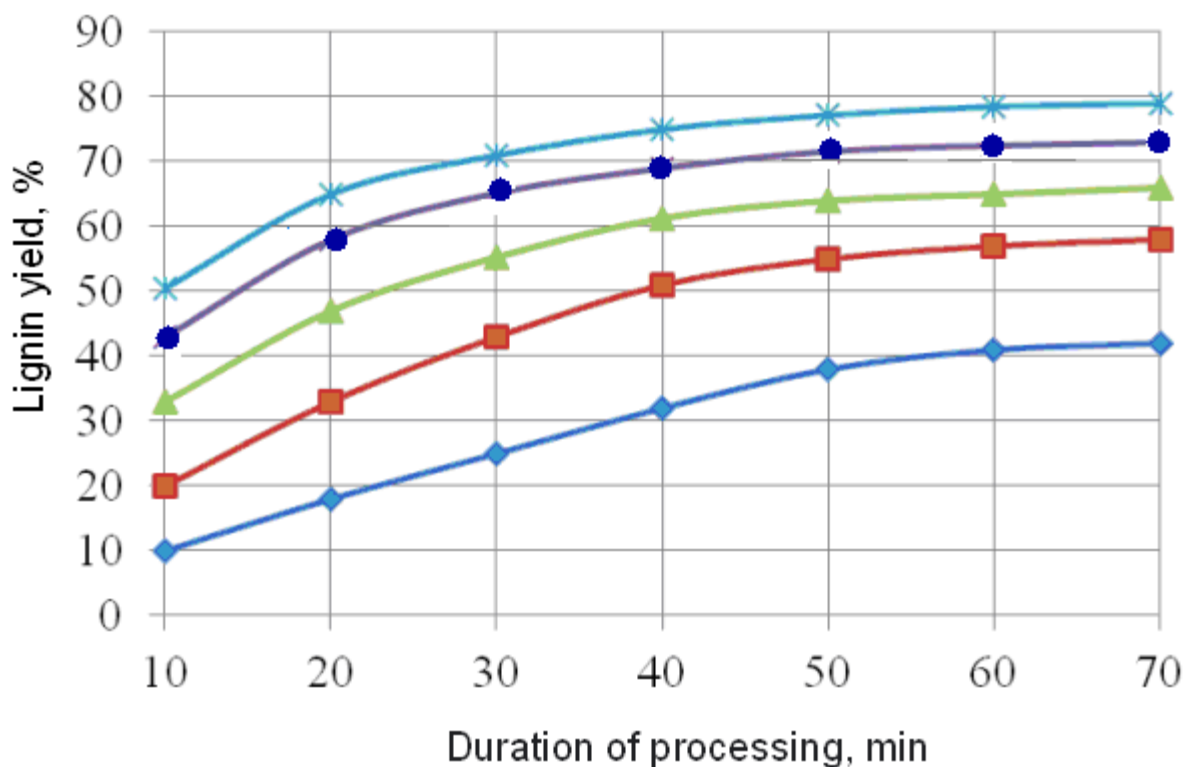


Fig. 1. Dependence of lignin yield on the initial temperature of the mixture:

◆ – 18 °C; ■ – 40°C; ▲ – 60°C; ● - 80 °C; ж - 90 °C.

The obtained curves (Fig. 1) allow us to conclude that increasing the temperature from 18 to 90°C increases the lignin yield from 40 to 79%. At a process temperature of 90°C, 84% of the released lignin is released in 20 min, while at a temperature of 18°C – 42,8%.

Conclusions. It was determined that the influence of a complex of thermodynamic and hydrodynamic processes occurring in the working zone of the rotary-pulsation apparatus, in particular high shear stresses, high turbulence, and generation of vortices in the inter-cylinder gap, allows to increase the yield of lignin compared to traditional mixing devices with the same technological parameters of alkaline preliminary preparation of plant raw materials for fermentation.