THE USE OF MINERAL SORBENTS IN THE DETOXIFICATION PROCESS OF LIGNOCELLULOSIC HYDROLYSATES

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ABSTRACT

Lignocellulose is a carbon-rich renewable source characterised by a high energy potential, which is used in the production of second generation ethanol. However, depending on the type of biomass and the nature of its pretreatment, the production process of ethanol generates a number of toxic compounds, including phenolic compounds, which adversely affect the enzymatic hydrolysis and fermentation. Selection of an appropriate method of detoxification allows for the improvement of the fermentation potential of hydrolysates and the increase in the ethanol content.

In the present study the usefulness of mineral sorbents: zeolite and halloysite in improving the fermentation potential of willow-derived hydrolysates (of Salix viminalis L.), obtained by a pretreatment process using orthophosphoric acid (H3PO4) was investigated. The study hydrolysates contained approximately 15.96 g/dm3 of reducing sugars and approximately 3.69 g/dm3 of phenolic compounds. The detoxification using zeolite at a dose of 10% w/w for 60 min allowed for the removal of 19.39% of phenolic compounds and caused a loss of sugars of more than 11%. On the other hand, the use of halloysite in the detoxification process enabled a reduction of the level of phenolic compounds by 28.30%, and at the same time slightly affected the change in the content of monosaccharides.

The results demonstrate that the use of mineral sorbents significantly improved the quality of the obtained hydrolysates and the alcohol content in the post-fermentation medium in comparison to the samples which were not subjected to the process of detoxification. Halloysite was characterised by better properties and its use led to more than doubling the amount of reducing sugars in the samples subjected to enzymatic hydrolysis, and increasing their use in the fermentation process by approximately 29%.

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