Summary

The object of the conducted research was to develop the conditions of fermentation of hydrolysates - lignocellulose derivatives and to evaluate fermentation efficiency taking into account the evaluation of the most advantageous process of bioconversion of lignocellulosic substrates into ethanol.

In the first stage of the studies the suitability of eight yeast strains predisposed to ethanol fermentation of pentoses and/or hexoses was evaluated using synthetic medium containing glucose and/or xylose as substrates for ethanol production. Four strains of *S. cerevisiae* capable of efficiently fermenting glucose into ethanol were selected and used in subsequent stages of the studies.

In the second phase of the experiments the tolerance of the selected strains of *S. cerevisiae* to the inhibitors most commonly produced during the pretreatment of lignocellulosic materials was determined. For this purpose, fermentation processes were carried out with the use of synthetic media containing selected substances potentially inhibiting the fermentation activity of microorganisms.

In the third stage of the studies two methods of fermentation of polysaccharides derivatives from selected lignocellulosic substrates: rape straw and *Salix viminalis* were tested. The process was carried out in sequential and simultaneous systems using *S. cerevisiae* yeast strains selected in the earlier stages of the studies.

Further experiments involved detoxification of lignocellulosic materials after pretreatment by separating the solids from the liquid by centrifugation and rinsing the solids with water. The impact of the applied operation on the content of selected toxic compounds in lignocellulosic hydrolysates and on the efficiency of the fermentation process was determined.

The studies carried out in the next step were aimed at achieving a higher concentration of ethanol in the final stage of lignocellulose bioconversion. For this purpose, the concentration of hydrolysates of rape straw and *Salix viminalis* was carried out to obtain a higher concentration of fermentable sugars. The content of selected compounds potentially inhibiting the fermentation activity of the used yeasts in the concentrated hydrolysates was also checked.

Modification of the simultaneous hydrolysis and fermentation system was also used to increase the initial substrate concentration. This modification involved adding additional portions of lignocellulosic material during the process (SSF with feed). Evaluation of the

effectiveness of the applied operations was based on the final concentration of ethanol obtained in the fermented hydrolysates.

In the last stage of the studies the quality of the obtained lignocellulosic distillates was checked by analyzing the volatile pollutants in the distillates obtained after the bioconversion of rape straw and *Salix viminalis*.