

Summary

The subject of the research was defining the factors and the range of their influence on the efficiency of the use of the *Miscanthus giganteus* saccharides in the process of its bioconversion to ethanol.

In the first stage of the research, the attempts were made to obtain enzyme preparations after cellulolytic bacteria or filamentous fungi culture. It was indicated that there was the possibility to use the biomass of the *Miscanthus giganteus* as the source of carbon and energy inducing the synthesis of extracellular enzymes from a cellulase complex. The evaluation of their usefulness in the process of biodegradation of the *Miscanthus giganteus* biomass was also carried out. The received preparations turned out to be uncompetitive in comparison with commercial enzymatic preparations. In this stage, the stimulating influence of lactose added as an inductor of secretion of cellulolytic enzymes was not proved.

The second part of experiments related to the improvement of the process of bioconversion of the *Miscanthus giganteus* saccharides to ethanol through selection and improvement of biodegradation conditions of the polysaccharides of the raw material as well as intensification of ethanol fermentation. The experiments carried out during this stage of research regarded the selection of conditions for pretreatment using sodium hydroxide, ammonia solution and oxalic acid. Their effectiveness was assessed on the basis of the quantity of reducing sugars, released during enzymatic hydrolysis as well as the productivity calculated in relation to the sum of polysaccharides contained in the pretreated substrate. The treatment using sodium hydroxide at 120°C, the parameters of which were developed during earlier research carried out in the Department of Food Biotechnology, was regarded the most advantageous method of the *Miscanthus giganteus* pretreatment.

During the implementation of the following research tasks, the suitability of *Pachysolen tannophilus*, *Pichia stipitis* and *Mucor indicus* for ethanol fermentation of pentoses and/or hexoses using synthetic wort containing glucose and/or xylose as substrates used in ethanol production was evaluated. The resistance of the tested microorganisms to toxic substances most frequently originating during the pretreatment of the lignocellulosic materials such as: furfural, 5-hydroxymethylfurfural, vanillin, 4-hydroxybenzaldehyde, formic acid and levulinic acid was also determined.

The influence of types of the used ethanol hydrolysis and fermentation systems on the productivity of lignocellulose conversion to ethanol fuel was also assessed. The process was carried out in a sequential or simultaneous systems using yeast strains *S. cerevisiae*, selected

during earlier research conducted in the Department of Food Biotechnology. In both experimental variants, the content of alcohol in post-fermentation wort reached the value close to 2% (v/v).

In the last stage of experiments, the suitability of the received hydrolysates for the process of alcohol fermentation using *P. tannophilus*, *P. stipitis* and *M. indicus* was tested, and also the influence of the selected detoxification methods on the content of particular inhibitors in lignocellulosic hydrolysates as well as on the productivity of the process of ethanol fermentation was defined. The suitability of the proposed methods of toxic substances elimination in the process of bioconversion improvement of the saccharides of the *Miscanthus giganteus* was shown. However, it was found that their effectiveness depends to a large extent on a kind of a used microorganism and its resistance to inhibitors.