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New inulin hydrolysing fungal enzymes – production and potential applications for modifying inulin

The food and beverage industries depend heavily on enzymes. Enzymes which are able to degrade inulin (inulinases) to its monomers play important role in the mentioned fields. Inulin modifying enzymes are widely used for the production of High Fructose Syrup (HSF), main raw material in food industries. HFS contains fructose and glucose in roughly equal proportions, and it can be produced by an enzymatic reaction where inulin modifying enzymes (inulinases) catalyse the degradation of inulin to its monomers. In addition, inulin can be used as biomass for bioethanol production. By using simultaneous or separate saccharification (using inulinase producing fungus) and fermentation of inulin, it can be converted to bioethanol efficiently. Moreover, prebiotic and bifidogenic properties of inulin can be enhanced as result of inulin modifying enzymes. As a result of the degradation of inulin by inulin modifying enzymes (inulinases) low molecular oligofructans such as di- and tri-fructose chains and fructose are produced. These products may have significant stimulation on the growth of bifidobacteria and enterobacteriaceae and decrease the growth of potential pathogens in human gut environment.

Inulin is a polysaccharide comprised of a fructose chain terminated by one glucose molecule. Inulin occurs as a reserve carbohydrate in various plants, like Jerusalem artichoke and it is a component in roots of dandelion (*voikukka* in Finnish), which a dominant flowering plant is growing across Finland in spring and summer time.

However, there are no cheap inulinase preparations in the market, and compared to its biotechnological potential, relatively little is known about this enzyme and its producers. In this work ascomycetes and other fungi recently isolated from agricultural field soils in Viikki and Jokioinen were screened for their inulinase activity. The most promising fungi were identified, and novel producers of inulinase were found. They are cultivated in laboratory scale, and the inulin hydrolyzing enzymes will be purified and characterized. Cloning of inulinase-encoding gene(s) from an efficiently inulinase producing fungus will be done. The methylotrophic yeast *Pichia pastoris* will be used for heterologous production of the enzyme, and the production of recombinant inulinase(s) in *P. pastoris* through fermentation will be scaled up. For the evaluation of the potential of inulinase/inulin in relevant applications, the efficiency of new inulinases in the saccharification of inulin and in the production of bioethanol in simultaneous and/or separate systems in laboratory scale will be compared with respective saccharification and fermentation of lignocelluloses substrates (straw).