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ABSTRACTS



parapsilosis, *C. metapsilosis*, *C. orthopsilosis*) increased the TNFRSF9 mRNA level more significantly, than those of other *Candida* species we used. Based on the results from murine cell-lines, we examined the response of the human PBMC derived macrophages upon *C. parapsilosis* infection, and found the 4-1BB response similarly to that of the mouse macrophages.

ENHANCE EFFICIENCY OF ETHANOL PRODUCTION BY FERMENTATION WITH MIXED CULTURES AND IMMOBILIZED CELLS

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Modern civilization is heavily dependent on the consumption of fossil energy sources. Moreover, the scale and intensive use of this causes many problems especially for the environment and the economy. It is therefore increasingly urgent to replace the depleting energy sources with environmentally friendlier, renewable energy sources. The most dominant biofuel produced today is bioethanol, mainly from sugar and starch based biomass. The currently dominating crops and the land on which they are produced are also potential resources for food production, and it is well recognized that the use of edible crops for biofuel production may threaten food security. Thus, development and production of second generation biofuel are become to front. One of promising raw materials is Jerusalem artichoke (JA), which is favourable for cultivation and nutritive properties. Main goal of this work is enhance Due to lack of inulinase activity in *Saccharomyces cerevisiae* and weak capacity of fermentation of *Kluyveromyces* species, monoculture fermentation of JA substrate were inefficiently with bioconversion rate lower than 70 %. Screening of different *Kluyveromyces* species for co-fermentation of ethanol with *S. cerevisiae* was carried out and *Kl. marxianus* Y.00959 strain was selected for further studies. Effects of the extract content in the mash and initial cell numbers on co-fermentation with mixed culture were investigated using response surface methodology. Optimal extract content and cultured cell numbers were determined to be 25 % and 210 OD600xml, respectively. Naturally, dry matter of Jerusalem artichoke extract varies from 15 % up to 20 %, thus only 200 OD600xml of cell numbers should be enough to initiate co-fermentation of ethanol. The efficiency of ethanol fermentation was also studied using immobilized cell technology, where *S. cerevisiae* cells were immobilized on the surface of Siran SIKUG 035/xx/300/A carrier. Bioreactor was engineered by adding different microcapillars to improve the diffusion of substrate and products as well as block formations of gas-microfilms. Jerusalem artichoke substrates with different concentration and flow rates were used to model operation of the engineered reactor. Optimal dilution rate was 0.23/h in the case of 13% extract content. The productivity of ethanol was about 13 g/Lh. At least 6 hours residence time was needed to reach 80% of bioconversion. Km and column capacity were 2.12 w/v % and 9.25 g/Lh, respectively. These results of both fermentation technologies are promising for development of technology for production of bioethanol based on Jerusalem artichoke as raw material. The use of mixed culture increases efficiency of bioconversion, while application of immobilised cell bioreactor, the fermentation time may be shortened significantly and the productivity was multiple compared to batch fermentation. Scaling-up studies are needed in order to apply these technologies in semi-pilot or pilot scale.

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