OP18. Integrated bioprocess approach for the production of xylooligosaccharides

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The demand of prebiotic ingredients has been growing over the years as consumers pay more attention to their health. Xylooligosaccharides (XOS) are considered emergent and competitively priced prebiotics, presenting high potential as food ingredients. As a result, the industry is focused on developing new approaches to improve their production efficiency to meet the increasing demand while reducing costs. Hence, the main purpose of this work was to develop an integrated bioprocess, based on one-step fermentation, for the production of prebiotic XOS, towards the simplification and cost reduction of the process.
The one-step fermentation of 13 agro-residues was done using two *Trichoderma* species. The most promising results were found for *T. reesei* using brewers' spent grain (BSG) as substrate. BSG is an inexpensive and abundant agro-industrial residue that was proven interesting for the production of arabino-xylooligosaccharides (AXOS).
In order to reduce the production time obtained with *T. reesei* (3 d), the *Bacillus subtilis* 3610 wild type (wt) was successfully used to produce AXOS through direct fermentation of BSG, reducing the production time to 12 h. Genetic engineering was used to further optimize the microorganism performance, by cloning the *T. reesei* xylanase gene coupled with a secretion tag into the *B. subtilis* chromosome (*B. subtilis* 3610 clone 2). This strategy led to a yield increase of 33 % comparing to the wt, and 29 % comparing to the *T. reesei*.
B. subtilis 3610 clone 2 was also selected for downscale production of XOS by direct fermentation of commercial beechwood xylan. The maximum production yield, 306 ± 4 mg/g (XOS/xylan), was achieved after 8 h of fermentation operating under one-time impulse fed-batch regimen.
In vitro studies using human fecal inocula were performed to evaluate and compare the potential prebiotic effect of commercial lactulose and the XOS herein produced. The significant increase in the production of short chain fatty acids and CO_2, added to the reduction of pH and ammonia concentration suggest that the XOS hold potential functional properties for human health. The results gathered provide important insights for the development of new integrated strategies for XOS production from agro-residues.