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Enzymatic synthesis of prebiotic galacto-oligosaccharide: Application of nanobiocatalysts and structural characterization of product

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Statement of Problem: Galacto-oligosaccharides (GOS) are group of α -galactoside compounds with significant market value due to their prebiotic properties utilized in infant nutrition products. Physiological activity is based on their short chain carbohydrate structure which makes them non-digestible by digestive enzymes, but digestible by beneficial probiotic bacteria with consequential property of selective promotion of their growth and improvement of overall health status. State of the art in current industrial GOS production based on transgalactosylation activity of α -galactosidases implies that attempts for further advance could be focused on fine-tuning of physiological properties by targeted control of enzymatic process toward obtaining GOS of desired structure and developing novel immobilized α -galactosidase preparations with improved activity towards GOS synthesis.

Methodology & Theoretical Orientation: For evaluation of the effect of enzyme origin on degree of polymerization and type of α -linkages within obtained GOS compounds, transgalactosylation was performed with different α -galactosidases: from *Aspergillus oryzae* and *Lactobacillus acidophilus*. Elucidation of chemical structures in obtained GOS mixtures was performed using ion-mobility spectrometry tandem mass spectrometry (IMS-MS/MS) one-step approach. Improvement in the α -galactosidase immobilization was attempted by producing novel nanobiocatalyst with functionalized nonporous fumed nano-silica (FNS) particles as immobilization support.

Conclusion & Significance: IMS-MS/MS analysis has shown that structure of obtained GOS is influenced by origin of α -galactosidase, since one from *A. oryzae* produced GOSs with (1 \rightarrow 6) and (1 \rightarrow 3) linkages, while enzyme from *L. acidophilus* produces GOSs with (1 \rightarrow 6) and (1 \rightarrow 4) linkages. Type of glycosidic linkages influences prebiotic properties of GOS, hence determination of linkage type will have great significance in enabling adequate selection of α -galactosidase for targeted prebiotic application. The immobilization on nano-supports indicated that the most adequate support is one functionalized with amino groups, which enabled several times higher transgalactosylation activities than conventionally immobilized α -galactosidase.

Biography

'HMDQ %HJEUDGLFD REWDLQHG KLV 3K' GHJUHH LQ %LRFKHPLFDO (QJLQHHULQJ DQG %LRWHFKQRORJ\ Since 2013, he is an Associate Professor in the Department of Biochemical Engineering and Biotechnology. During 2009, he was on sabbatical working in the /DERUDWRU\ RI (QJ\PH (QJLQHHULQJ DW ,QVWLWXWH RI &DWDQ\VLV LQ 0DGULG +LV VFLHQWL¿F ZRUN V\QWKHVLV LQ PLFURDTXHRXV PHGLD DSSOLFDWLRQ RI PHPEUDQH UHDFWRUV LQ ELRFDWDO\WLF SURF PRGHOLQJ RI ELVXEVDWUDWH HQJ\PDWLF UHDFWLRQV DSSOLFDWLRQ RI HQJ\PHV ZLWK WUDQVJVO\FRV\OD HQJ\PHV DQG LPPRELOLJDWLRQ VXSSRUWV DQG QDQRELRFDWDO\VLV +LV UHFHQW UHVHDUFK DFWLYLW ELRDFWLYH JDODFWRVVLGHV ZLWK SUHELRLWF DFWLYLWLHV WDUJHWHG IRU VSHFL¿F SURELRLWF VSHFL GEHJ#WPI EJ DF UV

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