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Structural features and antioxidant activity of xylooligosaccharides enzymatically produced from sugarcane bagasse

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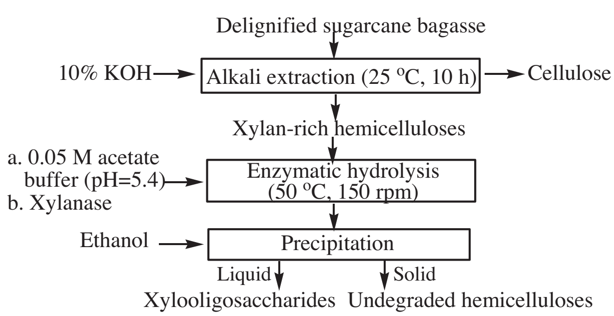
HIGHLIGHTS

- Xylooligosaccharides (XOS) were produced by enzymatic hydrolysis of xylan.
- XOS with degrees of polymerization from 2 to 4 were the major components.
- XOS contained Ara*f* and 4-*O*-Me-α-D-GlcpA residues.
- The antioxidant activity of XOS exhibited a dose-dependent behavior.

GRAPHICAL ABSTRACT



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ABSTRACT

Xylooligosaccharides (XOS) were prepared from xylan-rich hemicelluloses isolated by potassium hydroxide from sugarcane bagasse by hydrolysis with crude xylanase secreted by *Pichia stipitis.* Hydrolysis for 12 h produced XOS with a maximum yield of 31.8%, equivalent to 5.29 mg mL^{-1} in the hydrolyzate. XOS with degrees of polymerization (DP) from 2 to 4 (xylobiose, xylotriose, and xylotetraose) were the major components in the hydrolysates, whereas the oligosaccharides with higher DP of 5–6 (xylopentaose and xylohexose) showed a constant low level. FT-IR and NMR (^1H, ^{13}C, HSQC) demonstrated that XOS contained Ara*f* and 4-*O*-Me-α-D-GlcpA residues. The 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay showed that the XOS exhibited concentration-dependent antioxidant activity. The results obtained indicate that the XOS produced from sugarcane bagasse can be employed in food-related applications.

1. Introduction

Xylooligosaccharides (XOS) are sugar oligomers mainly produced during the hydrolysis of xylan-rich hemicelluloses, which are heteropolysaccharides with homopolymeric backbone of xylopyranose moieties. XOS have a ramified structure containing 2–7 xylose units linked by *β*-(1,4) bonds and with a variety of substituents such as acetyl groups, uronic acids, and arabinose units (Caparros et al., 2007). The type of substituting residues, their degree and pattern of substitution along the xylan backbone, and the molecular weight distribution are structural features that determine the biological and physicochemical properties of XOS (Reis et al., 2003). XOS exhibit a large variety of biological activities such as stimulation of the growth of beneficial bacteria (*bifidobacteria* and *lactobacilli*), improvement in calcium absorption, reduction of the risk of colon cancer, immunomodulatory and anti-infection properties, blood and skin-related effects, and antimicrobial activities (Moure et al., 2006). Glucuronic acid

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