World Academy of Science, Engineering and Technology
International Journal of Biotechnology and Bioengineering
Vol:19, No:02, 2025

Biosynthesis of L-Xylose from Xylitol Using a Dual Enzyme Cascade in Escherichia coli

Authors : Mesfin Angaw Tesfay, Xin Win, Jianqiang Lin, Jianqun Lin

Abstract : L-Xylose is a crucial intermediate in pharmaceuticals, used in the production of various antiviral and anticancer medications. However, it is a rare and expensive sugar with limited natural availability. Recently, enzymatic methods for producing L-xylose have gained significant interest due to their advantages over traditional chemical synthesis. In this study, a novel approach was developed to produce L-xylose from the inexpensive starting material, xylitol. The L-fucose isomerase (L-fucI) gene from Escherichia coli K-12 and the Xylitol-4-dehydrogenase (xdh) gene from Pantoea ananatis ATCC 43072 were cloned and co-expressed in Escherichia coli, resulting in recombinant cells containing the vector PET28a-xdh/L-fucI. The co-expression system achieved optimal activity at 40°C and pH 10.0, with the addition of 7.5 mM Zn^{2+} increasing the catalytic activity by 1.34-fold. This system produced 52.2 g/L of L-xylose from an initial xylitol concentration of 80 g/L, corresponding to a conversion rate of 65% and productivity of 1.86. This study provides a viable approach for producing L-xylose from xylitol using a co-expression system harboring L-fucI and xdh genes.

Keywords : L-fucose isomerase, xylitol-4-dehydrogenase, L-xylose, xylitol, co-expression
Conference Title : ICBB 2025 : International Conference on Biotechnology and Bioengineering
Conference Location : Melbourne, Australia
Conference Dates : February 03-04, 2025