Production of Biotechnological Chondroitin from Recombinant E, Coli K4 Strains on Renewable Substrates

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Abstract : Chondroitin sulfate (CS), as well as modified CS, and unsulfated chondroitin, are largely applied in research today. CS is a linear glycosaminoglycan normally present in cartilage-rich tissues and bones in the form of proteoglycans decorated with sulfate groups in different positions. CS is used as an effective non-pharmacological alternative for the treatment of osteoarthritis, and other potential applications in the biomedical field are being investigated. Some bacteria, such as E. coli K4, produce a polysaccharide that is a precursor of CS (unsulfated chondroitin). This work focused on the construction of integrative E. coli K4 recombinant strains overexpressing genes (kfoA, kfoF, pgm and galU in different combinations) involved in the biosynthesis of the nucleotide sugars necessary for polysaccharide synthesis. Strain growth and polymer production were evaluated using renewable waste materials as substrates in shake flasks and small-scale batch fermentation processes. Results demonstrated the potential to replace pure sugars with cheaper medium components to establish environmentally sustainable and cost-effective production routes for potential industrial development. In fact, although excellent fermentation results have been described so far by employing strains that naturally produce chondroitin-like polysaccharides on semi-defined media, there is still the need to reduce manufacturing costs by providing a cost-effective biotechnological alternative to currently used animal-based extraction procedures.

Keywords : E. coli K4, chondroitin, microbial cell factories, glycosaminoglycans, renewable resources
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