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Characterization of exopolysaccharides from floccular and aerobic granular activated sludge as alginate-like-exoPS

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ABSTRACT

As a component of activated sludge (AS) extracellular polymeric substances, exopolysaccharides (exoPS) have been associated with contributing physically and chemically to the structural strength and coherence of both conventional (floccular) (CAS) and aerobic granular activated sludge (GAS). The study aims at characterization of exoPS extracted from CAS fed first with synthetic wastewater, then with brewery effluent and from GAS treating the latter. CAS and GAS exoPS were analyzed for their gel-forming capacity, morphology, and moisture content of the formed hydrogels, and chemical properties of the extracted exoPS by Fourier transform infrared (FTIR) spectroscopy. Commercially available sodium alginate was used as the reference polysaccharide for comparison. The extracted exoPS from both CAS and GAS formed hydrogels or gel-like structures in $CaCl_2$ solution, similar to $CaCl_2$ reactions of alginate. Environmental scanning electron microscopy images displayed similarities in the morphologies of hydrogels formed by the AS exoPS and alginate. The similarity between the two was further strengthened by FTIR spectroscopy which indicated similar functional groups in the chemical structure of both exoPS extracts and alginate. Moreover, characteristic peaks of the uronic acid residues, namely guluronic and mannuronic acids, were detected at 948 and 882 cm^{-1}, 964 and 879 cm^{-1}, 902 and 879 cm^{-1} for alginate, CAS-exoPS and GAS-exoPS, respectively. Results indicated that the exoPS extracted from the AS samples resembled alginate and likewise the functions of alginate; they seemingly contribute to the physical and chemical properties and structural strength and coherence of AS, especially to the compact and durable nature of excellently settling aerobic GAS.

Keywords: Aerobic granular activated sludge; Alginate; Extracellular polymeric substances; Exopolysaccharides; FTIR spectroscopy; Gelation; Hydrogel

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