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含水介质中胞外聚合物的影响因素研究

Effects of factors on extracellular polymeric substances in water-bearing medium

关键词: [含水介质](#) [胞外聚合物](#) [多糖](#) [蛋白质](#) [渗透系数](#)

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摘要: 明确含水介质中微生物胞外聚合物 (EPS) 生成量的影响因素, 是解决含水层生物堵塞的关键问题. 本文在现场样品采集和微生物培养的基础上, 通过砂柱试验模拟人工回灌过程, 系统研究了进水碳、氮、磷浓度、盐度和温度对含水介质中EPS组成和含量的影响. 结果表明, 砂柱中EPS最主要的成分为多糖和蛋白质, 其中多糖占总量的72%~99%; 砂柱生物堵塞程度与介质上附着的EPS含量呈正相关关系, 当回灌水碳、氮、磷浓度、盐度和温度分别为 $50 \text{ mg} \cdot \text{L}^{-1}$ 、 $5 \text{ mg} \cdot \text{L}^{-1}$ 、 $1 \text{ mg} \cdot \text{L}^{-1}$ 、0.5%和 $30 \text{ }^\circ\text{C}$ 时, 微生物EPS生成量最高, 砂柱渗透系数降低最显著, 堵塞程度最严重. 此外, 碳、磷浓度、盐度和温度是影响EPS生成量的主要因素, 而氮浓度对其影响不大; 碳浓度和盐度对EPS中多糖、蛋白质的组成影响较大, 而氮、磷以及温度则影响不明显.

Abstract: It is important to clarify the effects of factors on the production of microbial extracellular polymeric substances (EPS) when solving aquifer bioclogging. On the basis of field sampling and microbial cultivation, the impacts of carbon, nitrogen, phosphorus, salinity and temperature on the production and composition of EPS in water-bearing medium were investigated by simulating artificial recharge process in sand columns. The results indicated that the main components of EPS in the sand were polysaccharide and protein, and polysaccharide accounted for 72%~99% of the total EPS production. A positive correlation was observed between biological congestion degree and EPS production. Moreover, the maximum EPS production was reached when carbon, nitrogen, phosphorus, salinity and temperature were $50 \text{ mg} \cdot \text{L}^{-1}$, $5 \text{ mg} \cdot \text{L}^{-1}$, $1 \text{ mg} \cdot \text{L}^{-1}$, 0.5% and $30 \text{ }^\circ\text{C}$, respectively. In addition, carbon, phosphorus, salinity and temperature were the main factors influencing EPS production, while nitrogen concentration had little impact. Carbon level and salinity were the major factors influencing the composition of polysaccharide and protein in EPS, while the effects of nitrogen, phosphorus as well as temperature were not significant.

Key words: [water-bearing medium](#) [extracellular polymeric substances](#) [polysaccharides](#) [protein](#) [permeability coefficient](#)

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