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Effective treatment of offshore produced water prior to its release into the environment would remove most of the pollution of marine ecosystems related to oil production. Biofilm reactors represent a potential solution, which can deliver efficient and stable toxicity removal. In this research work treatment performance for produced water by moving bed biofilm reactor (MBBR) and membrane-aerated biofilm reactor (MABR) were investigated in laboratorial scale. These systems used salt-adapted biofilm inside each reactor attached either on moving carriers (MBBR) or onto an aeration membrane (MABR). Batch experiments were carried out with produced water from different oil fields in the North Sea with distinct characteristics such as high organic content, toxicity and salinity. Both bioreactor types could remove a large fraction (up to 80%) of organic content including toxic and persistent chemicals as well as whole water toxicity as measured by bioassays. Both reactor types had similar degradation kinetics for total organic matter measured as COD (1st order reaction) with a fast removal within the first 2-3 hours of treatment. After 8 hours of treatment, no significant further removal could be observed. The obtained results highlight the potential of biological treatment, which apparently can be directly cost competitive to produced water reinjecting (geologically challenging in part of the Danish North Sea).

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Moving bed biofilm reactor

Membrane-aerated biofilm reactor

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