Modelling and process design of Moving Bed Bioreactor (MBBR) for wastewater treatment — A Review

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Highlights:

1. The present paper highlights firstly the origin and significance of MBBR system with its historical backgrounds.
2. Important milestones in its performance and mathematical models are also presented.
3. Chronological developments of various mathematical models on biofilm and MBBR system with their relative features and critical remarks are also presented.
4. Application of existingbiofilm and MBBR models, advantages and limitations under certain conditions are also reviewed with various illustrative examples.

This paper includes future scope of modelling and process design of a Moving bed hybrid bioreactor (MBHBR) system.

Abstract

Moving bed bioreactor (MBBR) is an advanced technology for treating both municipal and industrial wastewater. The main operational principle of MBBR is based on bio-film reactor technology under moving state. The important component of this system is bio-carrier on which bio-film grows continuously throughout its entire surface under dynamic condition. Moving bed hybrid bioreactor (MBHBR) is one modification of MBBR, where suspended growth phase is also present due to hydraulic shear from the attached biomass. Mathematical Modelling of MBBR process is extremely essential for its rational design in wastewater treatment. Very few research studies have been reported so far pertaining to model development for MBBR and its application in real life situation. The major drawback is that the biofilm under moving state integrated with suspended growth process makes the mathematical model very difficult and complex. Therefore it is absolutely necessary to develop a simplified mathematical model to understand the performance of MBBR/MBHBR more scientifically. The present paper reviews all the existing mathematical models, which have been developed so far on MBBR/MBHBR system. The criteria, applications and limitations of those models are compared in respect of various operational issues. The issue of process design has also been highlighted in the light of different models already developed for MBBR.

Keywords: moving bed bioreactor, MBBR/MBHBR, mathematical modelling, comparative study, process design.