CAPEX and OPEX savings using integrated Clarifier with Moving Bed Bioreactor (MBBR) – The Moving Bed Clarifying Reactor (MBCR)

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INTRODUCTION

In order to comply with regulations for Total Suspended Solids (TSS), the effluent obtained from Moving Bed Bio-film Reactor (MBBR) systems need to be treated downstream in a sedimentation tank or clarifier through settling device. Addition of flocculants and/or coagulants is occasionally required. In MBBR systems the diffusers are located on the reactor's floor providing the oxygen and the carrier's mixing.
Mounting the diffusers in a height above the floor level, create two different activity areas, as can be seen in Figure 1.

This report summarizes the variables that affect the solids settling in MBCR configuration.
The following parameters were examined:

a. Carrier's fill ratio
b. Initial solid concentration
c. Reactor surface area
d. Particles settling velocity
e. Air flow

β site pilot was set in order to compare between MBBR to MBCR system and to verify the specified parameters.
Few stages were defined during the project:

Feasibility test – to prove that elevating the diffuser's level will influence the effluent's TSS levels.
Evaluating the odds for industrial WW treatment to reach effluent quality that will stand within the required standards for removal to municipal sewage system.
Characterize the design parameters for the integrated clarifier.
Running a β site pilot, both from the Pharmaceutical and Petrochemical industries to verify the design parameters defined at previous stage.

COST ANALYSIS

To examine capital expenses and operating expenses, a comparison was made between MBBR system including DAF and MBCR. Both systems were examined only for BOD removal. The comparison calculations for the Capital expenses were based on systems with an HRT of 10 hours. For the CAPEX, the calculations were for units with HRT of 4 hours.

CONCLUSIONS

1. Based on the data collected during the different studies and the TSS removal efficiency, the MBCR was found to be applicable and cost effective for Industrial WW, at a defined flow range.

2. The capital expenses of MBCR are lower compare to the expenses for MBBR and DAF construction. Moreover, since there is no need to use chemicals in the MBCR, the operational costs are about 20% lower compare to the MBBR/DAF alternative.
3. The solids removal in the MBCR system is influenced by:
    a) Carrier's fill ratio
    b) Required outlet solid concentration
    c) Reactor surface area
    d) Particle settling properties