Waste water Treatment

Moving Bed Biofilm Reactor (MBBR)

Sewage Treatment Plant (STP)

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Moving Bed Biofilm Reactor (MBBR)

MBBR process that was first invented by Prof. Hallvard Ødegaard at Norwegian University of Science and Technology in the late 1980s

- It is attached growth biological wastewater treatment process.
- MBBR process utilizes small plastic carrier media upon which the microorganisms are attached and grow.
- The carrier media is kept suspended by diffused air aeration system for an aerobic process or by a mechanical mixing system for an anoxic or anaerobic process.
- Primary and secondary clarifiers are used in this process but there is no sludge recirculation of activated sludge because an adequate microorganism population is maintained attached to the media.

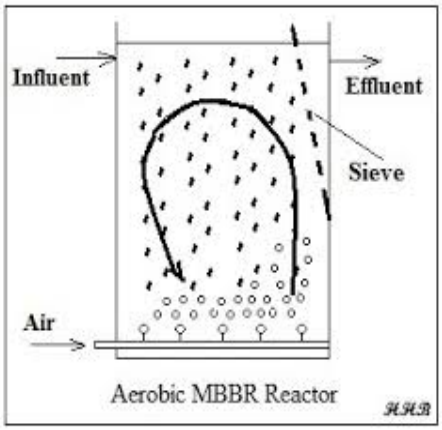

Fig a

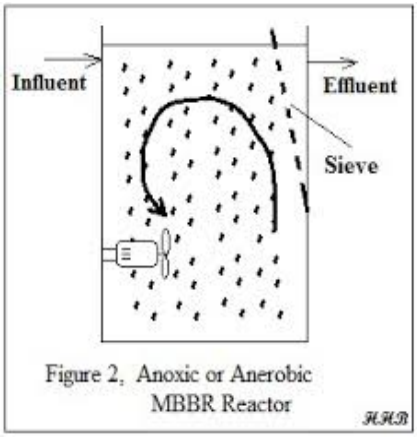

Fig b

Properties of MBBR media considered in design

- Specific surface area of MBBR carriers m2/m3
- Void ratio i.e. void volume to volume of solid. Its ranges from 60% to 90%
- Surface area loading rate (SALR)

The design properties should be obtained from manufacturer or vendor.

Advantages of MBBR media

- Using these technology we can achieve the similar objective with respect to BOD_5 and nitrogen removal in smaller tank volume.
- Biomass retention time is independent on clarifier.

- MBBR is continuous –flow process that does not require a special operational cycle for biofilm thickness control.
- System required low maintenance.
- MBBR is well suited for retrofit installation.

Typical Design value for MBBR at 15 °C		
BOD removal	**Treatment Target % Removal**	**Design SALR g/m2/day**
High Rate	75-80	25 BOD_7
Normal Rate	85-90	15 BOD_7
Law Rate	90-95	7.5 BOD_7

Table 1.

Applications of MBBR media

- Municipal and industrial wastewater treatment
- Used in aquaculture
- Potable water de-nitrification
- Used to remove ammonia from waste water

Surface Area Loading Rate

It is expressed in g/m2/day in this the g/day is parameter is to be removed and m2 refers to the surface area of carrier.
There for SALR is the g BOD/day entering the MBBR tank per m2 of carrier surface area.

Process Design Calculations

Method -I

Single Stage BOD removal MBBR process design calculations

1. **BOD Loading Rate**

   BOD Loading Rate = Q X S_O

   BOD Loading Rate – g/day

   Q – Wastewater flow rate in kg/hr.

   S_O – BOD Concentration in mg/lit

2. **Required Carrier Surface Area**

   Required Carrier Surface Area = BOD Loading /SALR

   SALR – Surface Area Loading Rate in g/m2/day (Refer table 1)

   Required Surface Area – m2

3. **Required Carrier Volume**
   Required Carrier Volume = Required Carrier Surface Area/Carrier Specific Surface Area
   Required Carrier Volume – m3
   Carrier specific surface Area – m2/m3.

Method -II

Design considerations for Aeration Tank

(As per Waste water engineering treatment & reuse by Metcalf & Eddy, Inc.)

Biofilm Surface Area - 300-350 m3/hr.

Organic Loading Rate - 4-7 kg BOD/m3/day

MLSS Concentration – 2500 -4500 mg/lit

- Biofilm surface area used for finding quantity of media.
- Organic loading rate is used to calculate volume of MBBR tank.
- MLSS concentration is used to calculate sludge production.

1) **BOD due to suspended solid**
   = Suspended Solid outlet X (MLVSS/MLSS) X 0.68 X 1.42

Constants comes from

2) **Total applied BOD**
   = Inlet BOD X Inlet Flow Rate

3) **Protected Surface area of medi**a
   =Surface Area of media X 0.80

4) **Media Organic Loading**
   = Organic BOD loading / Protected Surface Area of Media

5) **Quantity of media required**
   = Total applied BOD / (Media Organic Loading X Surface Area of Media)