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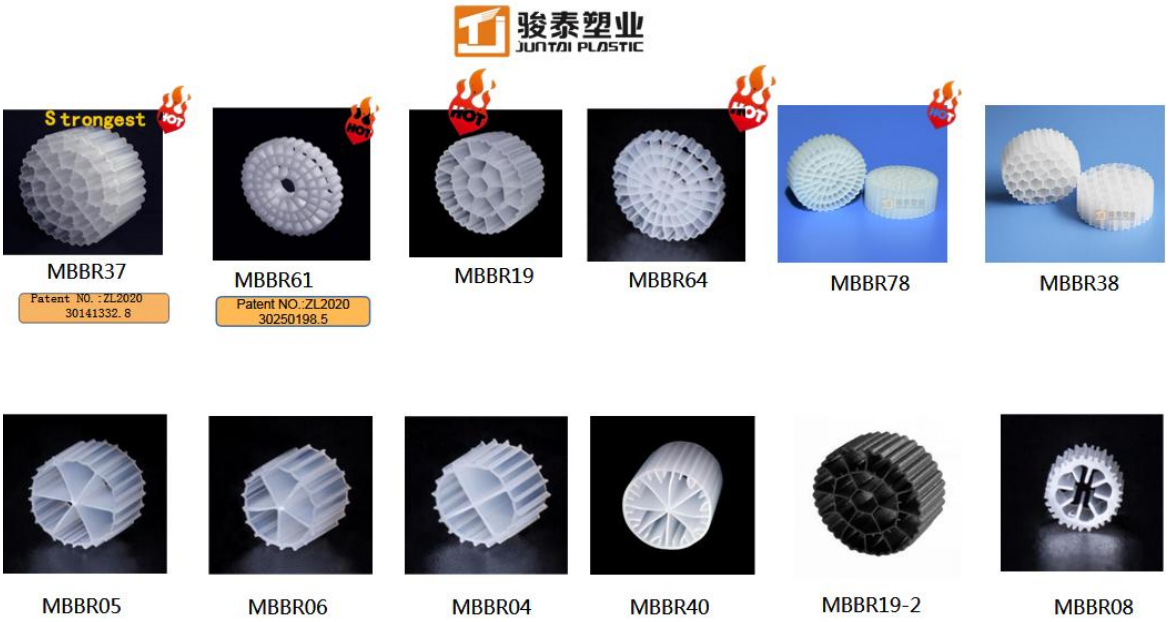
MBBR ACCLIMATION & START-UP PROCEDURE



MBBR, which stands for Moving Bed Biofilm Reactor, is a biological wastewater treatment process that uses a suspended media bed to promote the growth of microorganisms that can break down organic contaminants. The acclimation and start-up procedure for an MBBR system involves several steps to ensure the establishment of a healthy and efficient microbial community. Here's a general outline of the process:

1. Begin by analyzing the influent wastewater for nutrient calculation and characterization.

2. Ensure proper aeration and mixing of biofilm carriers by providing airflow and filling the bioreactor with clean water.

3. Add a portion of Return Activated Sludge (RAS) and a suitable "food source" such as process wastewater or a biodegradable carbon source.

4. Adjust the nutrient levels in the bioreactor if needed, considering the BOD:N:P ratio.

5. Use a defoamer if excessive foaming occurs during start-up.

6. Monitor and adjust dissolved oxygen levels and pH to maintain suitable conditions for microbial growth.

7. Increase airflow if biofilm carriers are not mixing properly.

8. Repeat monitoring and adjustments regularly, gradually increasing the wastewater or carbon source addition.

9. After one week, transition to continuous flow acclimation.

10. Initiate continuous flow of wastewater at a low rate, monitoring the liquid level and ensuring proper carrier retention.

11. Adjust nutrient and defoamer dosing if necessary.

12. Regularly collect and analyze samples to assess system performance.

13. Increase influent flow rate as the system acclimates, adjusting nutrient dosing, airflow, and pH as needed.

14. Continue sampling and monitoring until the influent flow reaches the design capacity.

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1. Begin by analyzing the influent wastewater for nutrient calculation and characterization.

Take a representative sample of the process wastewater (influent only) and conduct an analysis to calculate nutrient additions and gather characterization data.

2. Ensure proper aeration and mixing of biofilm carriers by providing airflow and filling the bioreactor with clean water.

Ensure proper airflow to the aeration grid for wastewater aeration and thorough mixing of the biofilm carriers. At this stage, fill around 70-75% of the bioreactor's working volume with industrial "clean" water. If the clean water is chlorinated, allow it to aerate for 24 hours before introducing Return Activated Sludge (RAS) to release any trapped chlorine gas.

3. Add a portion of Return Activated Sludge (RAS) and a suitable "food source" such as process wastewater or a biodegradable carbon source.

Add 5-10% of the bioreactor's working volume with suitable Return Activated Sludge (RAS) from an appropriate source.

Within one hour of completing step 3, introduce a "food source." If the wastewater is classified as low-foaming, add process wastewater up to 15% of the bioreactor's working volume. Alternatively, utilize a readily biodegradable carbon source such as methanol, ethanol, molasses, sugar, sodium acetate, etc., instead of process wastewater for batch acclimation. Add the carbon source to achieve the desired BOD5 concentration in the reactor.

4. Adjust the nutrient levels in the bioreactor if needed, considering the BOD:N:P ratio.

If necessary, add aqua ammonia and phosphoric acid to the bioreactor based on the influent's BOD, maintaining a ratio of BOD:N:P = 100:5:1. Adjust the chemical dosing proportionately if the influent wastewater already contains nitrogen and phosphorus.

5. Use a defoamer if excessive foaming occurs during start-up.

In the event of excessive foaming during bioreactor start-up (typical as billowy white foam), it is recommended to use a non-paraffin defoamer with an active ingredient concentration of 10-20%. Directly dose the defoamer into the bioreactor at a concentration between 1 and 10 ppm. Note that silicone-based defoamers are not suitable if a membrane process follows the bioreactor. Begin with a 1 ppm defoamer dose and increase it by 20% daily until the foam subsides (or follow the recommendations provided by the chemical supplier). BE CAUTIOUS, as excessive defoamer dosing can negatively impact downstream processes.

6.Monitor and adjust dissolved oxygen levels and pH to maintain suitable conditions for microbial growth.

After 24 hours of adding the RAS to the bioreactor, measure the dissolved oxygen level. If it falls below 3 mg/L, increase the airflow to optimize conditions.

Similarly, after 24 hours of RAS addition, measure the pH of the bioreactor. If it is below 6.5 or above 8.5, consider adjusting the influent's pH or adding a buffer to bring it within the desired range.

7.Increase airflow if biofilm carriers are not mixing properly.

If, after 48 hours of RAS addition, the biofilm carriers are not thoroughly mixed or there are accumulations of carriers floating on the surface, increase the airflow until the carriers are completely mixed and no floating accumulations remain.

8.Repeat monitoring and adjustments regularly, gradually increasing the wastewater or carbon source addition

Every subsequent 24-hour period, repeat the actions described in steps 6.

When the dissolved oxygen level exceeds 3 mg/L and the pH remains within the desired range, additional wastewater or carbon source can be added as outlined in step 5. Additions should be made in increments of 5% of the tank volume, with a maximum of one addition per 24-hour period. Repeat steps 9 and 10.

9.After one week, transition to continuous flow acclimation.

One week after adding the RAS to the bioreactor, transition to Continuous Flow acclimation.

10.Initiate continuous flow of wastewater at a low rate, monitoring the liquid level and ensuring proper carrier retention.

Upon completion of the batch acclimation procedure outlined in the previous section, initiate continuous flow of influent wastewater to the bioreactor at 5-20% of design influent flow depending on wastewater characteristics. Initial influent feed at a low rate is recommended to provide additional seeding time for the carriers as well as to minimize any potential toxicity effects during acclimation.

Check / monitor the liquid level in the bioreactor to ensure the level is remaining steady at the design operating level. If water level is increasing the beyond screen spool outlet, stop the influent flow, lower the water level in the bioreactor and inspect the carrier retention screens. Ensure that the carrier retention screens are clean and free from debris. If the screens are clean and increasing water levels in the bioreactor persists, discontinue influent.

11.Adjust nutrient and defoamer dosing if necessary.

If nutrient addition is required, inject appropriate amounts directly into the feed line or bioreactors

depending on injection setup.

If defoamer addition is required, the defoamer may be added into a foam abatement system or directly into the feed line.

12.Regularly collect and analyze samples to assess system performance.

Forty-eight (48) hours after initiating continuous influent flow to the bioreactor, collect samples and analyze the samples.

13.Increase influent flow rate as the system acclimates, adjusting nutrient dosing, airflow, and pH as needed.

When the effluent FCOD in the sample is less than or equal to the design criteria, increase the influent flow by 50%. For example, if the initial influent flow is 10% of the design capacity, it would be increased to 15% of the design capacity in the first increment, then to 22.5%, 35%, 51%, 76.5% and finally 100% of design flow.

a. If effluent ortho-phosphate-P is less than 0.5 mg/L, or ammonia-N is less than 2 mg/L increase nutrient dosing.

b. If the dissolved oxygen level in the bioreactor is less than 3 mg/L, increase airflow.

c. If the pH in the bioreactor is below 6.5 or above 8.5, the influent may require pH adjustment or addition of a buffer.

14.Continue sampling and monitoring until the influent flow reaches the design capacity.

Twenty-four (24) hours after flow adjustment, collect samples and analyze the samples and continue to easure the operating parameters.

Repeat steps until 100% of the design influent flow rate is achieved. Total acclimation time will be site specific.