

WASTEWATER TREATMENT WITH MEMBRANE TECHNOLOGY

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The main advantage of membrane technology is the possibility of decoupling the hydraulic retention time (HRT) and the sludge retention time (SRT). This can be achieved because the membrane works as a barrier, keeping the solids inside the reactor. No decanter is required and the concentration of solids in the bulk can be higher. More solids inside the reactor imply the possibility of working at higher organic loading rates with the consequent reduction of space. Activated sludge process works at an organic loading rate of 5-10g COD/L while membrane bio-reactor, MBR, can go up to 60g COD/L which implies a reduction of space of 10-12 times. A higher SRT is also an advantage since it allows slow growing rate bacteria to developed in the bulk liquid phase, improving the efficiency.

However, MBR have some disadvantages, life and cost of the membranes, fouling and clogging. Life and replacement cost are not anymore the main problems due to the rapid development of new materials and manufacturing methods in the last years. The high solid concentration turns out fouling and clogging as the major disadvantages. Fouling

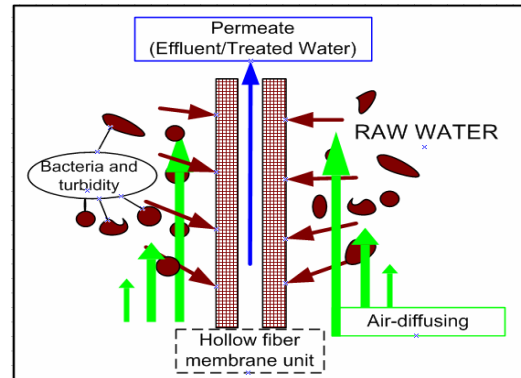


Figure 1. Membrane filtration process

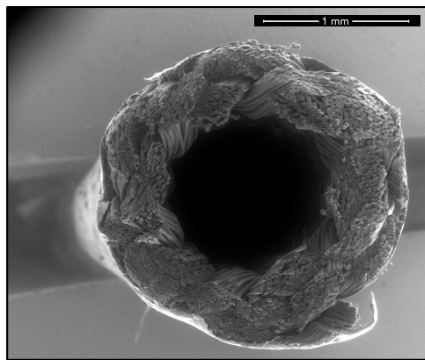


Figure 2. Hollow fiber cross-section.

refers to the biomass and mineral salts that get stuck on the membrane surface. On the other hand, clogging refers to the internal obstruction of the membrane pores. In addition, fouling and clogging can be classified as reversible and irreversible, where the first one is easily removed by regular backwashing with water and the second one needs more intensive cleaning with addition of chemical products. The routine to remove these foulants from the membrane surface will determine the operation cycles of the membrane.

The combination between membrane technology and anaerobic treatment allows to overcome the main limitations of anaerobic technology, broadening its range of application to more wastewaters such as low strength and recalcitrant wastewaters.

The Environmental Technology research group is actually studying the application of anaerobic membrane bioreactors for urban and industrial wastewater. The main variables to optimize in these projects are:



Figure 3. Urban wastewater An-MBR pilot plant. (Valladolid)

- Routines and methods for membrane cleaning.
- Operation cycles (filtration, backwashing, relaxation).
- Influence of solid concentration, and biogas velocity on membrane performance.
- Effluent quality (COD, SST, NH_4^+ , NH_3 , pathogens).
- Influence of membrane operation conditions on the biological process.