The anaerobic MBR for sustainable industrial wastewater management

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\textbf{ABSTRACT}

Anaerobic high rate processes are considered cost and resource efficient solutions for treating wastes and wastewaters. Referring to the global current “energy discussion,” anaerobic conversion processes recover “organic waste enclosed energy” to the gaseous energy carrier CH\textsubscript{4}, whereas no energy is required for stabilizing the waste organic matter. Considering the ongoing trends in industries to reduce specific water consumption, and thereby drastically changing the process water characteristics, membrane bioreactor (MBR) application opportunities are expected to grow in the future. Compared to aerobic MBR technologies, anaerobic MBR (AnMBR) systems do have the same energy benefits as all other anaerobic systems with regard to treatment of organic pollutants, but do also create an absolute barrier for the biomass. By using ultrafiltration membranes, both the dissolved and nondissolved organic matter are retained in the bioreactor preventing that they will leach out with the effluent or digestate. This makes further degradation and transformation of organic matter into biogas possible, and provides very clear and reusable water. These combined benefits provide an attractive economic and ecological perspective to treat industrial aqueous waste streams. Operating an AnMBR pilot plant for the wastewater from a salads factory has shown that the side stream (gaslift) anaerobic MBR system can operate stable at a significant higher flux levels (around 201/m\textsuperscript{2}-h) than the submerged AnMBR. Moreover, due to the absolute barrier to biomass, more organic material is converted to biogas (conversion rates up to 90% are achieved) compared to the conventional Upflow Anaerobic Sludge Bed systems (typically around 70% conversions). The effluent is clean and free of suspended solids allowing easy reuse of water or the discharge costs will be lower.

\textbf{Keywords:} Membrane bioreactor; Anaerobic; Industrial wastewater; Water reuse; Biogas; Side stream; Ultrafiltration

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