# Applied Research in Self-Forming Dynamic Membrane Bioreactor (SFDMBR) in Waste Water Treatment

Zhilu Liu, Deqin Ran [a,*]

Shandong Transportation Institute, Jinan, Shandong, 250031, China

*Corresponding author

[a]randeqin@126.com

## Abstract

**The self-forming dynamic membrane bioreactor (SFDMBR) has been increasingly used in water treatment in recent years. The scope of the current paper was to briefly review literature on influencing factors, different kinds of wastewater and pilot scale experiment of SFDMBRs. It will be conducive to further application of SFDMBR in the future.**

## Keywords

**Self-forming dynamic membrane bioreactor (SFDMBR), influencing factors, pilot scale experiment, membrane fouling, water treatment.**

## 1. The Self-Forming Dynamic Membrane Bioreactor (SFDMBR)

Self-Forming Dynamic Membrane Bio-Reactor(SFDMBR) is a new wastewater treatment method based on traditional Membrane Bio-Reactor(MBR) and Dynamic Membrane(DM) technology. Instead of micro filtration membrane, relatively large aperture membrane is used to effect solid-liquid separation by the sludge cake which is formed by the head pressure. For its solution of the high cost and the membrane fouling, the SFDMBR is with high value to research and develop.

According to the economic analysis, it could be concluded that the cost of module and operation of SFDMBR was lower than that of conventional membrane bioreactor. The SFDMBR meet the requirement of energy saving much more [1]. SFDMBR can be of use as an alternative advanced wastewater treatment system and its performance corresponds to that of a membrane bioreactor [2].

In the research of Liang [3], according to the changing rules of the flux, outflow quality and the water head, the running cycle of the SFDMBR could be divided into 5 stages as recovery period, stable period, mature period, dieing period and regeneration period. And Duan [4] divided the membrane formation processes into mosaic fast filter stage, network coverage phase and pore blocking phase. Fan and Huang [5] divided a running cycle into formation stage, stable stage and clogged stage.

## 2. Influencing Factors on SFDMBR

Gao [6] found the permeate flux had an essential influence to SFDMBR in its forming, stable operation and fouling periodicity. It was provided of a method to maintain stable and high permeate flux by means of adjustment of initial flux and stable operation flux parameters in this experiment.

Ye [7] pointed out that the major influence factors of NH3-N removal are temperature and COD. Under the condition of COD lower than 2000mg/L and temperature higher than 25-30℃, DMBR performance good removal of NH3-N: When the contration of NH3-N in the influx is at the range of 74.66-114mg/L, NH3-N in the effluent is at the range of 5.88-23.44mg/L with average efficiency of 83%.

Fuchs et al. [8] identified the characteristic of the sludge floc as a factor of vital importance, and found that the food to microorganism (F/M) ratio had a critical influence on the floc characteristics.

## 3. Different Kinds of Wastewater

Liu [9] equipped SFDMBR with plate membrane that was made of a 0.1mm nylon mesh as filter material instead of a micro-filtration membrane or an ultra-filtration membrane, and municipal sewage and artificial organic wastewater in high concentration were treated with the reactor. When HRT was about 5h, the average volume loading was 0.67kgCOD/m3•d, and water flux of membrane was 16.5L/m2•h, the SFDMB, in stabilization period, reached an average COD removal of 80% and the COD in the effluent could be kept under 40mg/L. And the average NH3-N removal

efficiency was 93.1%, even reached 99.5% sometimes, and the concentration of NH3-N in the effluent were under 8mg/L, most times under 2mg/L.

Aim at the existent problem of wastewater treatment for expressway service area, the advice of adopting nonwoven fabrics membrane bio-reactor to treat expressway service area wastewater is made [10]. The result of experiment shows that in the whole study, the average removal rate of COD, NH3-N, TN and TP is 89.7%, 90.5%, 39.4% and 18.4% respectively, when artificial wastewater is used.

In the research of Li [11], the activated sludge was cultured under sewage mixed with 2,4-DCP, after 35d the sewage was adoptIed to the 2,4-DCP 0f the concentration 30mg/L. After acclimation, the removal rates of COD,2,4-DCP were above 90% and 85% respectively.

## 4. Pilot Scale Experiment of SFDMBR

Liang [3] had run the SFDMBR stably for 30 days under the optimized running condition from this study and achieved good bin-chemical effects. The removal ratio of CODCr and NH3-N was both above 90%, achieving the standard of the reclaimed water. In the research of Ye [7], SFDMBR had a good performance of resisting the shock within COD concentration of 1260-4775mg/L and average sludge load of 0.05-0.09kgCOD/kg MLSS•d. The removal efficiency of COD is above 78%, of which almost is above 81%.

In the study of Lin[12], the pilot-scale experiments were conducted by synthetic domestic wastewater using four materials: PET non-woven, PP non-woven, PET mesh, PVA mesh. Non-woven for film-based materials, polysaccharides and proteins content retained basic stability. Mesh for film-based materials, polysaccharides and proteins content gradually increased with the resistance slow rising. Fouling degree of the four filter materials in turn: polyamide mesh, polyethylene mesh, polypropylene non-woven, polyethylene non-woven in the same operation cycle. Non-woven was superior to mesh in terms of prevention of irreversible fouling in SFDMBR used for treatment of domestic sewage.

He [13] carried out the 10m3/d pilot experiment use dynamic membrane bio-reactor conducted by A-O biological reactor and tubular membrane module to treat effluent from hydro-cyclone detritor of a sewage treatment plant. The medicine wash scheme that 2 hours alkaline cleaning and pickling makes flux recovery rate of the membrane module reach 96.8%, only pickling or alkaline cleaning flux recovery rate is about 80%, and alkaline cleaning before pickling is better than pickling before alkaline cleaning. Guan [1] used the air-water backwashing method during the operation process, when the TMP was up to 6cm, backwashing would begin, the backwashing interval was about 11 or l2 days. Ye [7] employed a cleaning method to inhibit membrane fouling that first air back flush with the aeration time of 1 min and the aeration intensity of 30 m3/h and then 6 min bottom aeration simultaneity of back flush with the time of 6 min and the intensity of aeration is 60m3/h. During treatment of the chemical wastewater, chemical clean should be carried out because of more bio-fouling and inorganic-fouling.

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