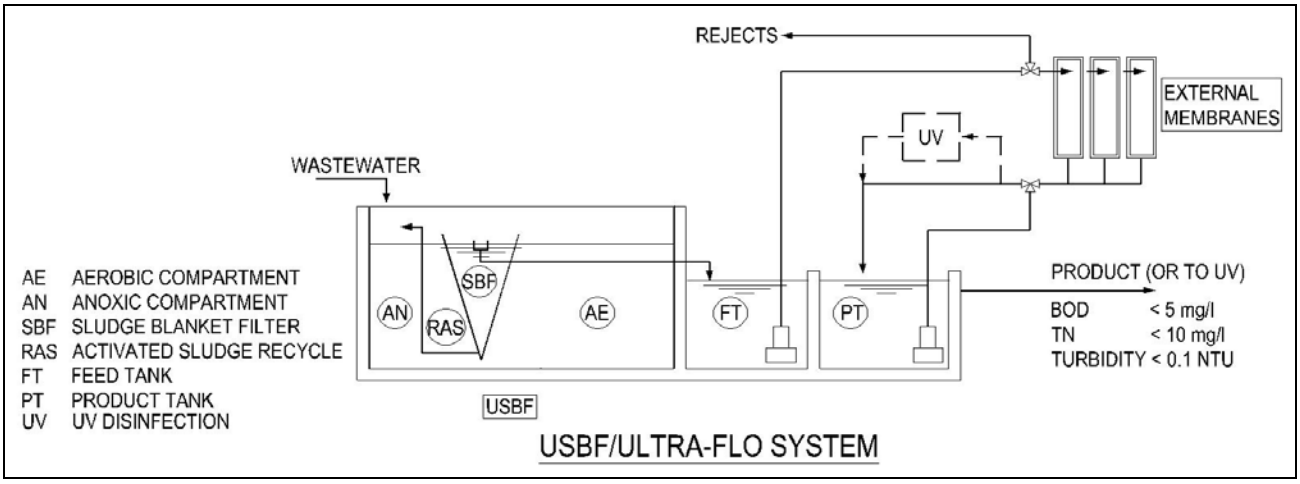
Upflow Sludge Blanket Filtration (USBF™)
AND
External Membrane System (eMBR)

In recent years, membrane filtration has been widely adopted by the wastewater treatment industry predominantly using immersed hollow fiber or panel membranes. The immersed membranes however, come with significant compromises involving costs, simplicity, flexibility, and more. Costly, 'special requirement influent fine screening' needs to be provided, and steps such as lifting and removing the membranes out of the bioreactor when required for maintenance are disruptive to routine plant operation. Additionally, membranes immersed in the bioreactor make optimization of the biological and the filtration processes difficult.

ECOfluid membrane system, which consists of an Upflow Sludge Blanket Filtration bioreactor followed by external membranes, builds on the treatment efficiency of the USBF™ process and utilizes external membranes for final polishing filtration. The configuration reduces or eliminates many of the immersed membrane compromises. No special pre-treatment is required, the biological treatment can be optimized for biological nutrient removal (and include chemical precipitation if desired), and the membrane energy input is kept low by the membranes design and by the fact that the TSS of effluent from the USBF™ sludge blanket filter is already less than 10 mg/l. The result is a membrane quality effluent, including giardia and cryptosporidium removal and turbidity reduction to 0.1 NTU, with significantly improved reliability, flexibility and simplicity of operation, and reduced capital and operating costs.



BRINGING IT TOGETHER

The system brings together the best of the biological and the membrane processes. The advantages of the ECOfluid membrane system are:

No "Special Needs" Fine Screening
The external membranes do not require "special needs" ultra-fine screening typically required for immersed membranes.

No Primary Clarification
The USBF™ process does not require primary clarification.

Optimized Biological Processes Including Biological Nutrient Removal (BNR), Alkalinity Recovery & Filamentous Bacteria Control
The single sludge denitrification process facilitates total nitrogen reduction and partial recovery of alkalinity lost during nitrification. Total phosphorus is reduced by 'luxury uptake' process, and 'the anoxic selector' controls filamentous bacteria growth.

High Membrane Flux Rate and Reduced Fouling

The low membrane feed solids concentration (~10 mg/l) enables high flux rates and reduced membrane fouling.

Multi-Barrier Two Stage Filtration

Two step filtration - upflow sludge blanket fluidized bed filtration followed by membrane filtration for greater reliability

Easy and Economical Membrane Cleaning and Maintenance

The external membrane maintenance is safe, easy and dry. There is no exposure to chemicals and sludge and no cranes are required.

Modular and Flexible Design

The modular nature of the USBF™ process and the external membrane systems ensures that plants can be readily expanded in response to growth in demand.

Reduced Operating and Maintenance Requirements

The compact design, minimal amount of moving parts, modularity of construction, high membrane flux rate, significantly reduced power consumption, low fouling and ease of maintenance result in decreased operating and maintenance costs.

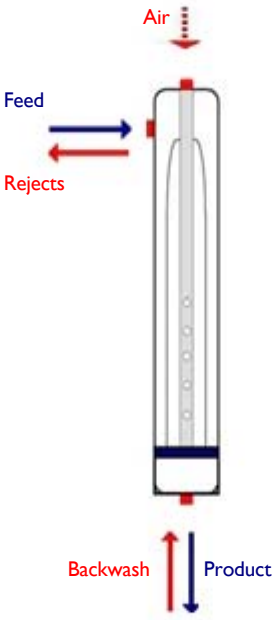
No Odor

Aerobic conditions throughout the process and extended sludge age eliminate or dramatically reduce odor. The plants can be located within populated areas without odor concerns.

Improved Sludge Characteristics

Low microbial loading (extended sludge age of 25-35 days) produces less waste sludge, which is aerobically stabilized, and which is characterized by improved structure and better dewatering capability.

ABOUT THE MEMBRANES



Ultra-Flo® membranes models MU 01 to MU 24 are designed for Cross-Flow and Dead-End (out-to-in) filtration. In dead-end filtration, one end of the hollow fiber is closed ensuring that the feed water permeates through the hollow fiber using less pressure.

The hollow fiber outside diameter is 2 mm and it is fabricated from hydrophilic modified PAN.

Each membrane cartridge is 8" dia x 60" long (200 mm dia x 1500 mm), its total surface area is 450 ft^2 (40 m^2), and the operating pressures are < 8 psig (55 kPa) and < 14 psig (97 kPa) for respectively feed and backwash.