



3FM™ Filtration (Flexible Fibre Filter Module) as tertiary treatment for industrial wastewaters

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3FM™ (Flexible Fibre Filter Module) is a high speed filtration device that can be substituted for conventional solid-liquid separation combined processes such as coagulation-flocculation-settling-sand filtration for tertiary treatment of wastewater. Suspended solids are filtered by the flexible fibers, which have softness, elasticity and a degree of surface roughness. The filter is packed with bundles of fibers along the module length and influent flow is introduced to the bottom of 3FM. Utilizing all of the filter area through deep bed filtration suspended solids particles are captured. The optimum operating parameters are managed according to the influent characteristics desired quality of the treated water. Removal efficiency of the filter can be upgraded using in-line injection of coagulant at very small dosage.

DESCRIPTION

The 3FM™ system involves high speed tertiary filtration radially through a bundle of flexible polyamide fibers adapted specifically for water treatment. The fiber bundles are loaded into a porous distribution jacket which is housed in specifically designed stainless steel vessels. Although an innovative process, 3FM® operation is easy as a sand filter.

Filtration process:

Raw water is fed through the inlet pipe of the lower part of the filter module and introduced uniformly into the flexible fiber filter layer. During the filtration process, the suspended solids are captured on the media surface and in the pores created among the fibers flowing in the co-current direction. Filtered water is discharged to upper port.

Backwash process:

When the differential pressure reaches a pre-set value, or the timer is reached, then the backwash process is initiated. The suspended solids collected in the 3FM filter

are displaced and removed by the turbulent flow and shearing force created by alternate cycles of air and water. The dirty backwash water is discharged from an upper port.



APPLICABLE FIELDS

- SS removal from sewage/wastewater treatment plant
- **Tertiary treatment** & reclamation of sewage/wastewater
- **Alternative to sand filtration**
- **SS removal from industrial and agricultural water**
- **Water re-use**
- Algae removal from river and reservoir
- Preliminary treatment of drinking water

A TECHNOLOGY ALREADY COMMERCIALIZED

Example of industrial plant: Gwangyang Steel mill (South Korea)



1 train of 8 modules
(Ø 1600 mm - H 3500 mm)



Filtration:

- Flowrate: 60,000 m³/day
- Flux: 3,700 m³/m²/day
- Run time: 3 hrs
- SS removal > 87%
(final SS content: 5 mg/l)

Backwash:

- Water + Air
- Duration: 3 min
- Volume: less than 1% of the maximum volume treated

INNOVATIVE ASPECTS

Uses flexible fiber as media:

A media that has been developed using a flexible fiber made from polyamide. Suspended solids are filtered by the flexible fibers which have softness, elasticity and a degree of surface roughness

Principle of solid-liquid separation by media-filtering & capillary phenomenon:

The flexible fiber media is available in several fiber sizes and packing densities according to the application. The 3FM filtration incorporates the use of the capillary phenomenon within the filtration principle.

Deep bed filtration:

The flexible fiber media is packed along the length of the filtration module and the flow travels in the same direction, which makes it possible to operate as deep bed filter ensuring excellent effluent quality that can be maintained.

Treat large capacity:

Compared with existing rapid sand filters, the 3FM filtration velocity is considerably higher, more than 10 times faster at 160 m³/hr. The 3FM system has a small footprint for a high flow capacity compared with the sand filter alternatives.

Possible to adjust quality and capacity:

Adjusting the type of flexible fibre, packing density, filtration velocity etc, the effluent quality can be controlled.

Simple backwash:

The backwash uses cycles of air and water and takes less than 3 minutes to complete. On some applications the influent can be used as backwash water.

CORE TECHNOLOGIES

Rapid filtration:

Flux rate: 2,000~5,000 m³/m²/d → More than 10 times than sand filter alternative

Space: Compact footprint, requiring up to 1/10th the space of sand filters

Deep bed filtration:

Head loss: 0.2~0.6 kgf/cm² SS removal efficiency: 70~90%

Cut size: 2~5 µm SS Output: Typically < 5 mg/l

BOD removal efficiency: over 60% (excludes soluble)

Large capacity filtration:

Single module: 10,000 ~ 12,000 m³/day with single module based on 3FM-C020 (Ø2000 mm)

Multiple modules: Unlimited capacity

Minimum by-product:

Backwash: Less than 1% of the maximum treated water volume

Media: Recyclable polyamide

Simplicity

Control: Fully automatic control triggered by pressure differential or timer

Maintenance: Minimal maintenance

Ancillary equipment: Only requires feed pump and air compressor



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