

22.- 3FMTM Filtration System, Flexible Fibre Filter Module

Title and name of product or technology
3FM™ Filtration System (Flexible Fibre Filter Module)
Abstract
<p>3FM (Flexible Fibre Filter Module) is a high speed filtration device that can be substituted for conventional solid-liquid separation process such as coagulation, settling and sand filtration. Suspended solids are filtrated by the flexible fibres, which have softness, elasticity and a degree of surface roughness. The filter is packed with bundles of fibres along the module length and influent flow is introduced to the bottom of 3FM. Utilising 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.</p> <p>Although an innovative process, 3FM™ operation is easy as a sand filter. Head-loss increases during the filtration cycle and the filtration capacity is recovered by periodic backwashing with a small amount of influent waste water and scouring air.</p>
Description including main features/advantages
<p>The 3FM™ system involves high speed tertiary filtration radially through a bundle of flexible polyamide fibres adapted specifically for water treatment. The fibre bundles are loaded into a porous distribution jacket which is housed in specifically designed stainless steel vessels.</p> <p><u>Process description</u> <i>Filtration process:</i> Raw water is fed through the inlet pipe of the lower part of the filter module and introduced uniformly into the flexible fibre filter layer. During the filtration process, the suspended solids are captured on the media surface and in the pores crated among the fibres flowing in the co-current direction. Filtered water is discharged to upper port.</p> <p><i>Backwash process:</i> 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.</p> <p><u>Principle</u> <i>Filtration</i> Method: Up-flow rapid deep filtration (up to 125 l/sec per filter) Principle: Filtration of suspended solids by filter & capillary phenomenon. Filter run time: ~2-3 hours between backwashing (varies according to flux) Cut-size: 2~5 µm (varies according to flux)</p> <p><i>Backwashing</i> Method: Alternate Air and Water cycles Principle: The effect of turbulent water flow and shearing force from air and water Time: ~2-3 minutes Reject water volume: Less than 1% of the maximum treated volume</p> <p><i>Media</i> Material: Flexible fibre (Polyamide) Fixing method: Upper-free / Lowe-fixed Packing density: Design options according to quality and volume of filtrated water Media replacement period: +5 years, simple to change</p> <p><i>Operating method</i> Control panel: Fully automatic operation with manual override</p> <p><u>Core technologies</u> <i>Rapid filtration</i></p>

Flux rate: 2,000~5,000 m³/m²/d
 Comparison: 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
 Cut size: 2~5 µm
 SS removal efficiency: 70~90%
 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

Innovative aspects

Uses flexible fibre as media
 A media that has been developed using a flexible fibre made from polyamide. Suspended solids are filtered by the flexible fibres which have softness, elasticity and a degree of surface roughness.
Principle of solid-liquid separation by media-filtering & capillary phenomenon
 The flexible fibre media is available in several fibre 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 fibre 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.

Current and potential industrial users/domains of application

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

Current state of development

Commercialized.
 References in:

- o Industrial WWTP (coal mine, steel...)
- o Drinking WTP
- o Municipal WWTP

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