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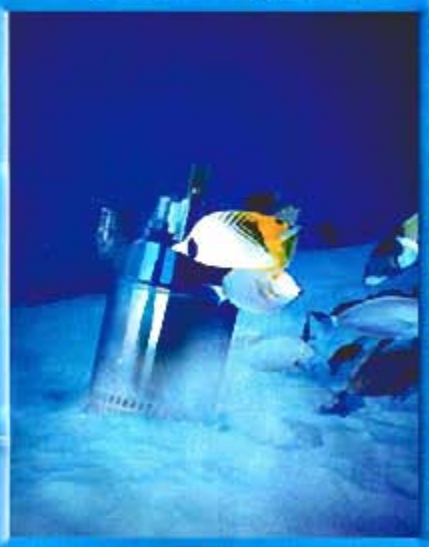

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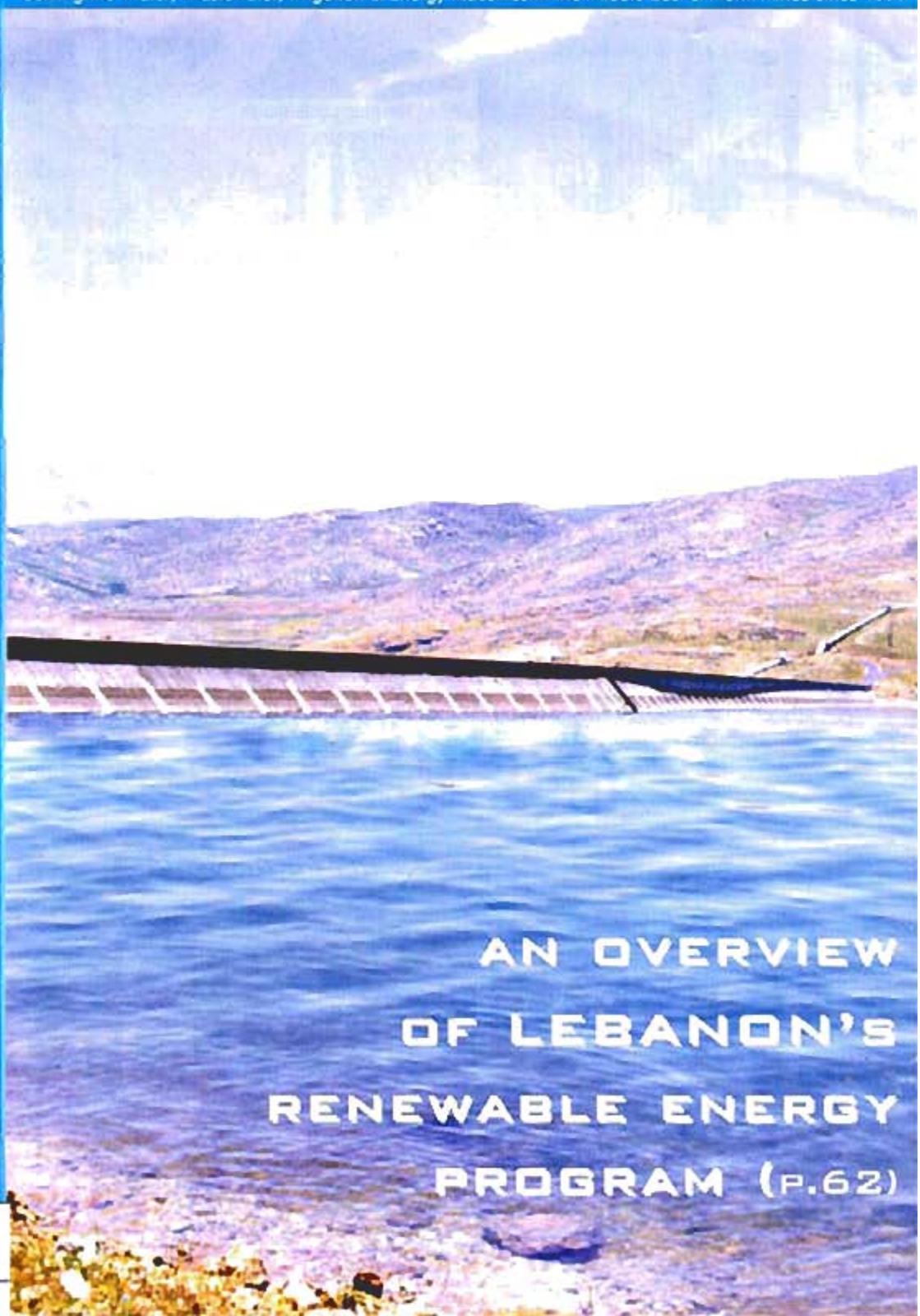

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New Developments in Filter Cartridges for Reverse Osmosis Pre-filtration

By: Hamid Omar*

Reverse osmosis (RO) pretreatment systems are designed to reduce suspended solids to a level that will provide the most suitable conditions for the performance of the membrane system. Depending upon the quality of the feed water, pretreatment may include settlement, clarification, multi-media filtration, and chemical treatment. However, sediment pre-filtration is always required to ensure that suspended materials in the source water do not permanently clog or foul the membrane. Reduction of suspended matter in RO feed water is a standard requirement to ensure cost-effective and efficient water treatment and enhanced RO system life.

In the early days, only cotton string wound onto a steel core was available for filtration. Today there is a wide choice in filter cartridges and filter media. The advantages and dis-advantages of various types of filter cartridges need to be considered to make the right choice for RO pre-filtration.

Conventional String-wound Filter Cartridges

Polypropylene string wound cartridges, due to their inertness and wide range of chemical resistance, are among the most commonly used filters for reducing sediments and other suspended impurities in liquids and water. Traditionally these cartridges are made from "friction-spun" yarns.

Despite their great popularity, these string wound cartridges have many major drawbacks. Fibers on the surface of yarn tend to come loose with flow of liquid and pressure surges in the system.

In the standard textile yarn manufacturing process a spin-finish has to be necessarily applied on the surface of the fibers. Spin-finish contains a number of chemicals like lubricants, surfact-ants, antioxidants, antistatic agents, emulsifiers, and bactericides, etc. Unless the media is pre-washed (though some residue will remain), these chemicals start to leach out and can be often observed as foaming in the filtrate. The leaching out of these chemicals can be detrimental for the filtrate as well as downstream treatments.

Melt-blown Cartridges

Melt-blown filter cartridges were developed several years ago as a lower cost substitute for string wound cartridges. They are made using a one-step process in which high-velocity air blows molten polypropylene resin from an extruder die tip onto a take-up screen or a mandrel to form layers of self bonding fiber web. The only real advantage melt-blown cartridges have over conventional string-wound filters is freedom from process chemicals. These cartridges do not have a supporting core and tend to collapse under even moderate pressure differential.

Pleated Paper Cartridges

They are fabricated in pleated form for extended area using filter sheet or a thin fibrous felt. These cartridges essentially work on the principle of surface filtration but some depth filtration also takes place, which can have a profound effect on the characteristic and life of the filter. When surface type filters are exposed to the flow of contaminated fluid, some of the pores become partially blocked by small hard particles as well as by partial intrusion of soft deformable particles. These particles can form a slime or gel that can completely clog a filter. As such, these filters are suitable only in situations where the incoming water or fluid is relatively clean.

Bonded Filter Cartridges

Bonded cartridges are usually of coreless construction and consist of resin bonded fibers of solid particles. A popular type is made from short cellulose fibers using phenols or melamine as the bonding agent. As these cartridges comprise more than one material, incompatibility can lead to ineffective filtration and costly process errors. The popularity of these cartridges is decreasing due to their relatively higher cost and suitability being mostly limited to viscous fluids.

Fig.1 Filter Cartridge made from new continuous media

New Developments in Filter Media

A new media for string-wound filter cartridges has been recently developed that overcomes all the shortcomings of friction spun yarn as well as those of pleated, resin-bonded and spun-bonded cartridges. See Figure 1. The process of making the new media begins with 100% pure polypropylene that is melt-spun (extruded) without the use of any chemicals. The extruded media consists of continuous filaments of multi-lobal cross-section with numerous micro voids between each individual filament. These chemical-free continuous filaments are then randomly oriented to each other, intermixed, looped and entwined into a non-round, highly stable, bulky yarn.

When this media is wound into a filter cartridge, each of the filaments continues, without a break, throughout the length of the yarn, making the cartridge free from any media migration problems. There are no short fibers that can come lose and migrate, a common problem with conventional string-wound filters. Each yarn also traps the randomly protruding short loops of adjacent yarns resulting in a highly stable media structure wherein the yarns are locked in place and prevented from rolling or shifting to a side. The stable structure provides an excellent knife-edge sealing property to the cartridge. Under conditions of flow and pressure fluctuations, the new cartridge is more resistant to particle unloading.

With the improved media, there are no typical diamond-shaped open spaces and the yarn media covers all the area. The liquid flows through the entire yarn structure and contaminant particles are forced to change direction as they proceed through the depth of the cartridge. The physics of flow is such that it becomes possible to trap particles smaller than the size of the complex pathways.

Finally, through improved winding technology, the pitch, number of crossings and space between each strand of yarn is continuously varied and controlled from start to finish in making the cartridge.

The inner layers of the yarns are wound close together and the space between yarns is gradually increased towards the outer layers, while the yarns remain locked together because of the random protruding loops. The structure has the same firmness throughout the depth of the cartridge, giving more consistent and better performance.

Test results have shown that this new process provides up to twice the dirt holding capacity and filter life at equivalent competitive efficiencies, while reducing pressure drop up to half. All this translates into improved filtration performance and reduced costs. ■

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تُعتبر مرحلة التصفية الأولية للمياه التي ستخضع لعملية التناضح العكسي مهمة وضرورية لإزالة الملوثات والمواد الكيميائية من المياه. وفي هذه المرحلة، يتمّ استعمال أنواع عدة من الفلاتر التي بدورها تطورت عبر التاريخ مع تطور استعمالاتها والحاجة إلى تحسين أدائها. استعملت الفلاتر التقليدية المصنوعة من الخيطان المحبوكة في تصفية المياه من الشوائب غير أنها لم تكن فعّالة بسبب تمزّق الخيوط وحدوث فجوات تسمح بدخول كميات كبيرة من المياه من مكان واحد. تطورت الفلاتر لتُستبدل بتلك الخالية من المواد الكيميائية ثم تلك المصنوعة من الورق أو الصلبة المتماسكة ولكن كلها كانت تفشل في تصفية المياه بشكل دقيق إلى أن تم اختراع الفلاتر المصنوعة من البروبيلين من دون أي مواد كيميائية. وقد أثبت هذا النوع فعالية بقدرته على منع نسبة كبيرة من الشوائب من الدخول عبره فضلاً عن أنه يصفي المواد الكيميائية ويُقاوم التفتت والهريان.

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