

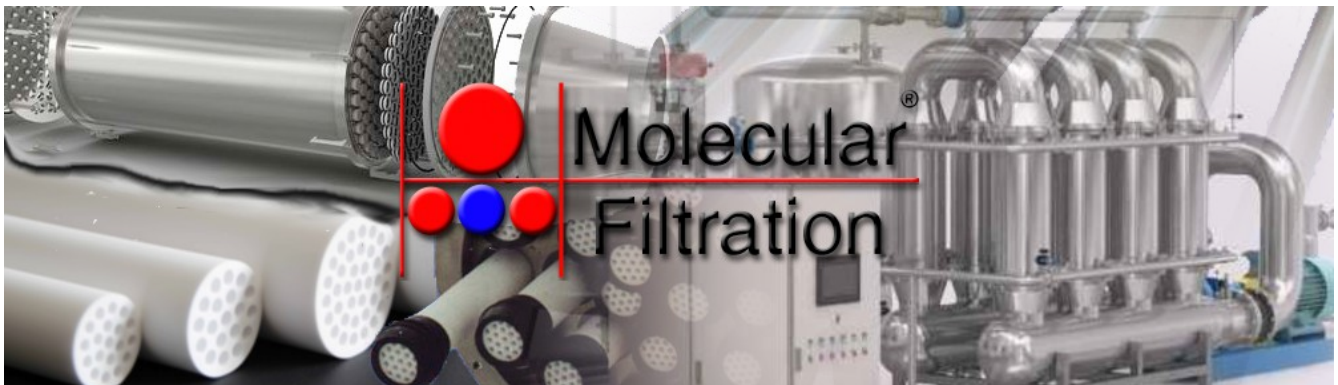
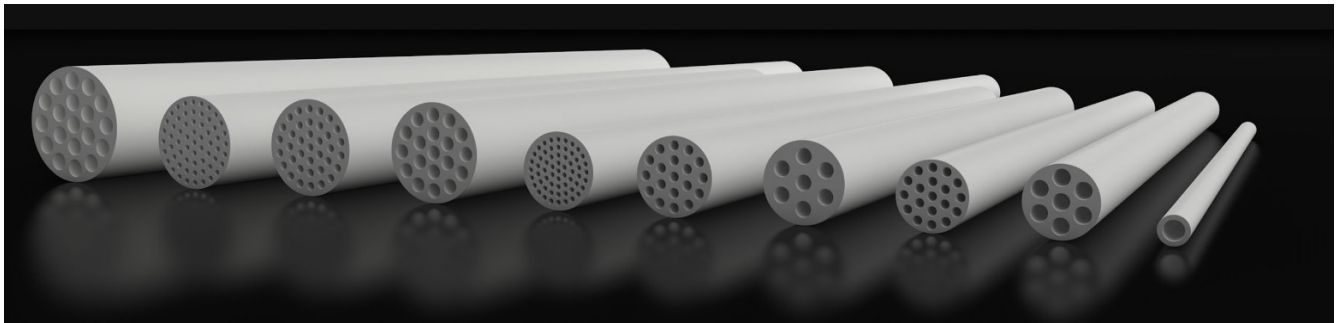


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Organophobic Ceramic Membranes Membrane Filtration Systems

Degree of Recycling Process Complexity and Energy Intensity



By: Felipe Lembcke and Dr. Eduardo Gomez Maqueo

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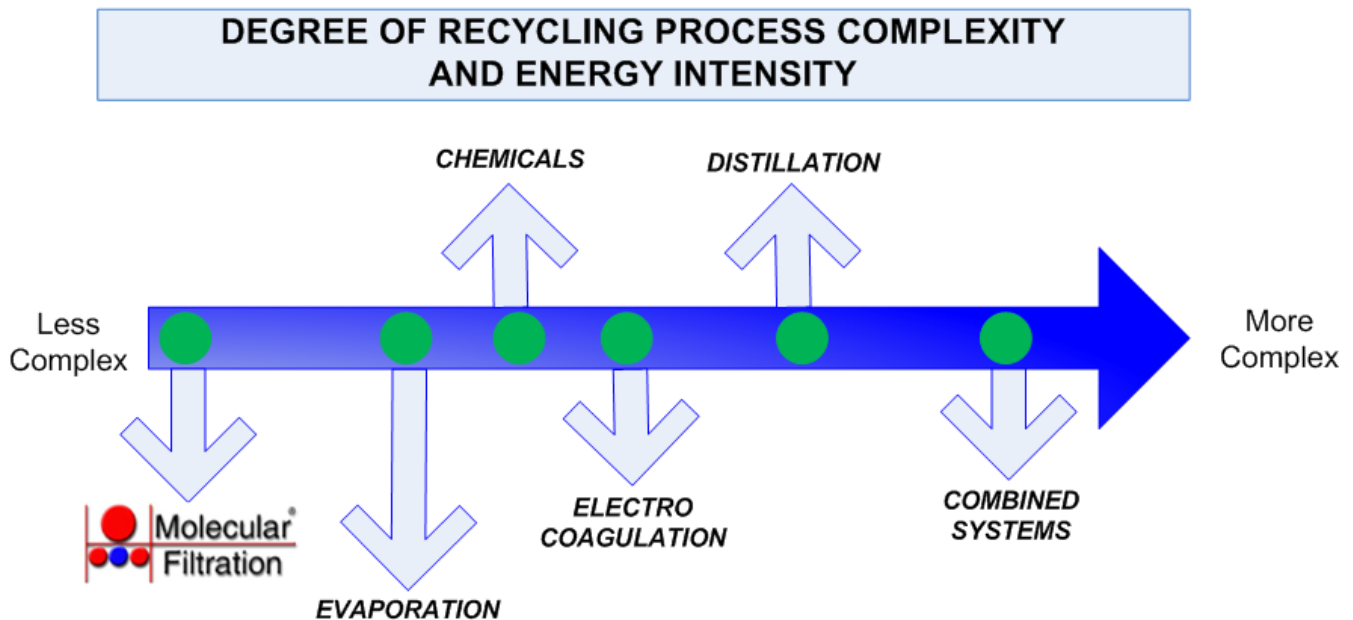
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Degree of Recycling Process Complexity and Energy Intensity

The effectiveness of a given technology is ultimately dependent on the naturally occurring contamination present with specific geologies of the various shale plays. Recyclers must work closely with well operators to ensure that the recycled water does not interfere with existing processes. This is especially important for recycling processes that rely on chemicals that may potentially have a negative interaction with those the well operator is using for fracking. The ability to reuse the water is also dependent on how well the recycling processes works, because particles in the recycled water can damage equipment and block the release of gas from the shale.






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A comparison of the treatment technologies is provided in Table 1.

TREATMENT TECHNOLOGIES	
<p>Organophobic Ceramic Membrane</p> 	<p>A ceramic membrane filter is used to remove contaminants. Process can effectively remove hydrocarbons. None destructive technology for hydrocarbon recovery; requires pre-treatment for heavy metal removal. Pro – Complete rejection of organics, and solids in one process. No Bio-fouling. Con – filters may need to be chemically cleaning, raising operating costs.</p>
Electric Coagulation	<p>Charged particles attach to metals and separate them from water; the pollutants are then skimmed off. Pro – process avoids the use of chemicals for treating water. Con – It does not remove light oils, solvent or salt, and generates a sludge that requires disposal. Not widely used for large-scale applications.</p>
Distillation / Evaporation	<p>Uses heat to evaporate fresh water. Pro – Only method that removes salts from waters with high concentration of solids. Con – more expensive as it has high energy input and may require pretreatment to remove metals and oils. Characterized as high capital and operating costs, low treatment capacity, and an inefficient use of energy.</p>
Combination	<p>Several methods, such as adding ultraviolet, ozone, ultrasound, electricity, pressure and captivation, are combined to kill bacteria, Oxygen molecules change the composition of pollutants, making them less harmful. Pro – almost no waste is created in the combined processes. Con – but it does not remove solids, metals.</p>
Settlement	<p>Inactive separation of heavy solids, limited removal of emulsified oil.</p>
Dissolved Air	<p>Proactive physical separation, removes light and heavy solids, oil.</p>
Ion Exchange	<p>Polishing agents only, does not remove oil.</p>
Reverse Osmosis	<p>Pre-treatment required, fouling and scaling issues, low flow and energy intensive.</p>
Dry-Well Injection	<p>Unsustainable, removes finite water resources from natural hydrological cycle.</p>



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