TECHNICAL BULLETIN

TB 503: Cleaning Recommendations for Thin Film Composite (TFC) and Polyamide (PA) Membrane Elements

This Technical Bulletin provides information regarding various Reverse Osmosis membrane foulants and procedures for removing these foulants using Professional Water Technologies, Inc.'s lines of Lavasol™ liquid Cleaners and OptiClean™ powder cleaners.

Membrane Fouling and Monitoring

Professional Water Technologies, Inc. recommends that all RO systems be tracked by collecting daily operational data and logging this data into normalization software, either supplied by the membrane provider and/or design/engineering firm. In most cases, this software is free and can be downloaded from the internet.

Typically, fouling of the membrane elements occurs over a period of time, and tracking the data can assist in determining cleaning frequencies and additional pretreatment strategies if necessary. Additionally, cleaning membranes in the early stages of fouling may prevent long term performance decline of the system. If membranes become heavily fouled (typically 30-50% performance decline), cleaning may not fully restore the performance of the membranes. It is important to clean the membranes when they are lightly fouled so that the cleaning chemicals can fully penetrate into the foulant allowing it to be more easily flushed away.

As a rule of thumb, cleaning should be conducted prior to long term shutdown, storage or as a regularly scheduled maintenance. Typical characteristics that indicate cleaning of the membranes is necessary include:

- A 10-15% increase in normalized pressure drop across the feed and concentrate headers
- A 10-15% decrease in normalized permeate flow (*Note: Depending on the control logic of the system in question, increased feed pressure may be the most accurate correlation to the change in normalized flow*)
- A 10-15% decrease in normalized permeate quality (increase in salt passage)

Often time's performance decline is the result of multiple foulants being present in the system. This is the reason that in many cases, cleaning episodes require the use of a low and high pH cleaner. To determine the exact nature of the fouling and therefore the best cleaning procedure, Professional Water Technologies, Inc. recommends contacting their Membrane Forensics department to complete a detailed analysis of the membrane element(s) and/or feed water. Membrane Forensics can also conduct in-house cleaning studies to further optimize cleaning procedures. Otherwise, the following troubleshooting matrix may assist in determining the type of fouling and the best product to use when cleaning the membranes.

Type of Foulant	Examples	Location	Pressure Drop	Permeate Quality	Feed Pressure	Recommended Cleaner	
Bilogical Fouling	Bacterial Slimes, Fungi	Any stage, usually lead elements	Increased	Normal to Decreased	Increased	Lavasol II	OptiClean B
Colloidal Fouling	Typically aluminum, iron, silica or sulfur. Inorganic and Inorganic/Organic based particles.	First Stage, Lead Elements	Steady Increase	Steady Decrease	Steady Increase	Lavasol II	OptiClean B
Metal Oxides	Cu, Fe, Mn, Zn	First Stage, Lead Elements	Sudden Increase	Sudden Decrease	Sudden Increase	Lavasol I	OptiClean A
Scale	Ba, Ca, Mg, Sr	Last Stage, Tail Elements	Steady Increase	Steady Decrease	Steady Increase	Lavasol I	OptiClean A
Organic Fouling	NOM	All Stages	Steady Increase	Improved	Increased	Lavasol IV	OptiClean B
Silica	Polymerized	Last Stage, Tail Elements	Normal to Increased	Decreased	Increased	Lavasol V	OptiClean S

Professional Water Technologies, Inc. Product Selection

Depending on whether liquid or powder cleaners are preferred, PWT offers a variety of solutions for your cleaning needs. Please refer to each individual product specification sheet for mixing/diluting instructions.

Professional Water Technologies, Inc. specialty cleaners are a blend of synergistic constituents that include, but are not limited to; buffers to maintain pH throughout the cleaning cycle, dispersants to assist in repelling foulants from the membrane surface, chelants to complex metals and keep them from re-depositing or interference with other chemical reactions, surfactants to lower the surface tension of water that will allow the water to better 'penetrate' the foulants, and builders to allow the rest of the constituents to work better by sequestering hardness ions in water. One of the key functions of a good cleaner is to reduce or eliminate the possibility of a foulant being re-deposited on the membrane surface during the cleaning process. In addition, Professional Water Technologies, Inc. has developed cleaners that contain no phosphates so as to reduce the negative impact on the environment.

Cellulose Acetate Membrane Element Cleaners

When considering cleaning of Cellulose Acetate (CA) membrane elements, PWT offers Lavasol III liquid cleaner for biological growth and colloidal foulants, and OptiClean C for biological growth, colloidal foulants and organic foulants.