



FILMTEC Membranes

Water Chemistry and Pretreatment: Biological Fouling Prevention

Other Sanitization Agents

Copper sulfate can be used to control the growth of algae. Typically, copper sulfate is fed continuously at concentrations of 0.1 to 0.5 ppm. pH of the water must be low (to prevent the precipitation of copper hydroxide). Generally the use of copper sulfate, however, is not recommended due to the following:

- Commercial CuSO_4 may contain some impurities detrimental to the RO membranes.
- CuCO_3 and Cu(OH)_2 tend to precipitate outside of a given pH range of operation, causing fouling to RO devices and making CuSO_4 ineffective.
- Copper ions can have negative effects on the environment.
- CuSO_4 only works properly against a limited range of microorganisms (e.g., some algae) but has only a marginal effect on most bacteria.
- Environmental protection standards of several countries limit the discharge amount of Cu salts, making it difficult to change dosage of this chemical if the biolife situation of a given plant requires it.
- In some specific conditions, RO membrane is oxidized with persulfate generated from copper sulfate.

Ozone is an even stronger oxidizing agent than chlorine. However, it decomposes readily. A certain ozone level must be maintained to kill all microorganisms. The resistance of the materials of construction against ozone has to be considered. Usually, stainless steel is employed. Removal of ozone must be performed carefully to protect the membranes. Ultraviolet irradiation has been used successfully for this purpose.

Iodine, quaternary germicides and phenolic compounds cause flux losses and are not recommended for use as sanitization agents.

Biofiltration

Biofiltration is the biological treatment of water to reduce the organic constituents that either contribute directly to organic fouling or provide carbon sources for the development of biofilms on the membrane surfaces. Processes include bank filtration for river sources, soil passage and slow sand filtration. Filter beds of biologically active granular activated carbon (GAC) are widely used in public water works, where the biological activity of the carbon filter is further enhanced by treatment of the feed with ozone [/3/](#). When such filters are operated at sufficiently low filter velocities (1–4 gpm/ft² or 2–10 m/h) and with sufficiently high beds (6.5–10 ft or 2–3 m), most of the biolife activity takes place in the upper region of the filter bed, and the filtered water is almost free of bacteria and nutrients.

Using biofiltration to prevent biofouling of RO/NF membrane systems has been demonstrated and advocated as a suitable pretreatment method by several authors [/29, 30, 36, 37/](#).

Microfiltration / Ultrafiltration

Microfiltration (MF) and ultrafiltration (UF) can remove microorganisms and especially algae that are sometimes very difficult to remove by standard techniques. The MF/UF membranes should be made from a chlorine-resistant material to withstand periodic treatment with biocides. MF/UF membranes, however, do not remove the low molecular weight fractions of organic matter and other compounds that are nutrients for microorganisms. Pretreatment with MF/UF membranes helps to retard and to control the onset of biofouling, but it is no safeguard by itself.

Ultraviolet Irradiation

Ultraviolet (UV) irradiation at 254 nm is known to have a germicidal effect. Its application has come into use especially for small-scale plants. No chemicals are added, and the equipment needs little attention other than periodic cleanings or replacement of the mercury vapor lamps. UV treatment is limited, however, to relatively clean waters because colloids and organic matter reduce the penetration of the radiation.

Use of Fouling Resistant Membranes

Use of FILMTEC™ FR (Fouling Resistant) membranes can minimize or retard biofouling significantly. The combination of FR membranes and intermittent application of DBNPA has been particularly successful /38/. For more information about FILMTEC fouling resistant (FR) membrane elements, please visit www.filmtec.com.

FILMTEC Membranes

For more information about FILMTEC membranes, call the Dow Liquid

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