FILMTEC Membranes

Water Chemistry and Pretreatment: Colloidal and Particulate Fouling Prevention

In-Line Filtration

The efficiency of media filtration to reduce the SDI value can be markedly improved if the colloids in the raw water are coagulated and/or flocculated prior to filtration. In-line filtration can be applied to raw waters with a SDI only slightly above 5. The optimization of the method, also named in-line coagulation or in-line coagulation-flocculation, is described in ASTM D 4188 /25/. A coagulant is injected into the raw water stream, effectively mixed, and the formed microflocs are immediately removed by media filtration.

Ferric sulfate and ferric chloride are used to destabilize the negative surface charge of the colloids and to entrap them into the freshly formed ferric hydroxide microflocs. Aluminum coagulants are also effective, but not recommended because of possible fouling problems with residual aluminum. Rapid dispersion and mixing of the coagulant is extremely important. An in-line static mixer or injection on the suction side of a booster pump is recommended. The optimum dosage is usually in the range of 10–30 mg/L, but should be determined case by case.

To strengthen the hydroxide microflocs and thereby improving their filterability, and/or to bridge the colloidal particles together, flocculants can be used in combination with coagulants or alone. Flocculants are soluble high molecular weight organic compounds (e.g., linear polyacrylamides). Through different active groups, they may be positively charged (cationic), negatively charged (anionic), or close to neutral (nonionic).

Coagulants and flocculants may interfere with an RO membrane indirectly or directly. Indirect interference occurs when the compound forms a precipitate that is deposited on the membrane. For example, channeling of the media filter may enable flocs to pass through and deposit on the membrane. A precipitate can also be formed when concentrating the treated feed water, such as when aluminum or ferric coagulants are added without subsequently lowering pH to avoid supersaturation in the RO stage. Furthermore, reaction with a compound added after the media filter can cause a precipitate to form. This is most noticeable with antiscalants. Nearly all antiscalants are negatively charged and will react with cationic coagulants or flocculants present in the water. The membranes in several RO plants have been heavily fouled by a gel formed by reaction between cationic polyelectrolytes and antiscalants.

Direct interference occurs when the compound itself affects the membrane resulting in a flux loss. The ionic strength of the water may have an effect on the interference of the coagulant or flocculant with the membrane. If so, the result at brackish water conditions could be different from that at seawater conditions. To minimize the risk of direct or indirect interference with the RO membrane, anionic or nonionic flocculants are preferred rather than cationic flocculants. Overdosing must be avoided.

Coagulation-Flocculation

For raw waters containing high concentrations of suspended matter resulting in a high SDI, the classic coagulation-flocculation process is preferred. The hydroxide flocs are allowed to grow and settle in specifically designed reaction chambers. The hydroxide sludge is removed, and the supernatant water is further treated by media filtration.

For the coagulation-flocculation process, either a solids-contact type clarifier (see also *Lime Softening, Section 2.3.6*) or a compact coagulation-flocculation reactor may be used. For details, please refer to the general water treatment textbooks /3, 4/.

FILMTEC™ Membranes
For more information about FILMTEC membranes, call the Dow Liquid Separations business:
North America: 1-800-447-4369
Latin America: (+55) 11-5188-9222
Europe: (+32) 3-450-2240
Pacific (ex. China): +800-7776-7776
China: +10-800-600-0015
http://www.filmtec.com

Form No. 609-02027-1004