

Pretreatment Dechlorination Using Sodium Metabisulfite

TRISEP® RO & NF thin-film composite membranes require the complete removal of free chlorine from the feed water. Sodium Metabisulfite (SMBS) is often used as pretreatment to large RO systems for free chlorine removal and as a biostatic. Carbon filters are a common alternative for small systems, but SMBS has an advantage for larger systems due to a lower risk of bacteria growth that can cause biological fouling.

IMPORTANCE OF DECHLORINATION

Feed water to an RO/NF system using TRISEP thin-film composite membranes must have all free chlorine removed to prevent membrane oxidation. Chlorine oxidation of the membrane surface can cause increased flux through the membrane and decreased salt rejection. MANN+HUMMEL Water & Fluid Solutions recommends total removal of chlorine during operation of the RO/NF system. A common rule of thumb is that degradation can occur from about 1,000 to 2,000 ppm-hours of chlorine exposure, although the rate of membrane oxidation will vary for different feed waters. Higher temperatures and heavy metals such as iron can catalyze membrane oxidation and significantly reduce the membranes resistance to chlorine degradation.

DOSING SMBS SOLUTION

SMBS is commercially available as a solid in various % purities, typically up to 99%. Food-grade quality SMBS that is free from impurities is preferred. Under dry, cool storage conditions, solid SMBS can be stored for about 5 months. SMBS solutions generally have a short shelf life, as it reacts with oxygen as well as chlorine, with a shelf life of only about 5 days for a 2% solution and about 1 month for a 20% solution. While theoretically about 0.75 ppm SMBS (equivalent to about 1.5 ppm sodium bisulfite (SBS)) will neutralize 1.0 ppm chlorine, typically 1.0-1.5 ppm SMBS (2-3 ppm SBS) per 1.0 ppm chlorine is used to account for incomplete mixing. The SMBS should be dosed downstream of cartridge filters so that the cartridges can still be disinfected by the chlorine. A separate cartridge should be used on the SMBS solution before dosing into the RO/NF feed water. The SMBS solution should be dosed well enough in advance of the RO system to allow for about 25 seconds of reaction time. A static mixer is recommended for enhanced in-line mixing.

SMBS DECHLORINATION REACTION

Sodium metabisulfite (SMBS) initially reacts with water to form sodium bisulfite (SBS):



Next, SBS reacts with hypochlorous acid to form byproducts free from free chlorines:



These byproducts are all readily removed by the RO system.

CHLORINE MONITORING

Chlorine levels in the RO/NF feed should be monitored continuously to prevent chlorine passing into the RO/NF system. An oxidation-reduction potential (ORP) electrode is recommended to be used downstream of the dosing plant to monitor the presence of chlorine or other oxidants. If the ORP meter reading exceeds 300 mV, a warning should notify operators to take action

to reduce the chlorine levels in the feed water. If the ORP meter exceeds 350 mV, the electrode signal should disable the high pressure pump until a safe oxidant concentration can be reached.

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