Resin Sanitization

CLEANING BIOLOGICALLY FOULED RESIN

Ion exchange resin beds are often an attractive growth medium for various biological organisms. Growths may include bacteria, mold, and algae. In some cases these growths can build up in the resin bed to the point where they physically foul the resin. However, in most cases, the concern is that of contaminating the effluent water leaving the ion exchange system.

Microbes can use as a source of food the traces of organic matter, nitrates, and ammonia that are absorbed and concentrated by ion exchange beads. Ion exchange units that run for long periods of time between regenerations can therefore support microbial growth. This can lead to microbial counts in the effluent of an ion exchanger being higher than the influent. Also, when ion exchange resins sit idle for long periods of time (months or years) they can become sources of microbial growth.

Normal regeneration of demineralizer resins with acid or caustic subjects the resin to pH extremes which can act as a sanitization step. However, regeneration with salt brine does little or nothing to reduce bacterial counts. There are many approaches to sterilizing ion exchange resin. Steam (or hot water) sterilization remains one of the most effective methods to sanitize resins and leaves little or no residual in the resin after treatment. However, equipment must be designed to tolerate temperatures close to that of boiling water (resins are generally tolerant of boiling water temperatures, at least for the relatively short time they are exposed during a sterilization procedure.

Potable water supplies generally contain chlorine or chloramine, added as a disinfectant. Where there is a chlorine residual left in the feed water to the ion exchange system, biological fouling is seldom a problem. However, long-term exposure to strong oxidants (such as chlorine) is well known to degrade ion exchange resin. Therefore the majority of users de-chlorinate the feedwater supply to the ion exchange system.

Sterilization with bleach (or with other chemicals that release chlorine as the active oxidant) is an inexpensive method to kill most biological foulants. The degree of risk to most ion exchange resins associated with short-term exposure to chlorine is overrated. One hour exposure to high concentrations of bleach does not severely degrade ion exchange resins, although some damage does occur. Short exposures to concentrations on the order 50-100 ppm do not measurably harm ion exchange resins and generally do a good job sterilizing the resin.

Other oxidants that are sometimes used to sterilize resin beds include ozone, hydrogen peroxide, potassium permanganate, iodine, and a host of chlorine-like oxidants (such as 1, 3-dichloro-5, 5-dimethylhydantion). By and large these are all effective and relatively safe. However, the plastic and rubber materials that are commonly used in ion exchange systems may not be impervious to oxidation. Ozone in particular will rapidly degrade some plastic materials. Another consideration is the possibility that there may be other foulants on the resin that act as catalysts, increasing the rate of oxidation. For instance, hydrogen peroxide is virtually harmless to new ion exchange resin but will rapidly oxidize iron fouled resins. In any event, the concentration of the oxidant used should be the minimum necessary to sterilize the resin, and not more than several hundred parts per million.

There are a number of organic biocides that are commercially available that are very effective. Some of these can organically foul the resin. It is generally better not to add an unknown chemical to an ion exchange resin without verifying its effectiveness and harmlessness.

After cleaning for biological fouling, it is usually necessary to physically clean and then to regenerate the resin. This ensures that any residual cleaner is removed from the resin, and that any dead organisms are flushed out of the resin bed.

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INNOVATIONS IN ION EXCHANGE

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