REV 0421

Barium Removal

Barium is an alkaline earth metal which has been found in the ground water in Arizona, Texas, Michigan, Vermont and Florida. Barium is present to some extent in all surface waters with the highest level occurring in the lower Mississippi basin.

Barium has a very high affinity for cation exchange resins and is well removed during the softening process. Since barium has a higher affinity for the ion exchange resin than calcium or magnesium, it is removed during the entire softening cycle. When barium is found to be present in a supply, it must be determined whether or not the barium is there as a suspended solid or soluble salt. If sulfates are present to any degree, it is probable that barium is present as a suspended solid. When sulfates are present, the soluble barium is usually limited to the parts per billion range.

Although barium is well removed by cation exchange resins, it must be regenerated properly in order to be removed from the resin. Appreciable amounts of sulfate either in the dilution water or in the salt itself will cause precipitation of the barium in the resin and result in barium build up that will begin to impair operating effectiveness in water softeners in periods ranging from a few months to a couple of years.

The removal of barium from resins that are fouled by it usually is difficult and not very practical or effective. One method is to soak the precipitated barium in 10% hydrochloric acid. This involves hazardous chemicals that are usually not well suited to a softener application. It is usually best to discard the resins when the degree of barium fouling has made them ineffective.

The resins can also become fouled by barium if regeneration levels are insufficient to remove the barium. Barium, because of its higher affinity for the resin, will tend to accumulate on the resin.

One solution to the barium problem is to use a weak acid resin in the hydrogen form for barium removal. This has limitations in that the effluent will have a reduced pH and, therefore, any alkalinity in the water will be converted to carbon dioxide, which must be stripped from the column effluent or by-passed by blending. By-pass blending will be required to maintain neutral or near neutral pH and avoid corrosive effluents.

Hydrochloric acid should be used as the regenerant since it can be used at a high concentration without causing precipitation, thus allowing a smaller volume of waste water to be generated. Sulfuric acid should be avoided due to the formation of barium sulfate precipitate which will quickly foul the resin and render it useless.

The weak acid resin can also be used in a sodium cycle to provide complete removal of barium and hardness. The use of a weak acid resin, whether in the hydrogen or sodium cycle, is more complex and more expensive because of chemical costs. This includes the need for acid-resistant materials, wastewater neutralization and the need to strip CO_2 from the product water.

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