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DOWEX Ion Exchange Resins

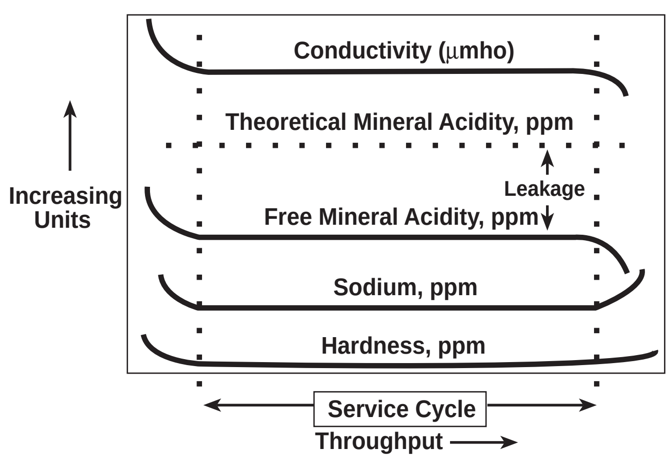
Operating Profiles for Ion Exchange Demineralizers

In the day-to-day operation of demineralization systems it is often difficult to determine the cause of problems which occur. Most of the performance problems in demineralizers can be attributed to either mechanical, procedural, or chemical variation. When evaluating the performance of ion exchange systems it is helpful to have a basic understanding of the anticipated effluent profiles for the various resin beds in the system.

Figured below are graphs of the effluent characteristics of strong acid cation (SAC) resin and strong base anion (SBA) resin as would be found in the simplest of demineralization systems. The SAC is operating in the hydrogen cycle and the SBA is operating in the hydroxide cycle.

Figure 1 shows the changes in effluent characteristics during the rinse, service cycle, and exhaustion of the SAC resin. As the SAC resin approaches exhaustion, there will be an increase in the sodium ion in the effluent. The conductivity of the effluent will decline as the sodium ion concentration and the corresponding sodium salts increase. The Theoretical Mineral Acidity is the sum of the chloride, sulfate, and nitrate ions in the feedwater. Free Mineral Acidity (FMA) is the sum of the chloride, sulfate, nitrate which are in the acid form, i.e. HCl, H_2SO_4, HNO_3, respectively. As the sodium ion increases in the effluent of the SAC resin at exhaustion there will be a corresponding decrease in FMA.

Figure 1: Typical Effluent Characteristics of SAC Resin



Figures 2 and 3 depict the changes in effluent quality for SBA resin operated downstream of a SAC resin. Figure 2 is for systems where the SBA resin exhausts before the SAC resin. When the SBA resin begins to exhaust there will be an increase in the effluent silica concentration. Since the silica will exist as silicic acid there will be a corresponding decrease in effluent pH and an increase in conductivity as the SBA exhausts.

Figure 3 shows the effluent characteristics of SBA resin in systems where the SAC resin exhausts before the SBA resin. In this case there will be an increase in the sodium ion concentration which will exist as sodium hydroxide. The increasing concentration of sodium hydroxide will elevate the pH, conductivity, and alkalinity concentration in the SBA effluent. There will also be an increase in the silica leakage due to the regeneration effect of the increasing sodium hydroxide.

Figure 2: Typical Effluent Characteristics of SBA Resin when SBA Exhausts

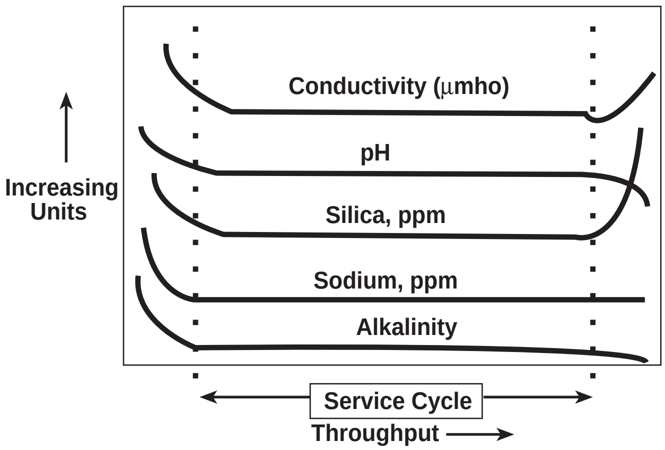
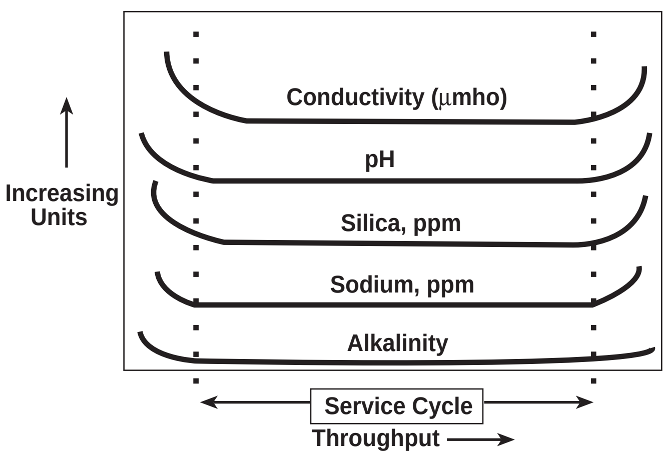


Figure 3: Typical Effluent Characteristics of SBA Resin when SAC Exhausts



Warning: Oxidizing agents such as nitric acid attack organic ion exchange resins under certain conditions. This could lead to anything from slight resin degradation to a violent exothermic reaction (explosion). Before using strong oxidizing agents, consult sources knowledgeable in handling such materials.

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