

# IMPROVING QUALITY OF WATER FROM IONS EXCHANGE METHOD

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## ABSTRACT

**Ion exchange** is an exchange of ions between two electrolytes or between an electrolyte solution and a complex. In most cases the term is used to denote the processes of purification, separation, and decontamination of aqueous and other ion-containing solutions with solid polymeric or mineralic 'ion exchangers'.

Keyword:- DNA ,RNA,MIB

### 1.Introduction:-

Ion exchange is an exchange of ions between two electrolytes or between an electrolyte solution and a complex. In most cases the term is used to denote the processes of purification, separation, and decontamination of aqueous and other ion-containing solutions with solid polymeric or mineralic 'ion exchangers'. Ion exchange is a method widely used in household (laundry detergents and water filters) to produce soft water. This is accomplished by exchanging calcium  $\text{Ca}^{2+}$  and magnesium  $\text{Mg}^{2+}$  cations against  $\text{Na}^+$  or  $\text{H}^+$  cations (see water softening)[2].

Industrial and analytical ion exchange chromatography is another area to be mentioned. Ion exchange chromatography is a chromatographical method that is widely used for chemical analysis and separation of ions. For example, in biochemistry it is widely used to separate charged molecules such as proteins. An important area of the application is extraction and purification of biologically produced substances such as proteins (amino acids) and DNA/RNA.

Ion-exchange processes are used to separate and purify metals, including separating uranium from plutonium and other actinides, including thorium, and lanthanum, neodymium, ytterbium, samarium, lutetium, from each other and the other lanthanides. There are two series of rare earth metals, the lanthanides and the actinides, both of whose families all have very similar chemical and physical properties. Using methods developed by Frank Spedding in the 1940s, ion-exchange used to be the only practical way to separate them in large quantities, until the advent of solvent extraction techniques that can be scaled up enormously. The ion-exchange process is also used to separate other sets of very similar chemical elements, such as zirconium and hafnium, which is also very important for the nuclear industry. Zirconium is practically transparent to free neutrons, used in building reactors, but hafnium is a very strong absorber of neutrons, used in reactor control rods[4]. Ion exchangers are used in nuclear reprocessing and the treatment of radioactive waste. Ion exchange resins in the form of thin membranes are used in chloralkali process, fuel cells and vanadium redox batteries. Ion exchange can also be used to remove hardness from water by exchanging calcium and magnesium ions for sodium ions in an ion exchange column.

## 2. Problems Formulation:-

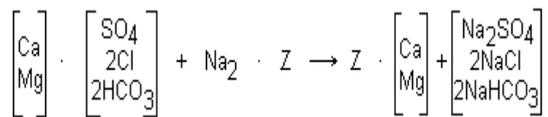
Water quality can deteriorate dramatically within a distribution system, with excessive microbial growth being of primary concern. Heterotrophs and nitrifiers are the most prevalent microbes found in drinking water distribution systems. However, several other types of organisms commonly are also found, such as anaerobic bacteria, protozoa, copepods (crustaceans), and nematodes (worms) (Geldreich, 1996). This variety of organisms demonstrates that the distribution system can be complex ecosystem teeming with life. Of course, this is not the desire of water consumers and utility operators and managers. Problems that water consumers can notice immediately are tastes and odors. Microbial growth in distribution systems can cause offensive tastes and odors (Burlingame and Anselme, 1995). For example, members of the genus *Actinomyces* release geosmin and methyl-isoborneol (MIB), which cause a musty odor at very low concentrations[6]. Also, musty taste episodes can be caused by the biotransformation of chlorophenol to chloroanisole by fungi (Piriou, Malleret, Bruchet, & Ki  n  , 2001). In anaerobic zones, compounds such as hydrogen sulfide and organic sulfhydryls can be produced microbially, causing swampy and rotten vegetable odors.

Corrosion of distribution system pipes causes many problems, including deterioration of pipe integrity, red water, tastes, and loss of chlorine. It is well established that microbial growth can enhance corrosion rates (Little et al.1998). Microbially enhanced corrosion creates localized pitting of metal surfaces, likely caused by the dissolution of the protective oxide layer, differential oxygen gradients, and limited transport of components to form a new passive layer, or increased dissolution rates of the metal surface caused directly by the bacteria. Most importantly, high numbers of microbes can adversely affect public health. For example, research shows a connection between high heterotrophic counts and increased instances of illness.

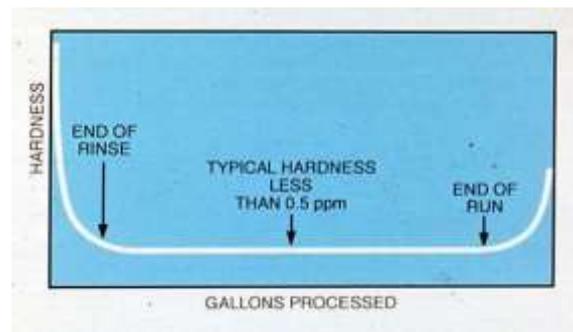
### 3. Proposed Methodology:-

(a) **Sodium Zeolite softening**:- Sodium zeolite softening is the most widely applied use of ion exchange. In zeolite softening, water containing scale-forming ions, such as calcium and magnesium, passes through a resin bed containing SAC resin in the sodium form. In the resin, the hardness ions are exchanged with the sodium, and the sodium diffuses into the bulk water solution. The hardness-free water, termed soft water, can then be used for low to medium pressure boiler feed water, reverse osmosis system makeup, some chemical processes, and commercial applications, such as laundries.

(b) **Principles of Zeolite Softening**:-The removal of hardness from water by a zeolite softening process is described by the following reaction:



Water from a properly operated zeolite softener is nearly free from detectable hardness. However, some small amounts of hardness, known as leakage, are present in the treated water. The level of hardness leakage is dependent on the hardness and sodium level in the influent water and the amount of salt used for regeneration. Figure 1. Is a typical profile of effluent hardness from a zeolite softener during a service cycle. After final rinse, the softener produces a low, nearly constant level of hardness until the ion exchange resin nears exhaustion. At exhaustion, the effluent hardness increases sharply, and regeneration is required



**Figure 1.** Typical sodium zeolite softener effluent profile

### 4.Applications :-

- Treated water has a very low scaling tendency because zeolite softening reduces the hardness level of most water supplies to less than 2 ppm[7]

- operation is simple and reliable; automatic and semiautomatic regeneration controls are available at a reasonable cost
- salt is inexpensive and easy to handle

#### **Limitations**

- Although sodium zeolite softeners efficiently re-duce the amount of dissolved hardness in a water supply, the total solids content, alkalinity, and silica in the water remain unaffected. A sodium zeolite softener is not a direct replacement for a hot lime-soda softener. Plants that have replaced their hot process softeners with only zeolite softeners have experienced problems with silica and alkalinity levels in their boilers.

#### **5. CONCLUSION**

A wide range of materials is available for the ion exchange treatment of liquid radioactive waste. These materials are available in a variety of forms and have widely differing chemical and physical properties. Ion exchange is used for processing liquid effluents in nearly all phases of the nuclear fuel cycle, including the early stages of uranium ore treatments, the chemical control of primary circuit coolants during nuclear power plant operations and polishing water effluents at spent fuel reprocessing plants. This method is one of the most widely used both in the nuclear industry and the conventional chemical industry for the purification, separation and partitioning of particular non-radioactive and radioactive species with different chemical properties. Organic and inorganic, naturally occurring and synthetic ion exchangers have found their specific fields of application in different purification and liquid waste treatment processes.

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