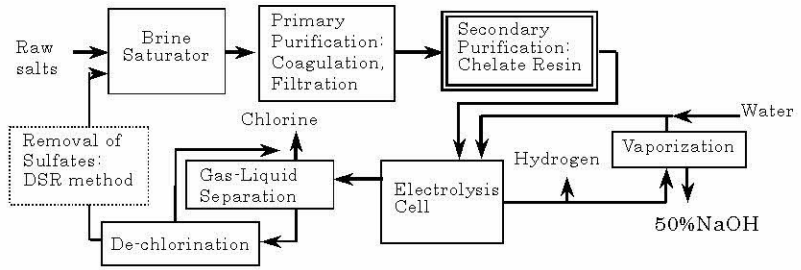
Chapter VII Purification of Chemicals

1. Removal of Hardness from Concentrated Brine

The removal of Ca, Mg and Sr from concentrated brines in chlor-alkali electrolysis factories, manufacturing factories of NaOH and Cl_2 by electrolysis of NaCl, is a typical example of removals of hardness form dense brines. Regarding manufacturing method of NaOH, the traditional mercury-cell process had been converted into the diaphragm process and the ion-exchange membrane process with "Minamata disease" that broke out early 1970's as a turning point. Then, the diaphragm process that needs asbestos membranes has been also converted into the ion-exchange membrane process, because of the malignant mesothelioma caused by asbestos.

Both solar salts and rock salts, raw salts, contain hardness such as Ca, Mg and Sr. In the ion-exchange membrane process, ions of these hardness move through membranes as well as sodium ion but sometimes they precipitate as their hydroxides within membranes due to strongly basic atmosphere. Such precipitates may cause interference of ions penetration, increase of operation voltages and damages onto membranes in the worst case. Accordingly, the concentrations of such materials in raw brines should be specified; e.g. Ca + Mg ≤ 20 μg-Ca/L and Sr ≤ 20 μg-Sr/L.

Fig.VII-1-1 illustrates a typical flow of the ion-exchange membrane process. Raw brines are usually treated as follows: a) dissolution, b) coagulation and filtration to remove hardness as carbonates or hydroxides with the addition of NaOH, soda ash and coagulants: primary purification, c) adsorption by chelate resin, CR11 etc.: secondary purification.



[Fig.VII-1-1] Typical Flow of Ion-Exchange Membrane Process of Electrolysis