ELECTROLYTE CONCENTRATION AND ION SPECIATION IMPACT ON GYPSUM DISSOLUTION IN SYNTHETIC WATERS

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ABSTRACT

Effect of four different salinity levels of water on gypsum dissolution was studied. Three salinity levels of water (EC_w 2,4,6 dS m^{-1}) were developed using chloride salts of Na^+, K^+, Ca^{2+} and Mg^{2+}, while the EC_w of the original water (0.01 dS m^{-1}), used to prepare other solutions was also taken as a treatment. The same EC levels were achieved with CO_3^{2-}, HCO_3^-, Cl^- and SO_4^{2-} salts of sodium. All the EC levels were also attained with two types of salt mixtures viz i) same cation but different anions (Na_2CO_3 + $NaHCO_3$ + Na_2SO_4) and ii) same anion but different cations ($NaCl$ + KCl + $CaCl_2.2H_2O$ + $MgCl_2.6H_2O$). After stabilizing the target EC levels, 5 g of 60-80 mesh sized gypsum (95% purity) was added to each solution and stirred for 20 minutes in a mechanical shaker at 32°C. The suspensions then were analysed for gypsum dissolution (using Ca+Mg as index ions). The average solubility of gypsum was found 31.0 me L^{-1} in distilled water. However, solubility of gypsum decreased with the increasing electrolyte concentration (EC). Among the CO_3^{2-}, HCO_3^-, Cl^- and SO_4^{2-} salts of the Na, maximum solubility (29.5 me L^{-1}) was achieved with chloride radical composition, while it was minimum in sodium salts with CO_3^{2-} + HCO_3^-. Less calcium recovery (14.2 me L^{-1}) with CO_3^{2-} + HCO_3^- may be due to precipitation of gypsum derived Ca as $CaCO_3$. The positive Langelier Index (pH_s-pH_c) in this respect supported the concept of $CaCO_3$ precipitation. Among the different Cl^- salts with different cations (Na^+, K^+, Ca^{2+}, Mg^{2+}), more gypsum got dissolved in NaCl solution followed by that of K and Mg salt solutions. Comparison of data revealed that individual salts show different effect on gypsum solubility than when they are in mixture form, where the role of ion complexation, precipitation and that of ionic strength cannot be overlooked.