



## Study of fractional crystallization during isothermal evaporation of Algerian inland brine at 35°C: discussion of the proposed approaches

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### ABSTRACT

Isothermal evaporation experiment of inland Algerian brine was carried out at 35°C. The study of fractional crystallization during this experiment has been addressed by different approaches. The identification of the solids recovered by X-ray diffraction together with the monitoring of the ionic composition, density, and pH of the evaporated brine. The Jänecke solubility diagram of the quinary system determined both predicted and experimental fractional crystallization pathways. The mass balance of  $\text{CaSO}_4$ ,  $\text{NaCl}$ ,  $\text{MgSO}_4$ , and  $\text{KCl}$  salts was calculated using the Zayani formulas. Finally, PHREEQC forward and inverse modeling has been done with the Pitzer thermodynamic database. The real crystallization sequences obtained are successively: gypsum and halite, halite and schoenite, halite, epsomite and sylvite, and finally halite, epsomite, sylvite, and carnallite. These results corroborate well with those obtained by both forward and inverse PHREEQC modeling but did not agree with those of Jänecke solubility diagram of the studied system at 35°C. This deviation is explained by the metastable equilibria occurred in the late stages of evaporation. Thus, PHREEQC software seems to be better when studying the evaporation of such concentrated inland brines. The calculated mass balance confirmed the possibility of the production of potassium and magnesium salts from these brines.

*Keywords:* Inland brine; Fractional crystallization; PHREEQC; Schoenite; Quinary diagram; Isothermal evaporation

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