Phase Equilibria for the Aqueous System Containing Sodium, Potassium, Chlorine, and Sulfate Ions at 273 K

YUN PENG[1,2], YING ZENG [1, 2] *, XUDONG YU[1,2]

[1]College of Materials and Chemistry & Chemical Engineering, Chengdu University of Technology, Chengdu, 610059, P. R. China;
[2] Collaborative Innovation Center of Panxi Strategic Mineral Resources Multi-Purpose Utilization, Chengdu 610059, P. R. China
(* correspondence: zengyster@163.com)

There are more than 1612 salt lakes, which are spread out over 1 km^2, in the Qinghai-Tibet Plateau, China[1]. Zabuye Salt Lake, located in Tibet, is famous for its abundance of lithium, potassium, and boron resources and also with a scarce magnesium resource. It is widely used the solar ponds to economically exploit salt lake brine resources in the Zabuye Salt Lake region because of its windy, arid, little rainfall, and great evaporating capacity. In the Zabuye Salt Lake region, the average annual temperature is about 273 K[1], thus studies on the phase equilibria at 273 K will be more closely related to reality and be of great use in exploitation of the brine.

Sodium, potassium, chloride, and sulfate ion are the main components of the brine. Researching on their relationship is important in the brine exploiting process. The phase equilibria in the quaternary system Na_2SO_4 + K_2SO_4 + NaCl + KCl + H_2O were studied at 273 K using an isothermal evaporation method. Up to now, some researching on the subsystem K_2SO_4 + Na_2SO_4 + H_2O have been reported at different temperature. The former research results show that K_2SO_4 + Na_2SO_4 + H_2O system is a complex system with an double salt $3K_2SO_4 \cdot Na_2SO_4$ formed at 288 K but is a simple system with two single salts(K_2SO_4, Na_2SO_4) at 308 K[2]. At 273 K, no double salt was formed in this system in our previous research. Therefore, we infer that the double salt $3K_2SO_4 \cdot Na_2SO_4$ was formed between 273 K to 288 K.

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