Thermochemical Fluids in Greenhouse Farming

Impurities in thermochemical fluids

Thermochemical fluids (TCF) are saline solutions and as such have a lower freezing point than water. Nevertheless, crystals can be found at higher temperatures, as was the case in the greenhouse used as a demonstrator for the TheGreefa project, located near Zurich. Here, crystallization was observed in a pump. An examination of the crystals found showed that they were Carnallite. Additionally, there were hexahydrate and bihydrate forms of magnesium chloride as secondary components.

Carnallite is a compound of potassium and magnesium chloride that also binds crystal water. In the production of magnesium chloride by evaporating water from salt lakes, potassium components are common, leading to the precipitation of Carnallite. The solubility of potassium chloride in the ternary mixture of water, magnesium chloride, and potassium chloride is relatively low near the solubility limit of magnesium chloride.

Figure 1. Membrane pump with crystal formation (left). Crystal formation in the concentrated solution tank (right).

In addition to deposits in the pumps, larger amounts of Carnallite had settled in the tanks of the concentrated solution. No deposits were found in other parts of the system. Measurements of the potassium content over time showed a decrease in potassium levels, indicating deposition in the tanks. An analysis of a freshly procured solution from the same supplier also showed a potassium content of the same magnitude. Therefore, it is assumed that the potassium was not introduced but was already present in the procured solution.

By cooling the concentrated solution, the potassium could be precipitated, and crystallization avoided.

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