

## COMPARING PROPERTIES OF AQUEOUS SOLUTIONS FOR LIQUID ONLY AND ICE SLURRY APPLICATIONS OF INDIRECT SYSTEMS

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### ABSTRACT

Indirect systems with liquid only aqueous solutions have long been used for ice rinks and heat pumps to transport energy from the heat source or cooling object to the evaporator. Such indirect systems are increasingly used for cooling cabinets, cold storage and freezers in supermarkets as the primary refrigeration unit then can be designed in a compact way and with an extremely small refrigerant charge. Much research has been carried out with ice slurries where the aqueous solutions operate below the freezing point. In order to choose a suitable fluid and for technical calculations of these types of systems there is a need to know the thermophysical properties of the liquid used. The aqueous solution chosen should have suitable concentration and freezing point, good transport capabilities, good heat transfer ability and low pressure drop giving small pumping power.

This paper includes a comparison of thermophysical properties of some aqueous solutions with concentrations typically used for liquid only and for ice slurry cooling cabinet applications in a supermarket. As the concentrations needed for ice slurry are lower than for liquid only, the viscosity of ice slurries with a moderate ice concentration can be in the same range as with liquid only aqueous solutions. The density for the ice slurry will generally be lower while the thermal conductivity is higher. The enthalpy change and heat transport capability of the ice slurry will be several times higher than for single-phase. This comparison of basic properties indicates the advantage with use of ice slurries. When choosing aqueous solution, attention should also be given to material compatibility, toxicity, handling security and environmental pollution.