Performance Evaluation of a Dehumidifier Using Aqueous Solutions of Lithium Chloride, Lithium Bromide and Calcium Chloride

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Dehumidification of air is an important operation in air conditioning, either for human comfort or for industrial processes. Conventional closed cycle absorption chillers require heat source temperatures significantly higher than the temperatures of the corresponding heat sinks. Indeed, common dehumidification is achieved when the air contacts a surface at a temperature below its dew point. During this process, the surface must be continuously cooled and the air is overcooled, so the air needs reheating before entering indoors. This process however, is energy intensive, since it consumes high grade energy at a very low efficiency. A promising alternative is the use of an open cycle absorption system, where humidity is absorbed directly from the process air by direct contact with the absorbent. The absorbent is then regenerated, again in direct contact with an air stream, at relatively low temperatures of the heat source; requiring thus less running costs. In this paper, there will be an attempt to evaluate the performance of a dehumidifier used in open cycle absorption systems. To this end, different solutions of sorbent materials will be tested against each other, such as Lithium Cloride, Lithium Bromide and Calcium Cloride. These materials are particularly suited for use as liquid desiccants in absorption air conditioning and refrigeration equipment. The study of the operational behaviour of the dehumidifier will be carried out in the form of mathematical analyses and simulations in MathCad software. This research has been undertaken in order to create consistent methods suitable for use in the industrial design of liquid desiccant air conditioning equipment.