ABSTRACT

In the thesis an effort is made to develop and study various decarbonizing and energy efficient refrigeration systems by hybridizing vapour absorption refrigeration cycles with vapour compression or ejector refrigeration cycles. The hybrid cycles are investigated from the point of view of energy and exergy.

In an attempt to develop a refrigeration system which can utilize heat available below 100°C, a H2O-LiBr based two stage absorption compression cascade refrigeration system is proposed for water chilling application. The proposed system is analysed and compared with vapour compression system from the viewpoint of energy, exergy, environment and economics. Another system which is a combination of a two stage absorption refrigeration system and a compression refrigeration system is proposed for water chilling application with the twin objectives of utilization of low temperature heat and reduction of carbon dioxide emission by sharing of cooling load and through cascading effect. The size and cost of the systems are determined by designing the heat exchangers. The optimization is also performed with the objective of minimizing the annual cost of plant operation which includes fuel exergy cost, initial investment and maintenance cost and environmental damage.

With the objective of further reducing the driving temperature in generator, a two stage absorption compression integrated refrigeration system utilizing H2O-LiBr as working fluid is proposed. As compared to conventional two stage absorption system and it can be operated at lower generator temperature.
Additionally, hybrid system based on generator-absorber-heat exchange absorption and compression refrigeration system is analyzed on the basis of energy and exergy concepts. For simultaneous production of cooling at different temperatures, absorption compression ejector combined refrigeration system is proposed and analyzed from the viewpoint of both energy and exergy concept of thermodynamics. The study is useful for the design and development of new and advanced cooling systems.