

A new lithium bromide absorption refrigeration machine air-air of direct expansion and split, with an energy efficiency similar to conventional models

CSIC has developed an Absorption refrigeration machine prototype air-air and split, that can be powered using fossil fuels, renewable energy, residual heat generated by trigeneration systems, solar thermal energy or using residual heat of industrial processes. It can be used to cool a small space, such as rooms, houses, small commercial areas, etc. Its mass-production would contribute to reducing the release of greenhouse gases such as CFC, HCFC and HFC in the air-conditioning sector.

We are looking for a company interested in manufacturing and licensing this technology.

Description of the Technology

Currently there are only bromide absorption machines water condensed of single effect and double effect available in the market. This is due to the problems generated by the crystallisation of the solution. A solution to this problem was found and has led to the development of this new technology.

The machine consists of an outdoor and an indoor units, as it can be seen in Figure. The outdoor unit is composed of a generator of refrigerant, an air condenser, an absorber cooled by air and the ancillary equipment. The indoor unit is composed of a direct expansion evaporator and is located inside the area that we want to cool. It can operate in single effect mode, multiple effect mode (double or triple) or single-double (hybrid) mode.

The fluid outside the evaporator is the air of the space to be cooled. The fluid inside the evaporator is the refrigerant, water, that doesn't deplete the ozone layer (ODP = 0) and doesn't generate additional global warming potential.

The prototype of 3,5kW cooling nominal capacity was tested during a total of 90 hours distributed in sessions of 6-7 hour per day. Under maximum outdoor temperature between 30°C and 42°C the solution didn't crystallize and the final absorption temperature was about 5-7 °C higher than the outdoor temperature, while the condensation temperature was in the range of 43°C - 53°C. When the machine was powered using solar thermal energy and operating in single effect mode, its daily energetic efficiency (COP) was around 0.6. When operating in double effect mode a 1.2 value was reached.



Absorption refrigeration machine prototype air-air and split installed in the testing bench

Main features and advantages

- The prototype can be assembled / manufactured easily and it has a small size.
- The ratio Volume/Cooling Power of the evaporator is 0.08 m³/kW and its maximum cooling power experimentally obtained was 4.5 kW.
- This environmental-friendly technology doesn't generate any green-house emissions. It doesn't need any water for the condensation process. For this reason, contamination by legionella is not an issue.
- When powered using renewable or residual energy no CO₂, NO_x, CO, etc. is released to the atmosphere.
- When the machine operates in single effect mode, the generator can be powered using solar thermal energy, other types of renewable energy as biomass or using residual heat. When the machine is running in double or hybrid effect mode, fossil fuels or renewable energy can be used.

Patent Status

Patent filed

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