ABSORPTION REFRIGERATION SYSTEM WITH MEMBRANE DEHUMIDIFIER (ARSMD) FOR AIR CONDITIONING, REFRIGERATION AND FRESHWATER.

IITM Technology Available for Licensing

Problem Statement

- Global energy consumption is expected to rise by 28% from 2015 to 2040, with the building sector's energy demand increasing by 1.1% annually. **Air conditioning and refrigeration systems may account for over 50%** of building energy use by 2050.
- Presently, more than 90% of the air conditioning and refrigeration systems are of **vapor compression refrigeration** type.
- There is a need for the system which uses **low-grade energy sources** like solar energy or waste heat, offer an eco-friendly alternative to the conventional compression system for humidity and temperature control.

Intellectual Property

- **IITM IDF Ref 1795**
- **IN 475440 Patent Granted**

TRL (Technology Readiness Level)

TRL 3: Experimental proof of concept

Technology Category/ Market

Technology Category: Applied Mechanics & Mechanical Engineering
Industry: Air conditioning, Refrigerator
Applications: Manufacturing of HVAC equipment.
Market report: The global refrigerator & air conditioners market size was valued at USD 211.54 billion in 2023 and is projected to grow from USD 224.24 billion in 2024 to USD 373.08 billion by 2032.

Research Lab

Prof. M.P.Maiya
Dept. of Mechanical Engineering
Prof. Shaligram Tiwari
Dept. of Mechanical Engineering

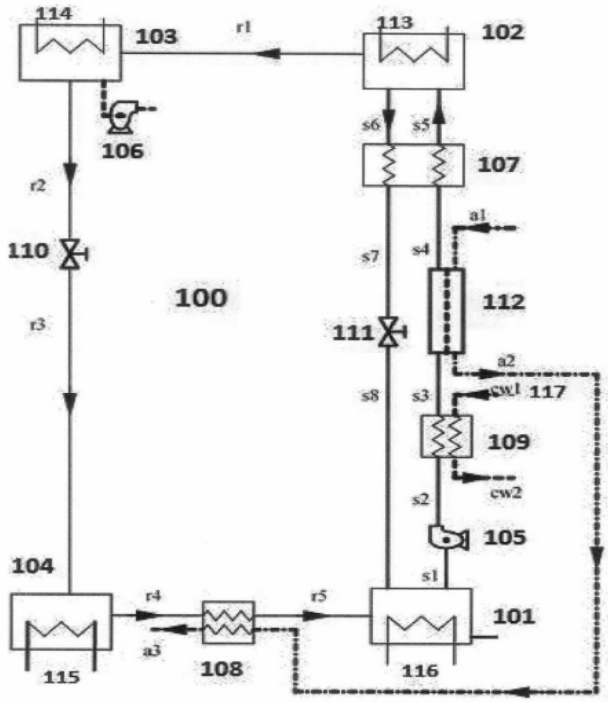


Fig.1: Schematic of ARSMD

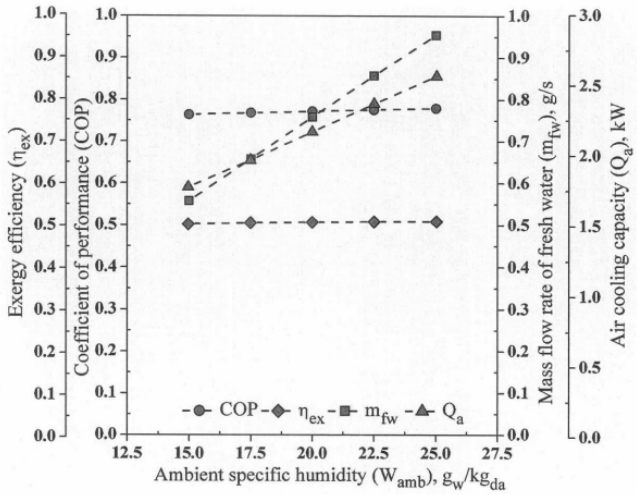


Fig.2: Effect of ambient specific humidity on exergy efficiency, coefficient of performance, mass flow rate of fresh water and cooling capacity of air

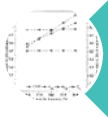
CONTACT US
Dr. Dara Ajay, Head TTO
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

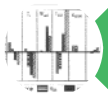
Email: headtto-icsr@icsrpis.iitm.ac.in
tto-mktg@icsrpis.iitm.ac.in
Phone: +91-44-2257 9756/ 9719

Technology

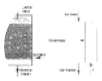
Use of Membrane based Liquid Desiccant Dehumidifier : The membrane dehumidifier (109) utilizes the liquid desiccant (i.e., lithium bromide-water) to regulate the humidity of the air.



Energy-Efficient Heat Exchange Design: The system employs two heat exchangers (107 & 108) to recover and reuse thermal energy.



Fresh Water Extraction: Excess water, after condensation at the condenser, is pumped (106) out as fresh water.



Optimized for Hot and Humid Climates: The system is specifically optimized for hot and humid climates, where conventional air conditioning systems is not energy efficient for humidity control and often struggle maintain the indoor air quality.

Key Features / Value Proposition

- Unlike traditional systems that only perform one function (air conditioning, refrigeration, or water generation), this invention combines all three into a single, integrated system. This reduces the need for separate equipment, saves space, and simplifies maintenance, while also offering cost savings through energy efficiency.
- The use of a membrane dehumidifier eliminates the risk of air entering the solution circuit, which is a common issue in traditional desiccant systems that can cause corrosion and performance decline. It ensures that the system operates reliably and maintains efficiency over a longer period.
- The optimal application of internal heat exchangers improves the overall coefficient of performance (COP) by recycling thermal energy, which is not typically done in conventional systems. This results in lower energy consumption and operational costs.
- Many existing systems focus only on cooling or refrigeration, while this invention adds the capability of fresh water production. The system recycles the condensate from the dehumidifier, converting it into fresh water.
- Traditional air conditioning systems tend to lose efficiency in humid and hot environments. This system is specifically designed to overcome the challenges of hot, humid climates by utilizing desiccant based humidity control.

CONTACT US
Dr. Dara Ajay, Head TTO
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: headtto-icsr@icsrpis.iitm.ac.in
tto-mktg@icsrpis.iitm.ac.in
Phone: +91-44-2257 9756/ 9719