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INVESTIGATIONS ON PASSIVE SOLAR LIQUID DESICCANT REGENERATOR UNDER INDOOR SIMULATED CONDITIONS

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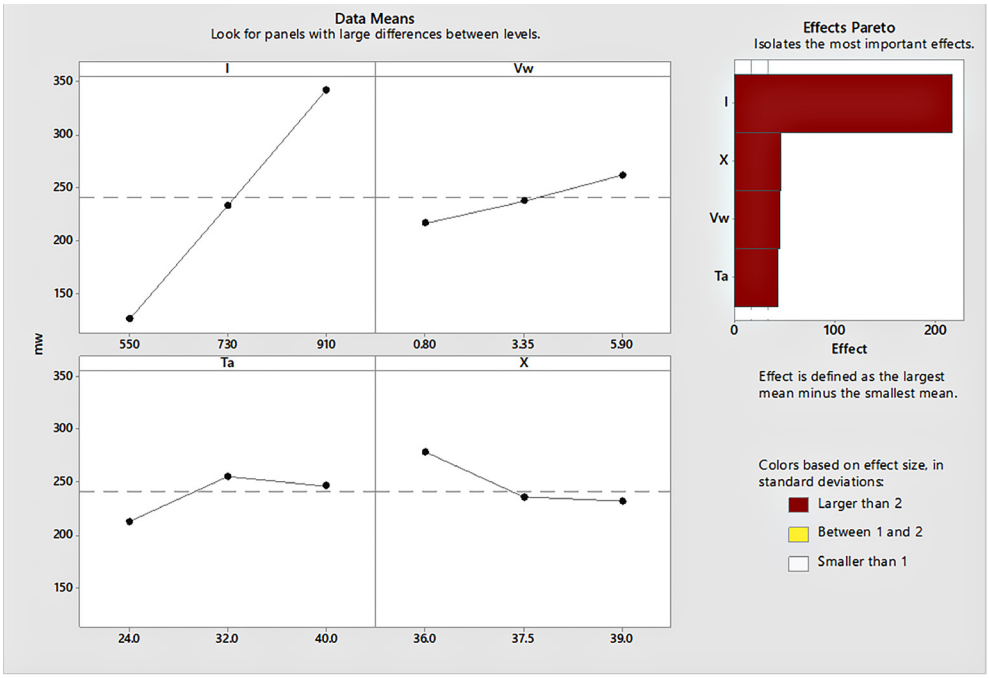
Abstract – Demand for air conditioning is rising exponentially due to improving economic conditions of large population of the world, growth of built-up space, changing lifestyles of people and higher comfort expectations. Most of the air conditioning systems use vapor compression refrigeration technology which needs electrical power to run. This has resulted in issues like higher peak demands for electrical power and higher direct and indirect emissions of greenhouse gases as well as other pollutants. The above issues can be alleviated by developing thermally activated air conditioning technologies, which use heat as the main energy source. Out of various thermally activated air conditioning technologies, liquid desiccant-based air conditioning (LDAC) systems are very attractive due to their adaptability for solar thermal energy. In LDAC systems the dehumidifier provides cooling using concentrated LD solution. This solution gets diluted there by absorbing moisture. The regenerator of LDAC systems utilizes thermal energy to remove water from the dilute LD solution to concentrate it and thus complete the cycle. The performance of the solar regenerators may be evaluated in terms of regeneration rate (moisture removal rate in ml/m2·h) and regeneration efficiency (useful heat/ solar energy input, unitless). Weather parameters like solar insolation, wind velocity, ambient temperature and system parameter like concentration affect the performance of the regenerator. The regenerator used in the current study is 'passive solar', meaning that no fan or pump is used in the device and solar thermal energy is the source of energy. Regression analysis of full factorial study was done using MinitabTM software to understand the effect of various parameters on performance of the passive solar regenerator. It is observed that as independent parameters, solar insolation, ambient temperature and concentration of LD have significant effect on the performance of the solar passive regenerator. The pareto chart shows that solar insolation has the most prominent effect on performance followed by the concentration of LD. Solar insolation has a positive effect on performance while higher concentration affects the performance negatively. The interaction plot for regeneration rate shows that solar insolation, when paired with other parameters, also has a considerable effect on the performance. The two-way interaction of wind velocity and concentration also has significant effect on the performance. Using ANOVATM, it was seen that the full factorial experiment design is linear. The insights developed in current work would help decide viability of using the passive solar regenerator at a given location and deciding the concentration range to be used in LDAC systems.

Keywords – Air conditioning; green technology; sustainable development; renewable energy technologies; solar energy



Main effects screener for regeneration rate

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