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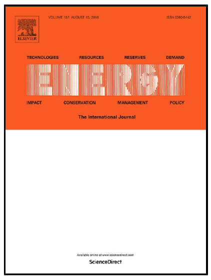

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# Effect analysis on performance and utilization of a novel compressed air drying system with a liquid desiccant cycle

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**Abstract**

A new method using liquid desiccant in compressed air drying was put forward in our previous work. However, only the test bench of the pressurized dehumidifier was established and analyzed. And the regenerator was not established, so the proposed system was not complete. Thus, the system performance of the complete system is unknown. In this paper, the experimental bench and steady-state mathematical model of the complete system are established to investigate the system performance. The dew point of compressed air is -2.4$^{o}$C (0.8MPa) in experiments, indicating dryness could meet needs of various industries which use cooling dehumidification. Besides, the average regeneration temperature is 72.9$^{o}$C in experiments, indicating using waste heat from the air compressor to drive solution regeneration is feasible. Moreover, effect of different key parameters, including solution flow rate, solution temperature and ambient conditions on system performance is analyzed by mathematical model. It can be concluded that relative higher solution flow rate, lower inlet solution temperature of dehumidifier and higher inlet solution temperature of regenerator can get a lower humidity ratio. The selected regeneration temperatures in different ambient conditions are 70$^{o}$C (summer), 39$^{o}$C (winter), 60$^{o}$C (transitional season) respectively, which can be used as a reference for the actual operation.

**Keywords:** Compressed air, drying, liquid desiccant, waste heat recovery.

**Nomenclature**

| | | | | |
|---|---|---|---|---|
| $A_v$ | specific surface area [m$^2$/m$^3$] | *Greek symbol* | | |
| $c_p$ | specific heat capacity [kJ/(kg K)] | | $\varepsilon$ | heat transfer efficiency [%] |
| $h$ | specific enthalpy [kJ/kg] | | $\beta$ | relative error [%] |
| $B$ | atmospheric pressure [Pa] | | $\eta$ | regeneration thermal efficiency [%] |