Desiccant Packet Regeneration

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Introduction

Desiccant packets are used in packaging and storage applications to absorb excess moisture. However, they are typically discarded, adding to landfill waste while also requiring new material production to maintain current demand, raising sustainability concerns. While regeneration (driving off absorbed water) allows for packets to be reused, this practice is not commonly done at the consumer level.

Objectives

The present study examines the effectiveness and energy use during four regeneration methods (vacuum pump, microwave, food dehydrator, and oven) for different desiccant types (silica gel, clay, activated carbon, and molecular sieves)

Method

To assess regeneration efficiency over time, the desiccants were weighed after removal from packaging, after water vapor absorption, and then again after treatment. Treatments were performed by following instructions on manufacturer websites or with modifications to reduce packet damage.

Figure 1. Desiccant types (Activated carbon, Silica gel, Clay, Molecular sieves)

Figure 2- Ambiano 95459 Food Dehydrator with circular grated platforms and low humidity heated air from base.
Conditions: 150 F, 10% RH, 3 hours

Figure 3- Chefmate P70D20AL-D4 1050 watt Microwave with rotating glass plate
Conditions: 10-70% power, 15 min

Figure 4- Chefmate T0-09 1000 watt Toaster Oven with stationary pan
Conditions: 150 F, 3 hours

Figure 5- BAC Eng VP-125 Single stage Vacuum pump
Conditions: Room Temp, 28 in Hg, 24 hr

Collected Data

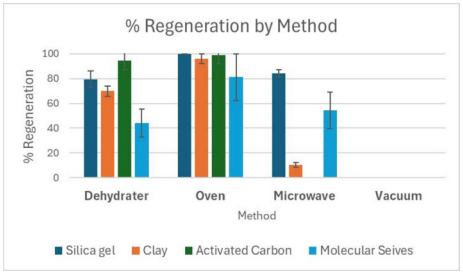

Figure 6. Amount of water (%) driven off by each method

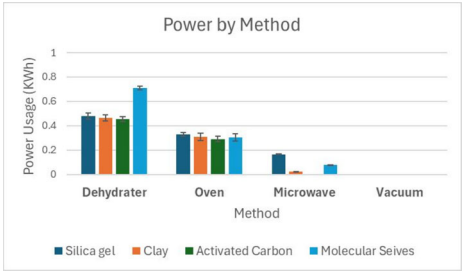

Figure 7. Power usage In Kilowatt hours for each method of regeneration

Results

Effectiveness varied considerably and was dependent on the desiccant type. Packet damage sometimes occurred with microwave and oven treatments until power was lowered below published recommendations. We considered 70% or more water loss as an effective treatment approach, allowing for potential re-use of the packets.

Figure 8 Damaged desiccants (Activated Carbon, Silica gel, Clay, Molecular Sieves)

Conclusions

Oven and dehydrator treatments were capable of reaching that threshold; however, microwave treatments only worked for silica and the vacuum pump allowed ~5% water loss. The microwave treatment was the fastest (15 min vs 3+ hours for other treatments), but also requires the ability to reduce power settings.These results show that regeneration of desiccant packets is a viable option at the consumer level, for reusing packets in non-sterile applications (shoes, electronics).

References and Acknowledgements

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References