



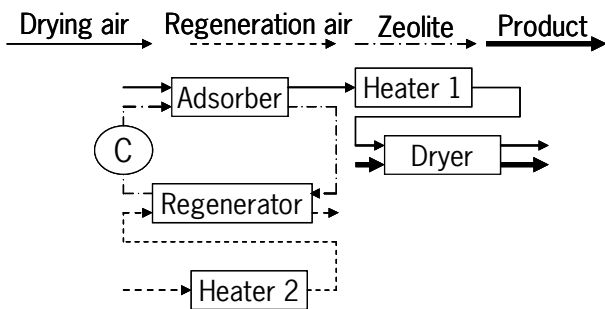
Modeling and Energy Efficiency Optimization of a Low Temperature Adsorption based Food Dryer

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INTRODUCTION

- Drying, an energy intensive process – about 15% of the industrial energy consumption
- Maintaining of food quality essential so low drying temperatures needed
- Adsorption drying capable of drying efficiently at low temperatures
- Modeling and optimization of operating conditions expected to yield energy efficiency improvements

DRYING SYSTEM WITH ADSORBENTS

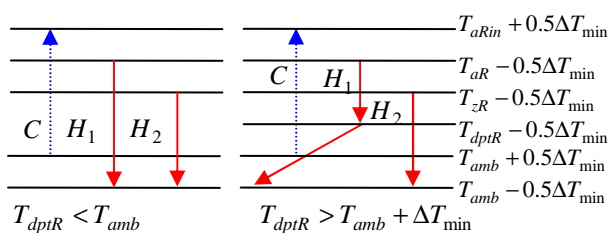


OPTIMIZATION PROBLEM FORMULATION

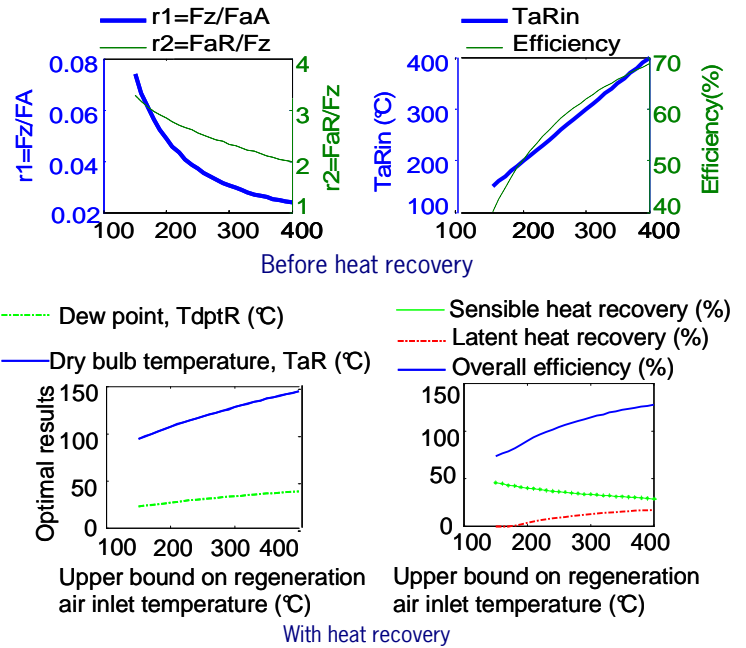
Maximize the thermal efficiency η by adjusting the regeneration temperature T_{aRin} , the ratio of zeolite to drying air flowrate F_z/F_{aA} and the regeneration air to zeolite flowrate F_{aR}/F_z , while limiting the regeneration temperature to 400°C, the product temperature to a maximum of 50°C and aiming at a product final moisture content of 0.05 kg/kg

HEAT RECOVERY OPTIONS

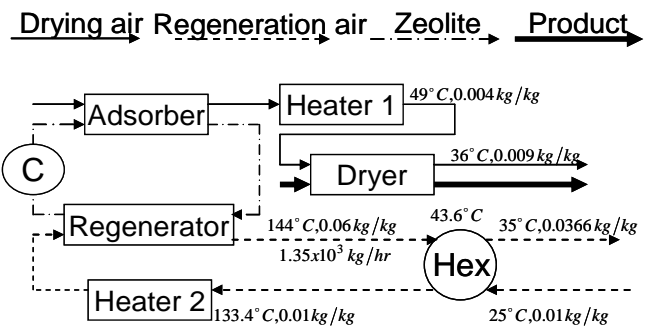
C – Cold stream -



RESULTS



DRYING SYSTEM WITH HEAT RECOVERY



CONCLUSIONS

- An optimised low temperature drying system based on adsorbents gives a high η (69% against 63% in conventional dryers)
- High regeneration temperatures important both for drying efficiency and heat recovery capacities
- Systematic choice of adsorbent and regeneration air flows reduces energy consumption in spite of high regeneration temperatures
- Sensible and latent heat recovery increase efficiency to about 125%