

## Formulation and validation of a two-dimensional steady-state model of desiccant wheels - DTU Orbit (08/11/2017)

### Formulation and validation of a two-dimensional steady-state model of desiccant wheels

Desiccant wheels are rotary desiccant dehumidifiers used in air-conditioning and drying applications. The modeling of simultaneous heat and mass transfer in these components is crucial for estimating their performances, as well as for simulating and optimizing their implementation in complete systems. A steady-state two-dimensional model is formulated and implemented, aiming to obtain good accuracy and short computational times with the purpose of inclusion in complete system models. The model includes mass and energy balances and correlations for heat and mass transfer based on empirical relations from the scientific literature. Convective heat and mass transfer coefficients are computed locally accounting for the entrance length effects. Mass diffusion inside the desiccant material is neglected. Comparison with experimental data from the literature shows that the model reproduces the physical behavior of desiccant wheels satisfactorily, as the deviation between the computed results and available data is always within 12%. The simulation time is as low as 3 s for a model with 200 control volumes. It is found that for the applied case, the model provides accurate results for the overall flow using an equiangular control volume discretization with 200 control volumes and no axial discretization. More computationally expensive configurations with axial discretization give more accurate results and information on local flow and desiccant conditions inside the wheel.

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