**Goal:** Abatement of indoor air pollution by the integration of a photocatalytic (PCO) TiO$_2$ coated reactor in HVAC systems.

**How?** Estimating the adsorption/desorption parameters as vital information for the design and development of the reactor.

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**Reaction kinetics of PCO acetaldehyde mineralization**

\[ \text{AcAl}_{(\text{bulk})} \xleftrightarrow{\text{adsorption}} \xrightarrow{\text{PCO1}} \text{AcAl}_{(\text{surface})} \]

\[ \text{H}_2 \text{O} + \text{CO}_2 \xrightarrow{\text{PCO2}} 2 \text{CO}_2 + \text{H}_2 \text{O} \]

with \( k \) = reaction rate constant

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**Using experimental data for parameter estimation**

**Goal:** Determining the kinetic parameters \( k_{\text{adsorption}} \), \( k_{\text{desorption}} \), and \( \Gamma_{\text{filter}} \) using Comsol optimization module in conjunction with the CFD calculations.

**Adsorption of acetaldehyde on uncoated fibers**

**Adsorption of acetaldehyde on TiO$_2$ coated fibers**

**CFD is useful to unravel adsorption/desorption behavior and to study the photocatalytic reaction mechanism**

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