TRANSPORT OF VOLATILE ORGANIC COMPOUNDS THROUGH BIOFILM IN BIOTRICKLING FILTERS

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Introduction: Though the biological gas treatment systems can be designed at ease, build and proved to be effective at lab scale, further scaling up at industrial level warranted the detailed knowledge of rate limiting steps in the system since it involved a series of complex physicochemical and biological processes. The present study focuses on elucidating the effects of various operating parameters such as biofilm thickness, liquid film thickness, gas film thickness on overall system performance.

Computational Methods: The model incorporates advection and dispersion in the gas phase, interphase mass transfer between the gas and the aqueous biofilm with an equilibrium partition at the interface followed by diffusion, transfer to the biofilm, and biological reactions in the biofilm. The 2D asymmetric model with stationary state was framed with the *Transport of Diluted Species* under the physics category of *Chemical Species Transport*. On first case, biofilm thickness was presumed to be constant along with variation of gas and liquid phase thickness (Fig 1a). And on second case (Fig 1b), both the gas and liquid phase was presumed to be constant and the biofilm thickness alone was varied.

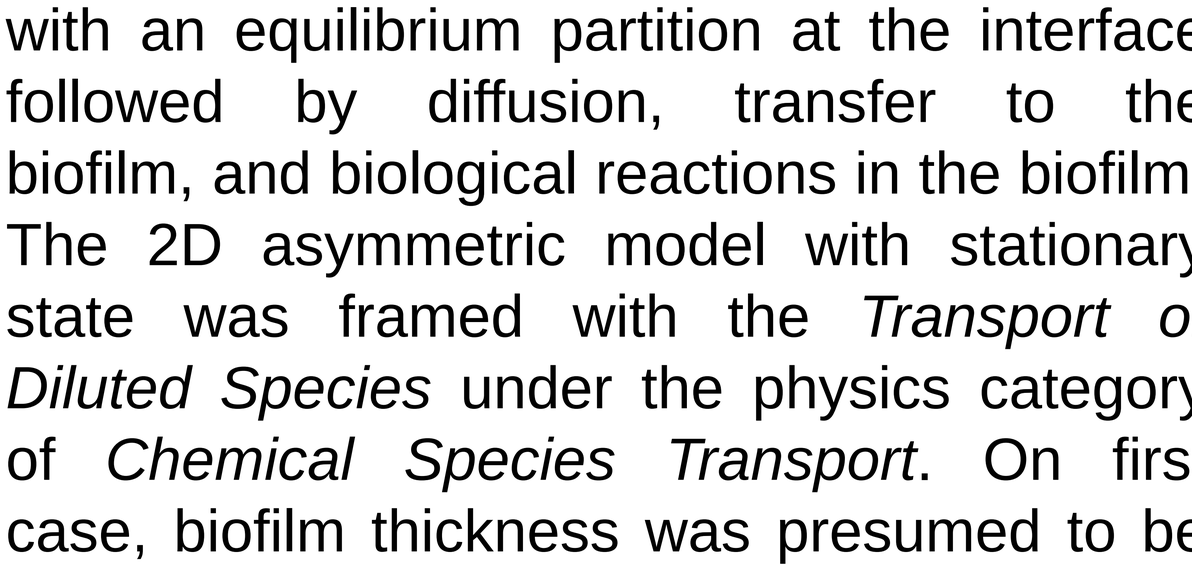

Figure 1. Model geometry with mesh for Case A and Case B

Results: Results indicate that the biotrickling filter performance is a strong function of biofilm thickness. Simulation results further suggest that higher biodegradative capacity biofilms are capable of handling load fluctuations of hydrophilic compounds irrespective of the variation in the gas and liquid phase thickness.

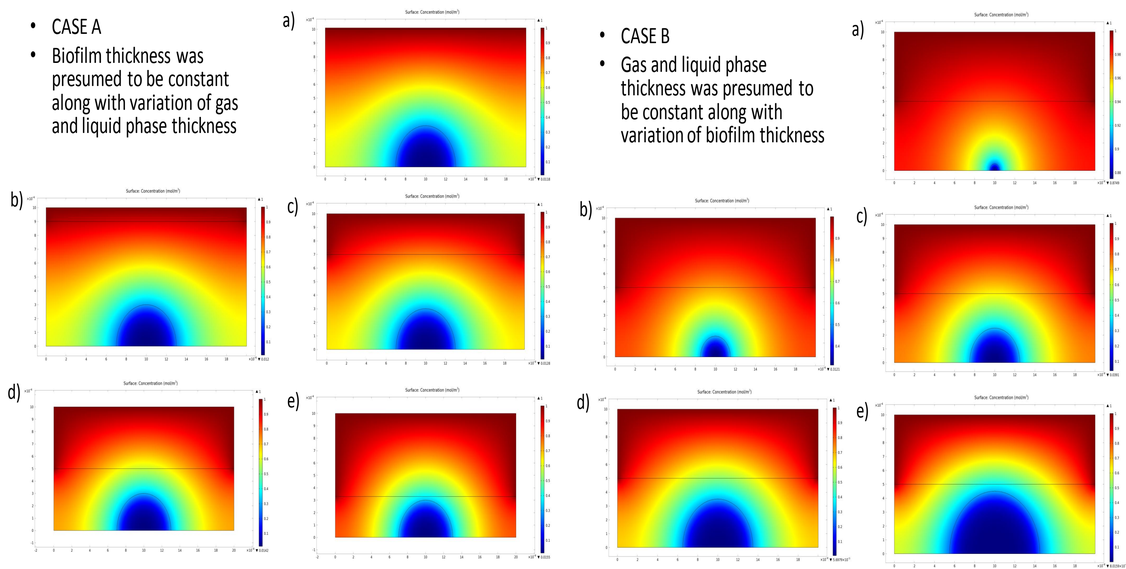

Figure 2. Concentration profile for Case A and Case B

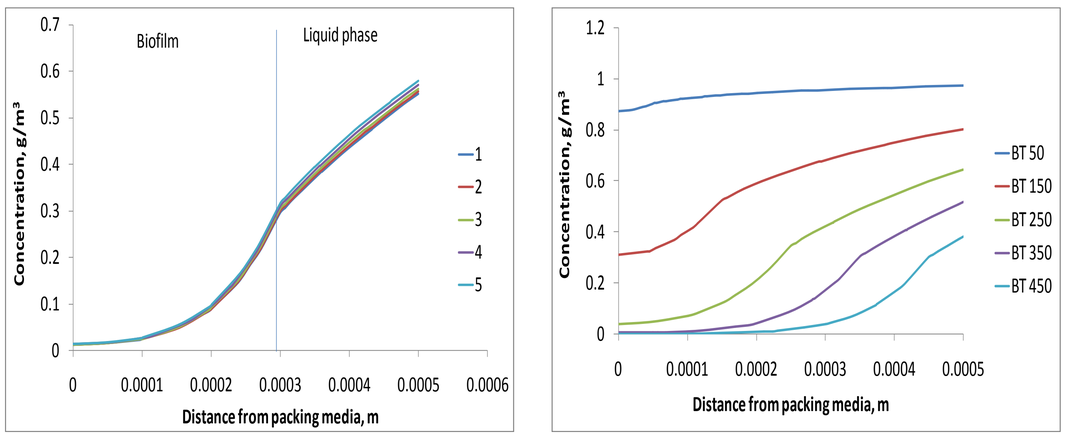

Figure 3. Concentration profile for Case A and Case B

Conclusions: Case A and Case B dictates that the system is fully reaction limited and system performance is strong function of biofilm thickness. Complementary recent results on similar cases at transient state conditions will be presented for the case of trickle bed reactors. Comsol can be a useful and reliable tool to find limits for scale-up models and other reactor designs.

References:

1. Advanced Biofilm Course, Technical University, Delft, The Netherlands.