Analysis of mass transfer with chemical reaction in finite gas-liquid systems

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Abstract title	ANALYSIS OF MASS TRANSFER WITH CHEMICAL REACTION IN FINITE GAS-LIQUID SYSTEMS
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Gas absorption accompanied by an irreversible liquid-phase reaction in thin liquid films is frequently encountered in the chemical and process industry. The classical Higbie's penetration theory fails to describe mass transfer in the system at large penetration depths, which renders the calculation of the rate of gas absorption therein highly dependent on the numerical solution. This work presents an overview of our recent research on gas absorption with chemical reaction in a liquid layer of finite depth. Based on numerical and theoretical analyses, approximate enhancement factor expressions have been formulated for various reaction orders (instantaneous, first-order and second-order) and velocity profiles in the liquid layer (plug and laminar flows) in the absence or presence of significant gas-phase mass transfer resistance, where the decisive influence of hydrodynamics and the finite thickness of the liquid layer on the rate of absorption has been elucidated. The proposed expressions in the case of a second-order reaction can be further extrapolated for estimating enhancement factor in a general case of a (1, *n*)-th-order reaction ($n \geq 1$). The findings of this work will therefore contribute to the theory of mass transfer with chemical reaction and can also provide a practical solution for mass transfer analysis in wetted-wall column reactors, falling film reactors / microreactors especially when the involved Fourier number is larger than 0.1.

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