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Explaining Hydrodynamics- mass transfer interplay in a bubble column column using bubble size distribution[1] MANAS MANOHAR MANDALAHALLI, JOHAN NIENHUIS, LUIS MANUEL PORTELA, ROBERT FRANK MUDDE, Delft University of Technology — Gas-liquid mass transfer in bubbly flows is strongly coupled with its hydrodynamics, an interdependency relevant for many industrial applications. Shrinking bubbles and/or presence of dissolved contaminants influence both transport processes and their interrelation; this makes understanding the interplay quite challenging. In our experimental work, we study the influence of dissolved electrolytes (up to 1M NaCl) on CO_2 mass transfer in a homogeneous rectangular bubble column, up to 7% gas fraction. Bubble size distribution, rise velocity and gas fractions are measured by high-speed imaging and digital image processing, while the liquid CO_2 concentration by monitoring pH variation. Coalescence inhibition, due to the electrolyte, and dissolving CO_2 both lead to a bimodal bubble size distribution with a lower mean bubble diameter, when compared to an ideal N_2-water system. Besides an increment in the interfacial area for the mass transfer, the bimodal distribution leads to bubble plume oscillations and recirculation zones in the column; dynamics of the shrinking bubble plume further influences mixing in the column. Our results strongly indicate that the mass transfer can be explained by the influence of the bubble size distribution on the hydrodynamics.

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Manas Manohar Mandalahalli
Delft University of Technology

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