Analysis of the spatial distribution change of the dissolved oxygen depending on the viscosity in the gas-liquid system

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Dissolved oxygen (DO) is a very important factor in a bioreactor. This is because if DO is below the threshold, the productivity is become very low. and if the spatial distribution of DO can be accurately predicted, one can calculate the appropriate stirring speed that do not cause damage to the cell due to the shear stress of the bubble without making dead-zone. There are some correlations that predict DO, however, they are geometry-dependent and the spatial distribution of DO cannot be predicted. Using CFD and population balance equation (PBE), the spatial distribution of DO can be predicted fairly well.
Moreover, There exist several empirical correlations between DO and liquid viscosity, but not including the spatial distribution. And most published CFD simulations predict the spatial distribution of DO, are using viscosity as same as water. In this paper, the spatial distribution change of DO according to viscosity was analyzed. A CFD-PBM coupled model is developed and validated with published experiment data. Case study for different viscosity are conducted and the spatial distribution of DO is compared.