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Gas-liquid oxygen transfer in aerated and agitated slurry systems with high solid volume fractions

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Abstract

Oxygen transfer can be a limiting step in biodegradation processes. Therefore, this process has been widely investigated for wastewater treatment, but only few research works have been done on soil slurry systems. This study focuses on the gas-liquid oxygen mass transfer in clay slurry conditions in an aerated and agitated reactor using a marine propeller. Conversely to most studies on oxygen transfer, pneumatic power input was not negligible compared to mechanical power input. Clay presence has a negative impact on the oxygen transfer.

However, the effect of agitation and aeration on this process remains unaffected at the clay concentrations tested. Three different phases explaining the depletion in the oxygen transfer rate were hypothesized. A model to predict the oxygen transfer coefficient in slurry reactors, including the three operational parameters tested within their respective ranges, was proposed.

Keywords: Slurry bioreactor, oxygen mass transfer, soil slurry, oxygen transfer coefficient model

Highlights:

- Clay presence has a negative impact on the oxygen transfer coefficient ($k_L a$).
- Bubble contamination seems to cause the decrease in $k_L a$ at low clay content (X_S).

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