# DRIFT FLUX MODELING OF GAS RELEASE IN OIL SAND TAILING PONDS

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## ABSTRACT

Gas bubbles trapped in liquids occur in natural and industrial processes such as tailing ponds, swamps, food processing, drilling fluids, etc. The bubbles are either introduced as part of the process (foamed cement, aerated chocolate, etc), or are generated in situ via chemical or biodegradation. These examples demonstrate a similar phenomenon of gas storage due to the slurry/paste-like properties of the materials. The trapping happens since the materials involved often show yield stress properties. Unless the bubble's buoyancy is large enough to overcome the yield stress, it will stay trapped in the material. For example, bubbles in a yield stress fluid are found in Canadian oil sands tailings, which consist of a mix of clay, bitumen residue, and various organic solvents. Both the Mature Fine Tailing (MFT) and Fluid Fine Tailing (FFT) strata of the tailing ponds show thixotropic yield stress properties. These layers provide a suitable environment for anaerobic bacteria to digest organic compounds and produce Carbon Dioxide ($CO_2$) and Methane ($CH_4$). The produced gasses will stay in FFT/MFT until the bubbles grow large enough to overcome yield stress and can rise to the surface. Methane release can be either continuous or transient. The latter scenario is that explored here.

In this study, we are interested in modeling the bubble growth and release in the tailing ponds and relating bacterial activities to the gas release rate. We are developing a 1D drift flux model to estimate the total bubble storage capacity of the pond as well as stability criteria for the pond. Using this model, we may estimate the gas release rate as a function of lake conditions: atmospheric pressure, temperature, and rheological properties. A set of experiments have also been conducted to study bubble cloud release in a test material (Carbopol). The drift flux velocity of bubbles in a model yield stress fluid can be estimated from these experiments and other sources.

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