

Title: Study on underwater interactions between yeast cells and air bubbles - aiming for new biodegradation solutions

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The efficiency of bioprocesses invovling yeast, like fermentation, flotation, and biodegradation of contaminants and hazardous pollutants, depends on efficient separation processes for the utilized yeasts. The ability of yeast to aggregate with microbubbles is key to efficient separation processes, which depends on the interactions betwen yeast cells and air bubbles. Measurements of these interactions are reported recently (by using atomic force microscopy, J Colloid and interface science 532 (2018) 689-699, by solvent exchange method, Nature Materials, Vol 15, April 2016, 407-413), under varioation of pH, ethanol concentration, salt concentration, ionic strength and influcence of storage time conditions. Yet little to nothing is known on how to calculate these interactions. Here we aim to establish a model and a set of equations to calculate these interactions, based on thermodynamic principles.

Our findings are useful for new practice in a wide range of bioprocesses including antifouling applications. This study is an extension of our previous works; (1) an equation of water contact angle calculation from entropy of an air-water-substrate system [1], and (2) an equation of temperature dependent strain energy from system entropy [2]. In this study, we derive new equations to calculate wetting of deformed bubbles on yeast cells at different bubble deformation and water chemistry conditions. We, then, apply the equations to explain the observed yeast cell-bubble interactions, and finally demonstrate their potentials in bioprocess optimization invovling yeast. This research may also provide novel insights on weakly bonded interface interactions between soft materials at microscale.

Biography

Prof. Wu (Singapore University of Technology and Design) focuses on Materials Chemistry research, which are shown in his highly cited papers: 1. NATURE NANOTECHNOLOGY 6(4): 247-252, 2011. Cited 308, 2. J ALLOYS AND COMPOUNDS, 179: 259-287, 1992. Cited 147, 3. NANO LETTERS, 7(8): 2370-2376, 2007. Cited 130, 4. J ALLOYS AND COMPOUNDS, 372(1-2): 40-48, 2004. Cited 112. He has produced >240 peer reviewed journal papers with citations >5000, and h index = 38 (web of science). He completed more than 50 contracted research projects in the area of materials chemistry, for which about half were directly funded by commercial companies.

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