Desalination and Water Treatment
www.deswater.com
doi: 10.5004/dwt.2019.24718

170 (2019) 91–100
December

Effect of salinity and temperature on air dissolution in an unpacked air saturator of a dissolved air flotation system

Vahid Reza Fanaie, Mehdi Khiadani*, Guangzhi Sun

School of Engineering, Edith Cowan University, Joondalup, Perth, WA, Australia, emails: m.khiadani@ecu.edu.au (M. Khiadani), v.fanaieesfahani@ecu.edu.au (V.R. Fanaie), g.sun@ecu.edu.au (G. Sun)

Received 4 December 2018; Accepted 26 July 2018

ABSTRACT

The amount of the precipitated air inside a flotation tank has a significant effect on the removal efficiency of a dissolved air flotation (DAF) system. For the first time, this study examined the effect of salinity (35 g L^{-1}) and temperature variations (10°C–40°C) on air solubility in an unpacked air saturator of a real-scale DAF system for different range of pressures (300–600 kPa) and recycle ratios (10%–40%). The amount of dissolved air inside the air saturator was measured using the liquid displacement method. The results indicated that, under equilibrium conditions, salinity and temperature are inversely proportional to air solubility. However, under non-equilibrium status, with increases in temperature, the amount of dissolved air declines to its minimum value at 20°C and then increased again. The observed behaviour was attributed to the effect of temperature on volumetric gas/liquid mass transfer (K_La). The effects of recycle ratio and pressure was also investigated for non-equilibrium conditions and it was observed that the temperatures was below 20°C, an increase in recycle ratio and saturator pressure can compensate the lack of air caused by salinity and increase of temperature. However, for temperatures above 20°C, it is not necessary to increase the recycle ratio and saturator pressure as the rise of temperature by itself increases air concentration. Finally, the size distribution of microbubbles was also investigated and it was found that temperature does not affect the average size of microbubbles noticeably whereas salinity prevents coalescence and contributes to smaller size bubbles.

Keywords: Dissolved air flotation; Microbubbles; Salinity; Temperature; Air saturator

* Corresponding author.