Desalination and Water Treatment
www.deswater.com

39 (2012) 55–69
February

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doi: 10/5004/dwt.2012.2561

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On the induction time of $CaCO_3$: effect of ionic strength

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Received 30 December 2010; Accepted 27 February 2011

ABSTRACT

This research investigated the induction times of $CaCO_3$ as a function of the saturation and ionic strength for synthetic solutions based on the Gulf of Oman seawater analysis. The investigation aimed to determine at elevated ionic strength levels, (i) the $CaCO_3$ phase incorporated in the Stiff and Davis saturation index and (ii) the mechanism of nucleation involved. Induction time experiments were performed with synthetic concentrates having different ionic strengths of 0.054, 1.12, 1.34, 1.61 mole/l. Results showed that S&DSI incorporate the solubility of calcite at low ionic strength but vaterite for high ionic strength water. This expectation was confirmed with microscopic analysis of the formed crystals at the end of the induction time experiments (24 h) as vaterite was found in the solution instead of calcite. These findings indicate that vaterite and not calcite maybe the precipitating phase in seawater. The study of the mechanism of nucleation showed three different trends describing three different nucleation mechanisms; namely homogenous, heterogeneous and a one characterized by an intermediate surface tension. The calculations of the apparent surface energy showed values ranging from 15–94 mJ/m^2 which is consistent with literature data for vaterite. Results suggest that for the level of saturation reached in SWRO systems, the nucleation mechanism will most probably be heterogeneous.

Keywords: Nucleation; Membrane; Desalination; Surface energy; Phase; Seawater

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