New insight into the relation between bulk precipitation and surface deposition of calcium carbonate mineral scale

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**ABSTRACT**

The formation of calcium carbonate mineral scale is a major issue in desalination. Understanding the precipitation and deposition of such scale is a necessity in order to prevent fouling of components and also under deposit corrosion. Research has mainly focused on either bulk scale precipitation or surface deposition. However, understanding both together is of great interest to predict and therefore prevent the formation of such inorganic deposits. This study presents an assessment of the kinetics of calcium carbonate formation in the bulk and on a stainless steel surface. The objective of the study is to improve the knowledge of the relationship between bulk precipitation and surface deposition. Both the processes (bulk precipitation and surface deposition) have been assessed together in situ and in real time. The procedure enabled the assessment of bulk precipitation by measuring the turbidity while the surface coverage of the surface scale was assessed by analysing images of the surface at different time intervals. Four brines were tested under three different temperatures to give a combination of 12 different supersaturation ratio values. From the results, the rate constants for both the processes and their relation have been assessed. It has been confirmed that both the processes are different and show different kinetics. The study therefore suggests that the relation between both processes has to be taken into account when developing a kinetic model or preventing the formation. However, the paper highlights the need for more investigation before the relationship between both the processes is fully understood.

**Keywords:** Scale; Crystallization; Calcium carbonate; Surface; Bulk

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