R.M. Wagterveld, M. Yu, H. Miedema, G.J. Witkamp, Polymorphic change from vaterite to aragonite under influence of sulfate: The “morning star” habit, Journal of Crystal Growth, Volume 387, 1 February 2014, Pages 29-35, ISSN 0022-0248, http://dx.doi.org/10.1016/j.jcrysgro.2013.10.044.

http://www.sciencedirect.com/science/article/pii/S0022024813007264

The presence of sulfate in reverse osmosis drinking water concentrate and its effect on calcium carbonate precipitation was studied, notably the overall kinetics of CaCO3 formation and the types of polymorphs formed. CaCO3 formation slows down with increasing sulfate concentration and the preferential polymorph shifts from vaterite to aragonite with increasing sulfate concentration. With this polymorphic change, a new combined habit is observed where aragonite spikes grow on top of vaterite (“morning star” habit). The presence of a moderate magnesium concentration results in the shift of vaterite to aragonite at relatively low sulfate concentrations; where sulfate and magnesium appear to have an additive effect. Without magnesium, spikes on top of vaterite were also observed, but only at relatively high sulfate concentration. Without the presence of magnesium, single crystals of aragonite were not found.

Keywords: A2. Growth from solutions; B1. Aragonite; B1. Calcium carbonate; B1. Sulfate; B1. Vaterite