Shape optimization in the batch crystallization of CAM

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The citric acid monohydrate (CAM) is an important organic substance but, until 1997, the scientific literature covered mostly the kinetics of nucleation [4] and the crystal growth [5] rather than its production via the crystallization by cooling in a stirred tank reactor (STR). The Department of Chemical Engineering at the University "La Sapienza" of Rome decided to fill that sci-tech gap through a meticulous investigation, with three STRs at the laboratories of San Pietro in Vincoli's district, on the crystallization in discontinuous (batch) of CAM from aqueous solutions. The author participated in that cutting edge experience, as experimenter and coder under the supervision of Prof. Barbara Mazzarotta, in the years 1997-1998 [1]. Our specific tasks were to spot the main operating conditions, to modify them until an *optimal* crystal size distribution (CSD), i.e., large-sized homogeneous crystals of CAM, and to write a QBasic program predicting the outcomes of any test in batch reactors [2]. Here we focus on the influence of the STRs' geometry, i.e., the role played by the tanks in crystallizing the CAM thanks to their differently shaped bottoms (flat, hemispherical, conical). All the data, collected and simulated, show that the round-bottomed crystallizer gives the best CSD, performing better than the conical-bottomed STR, and that we should discard the flat-bottomed STR for the poor quality of its crystalline product [3]. The homogenous distribution of large crystals from the round-bottomed STR is due to the *optimal* suspension state that such shape provides for the dispersed phase of CAM particles [6], as confirmed by the computational fluid-dynamics software `VisiMix`.

References

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