World Academy of Science, Engineering and Technology
International Journal of Chemical and Molecular Engineering
Vol:12, No:02, 2018

Impact of Fluid Flow Patterns on Metastable Zone Width of Borax in Dual Radial Impeller Crystallizer at Different Impeller Spacings

Authors : A. Čelan, M. Ćosić, D. Rušić, N. Kuzmanić

Abstract : Conducting crystallization in an agitated vessel requires a proper selection of mixing parameters that would result in a production of crystals of specific properties. In dual impeller systems, which are characterized by a more complex hydrodynamics due to the possible fluid flow interactions, revealing a clear link between mixing parameters and crystallization kinetics is still an open issue. The aim of this work is to establish this connection by investigating how fluid flow patterns, generated by two impellers mounted on the same shaft, reflect on metastable zone width of borax decahydrate, one of the most important parameters of the crystallization process. Investigation was carried out in a 15-dm³ bench scale batch cooling crystallizer with an aspect ratio (H/T) equal to 1.3. For this reason, two radial straight blade turbines (4-SBT) were used for agitation. Experiments were conducted at different impeller spacings at the state of complete suspension. During the process of an unseeded batch cooling crystallization, solution temperature and supersaturation were continuously monitored what enabled a determination of the metastable zone width. Hydrodynamic conditions in the vessel achieved at different impeller spacings investigated were analyzed in detail. This was done firstly by measuring the mixing time required to attain the desired level of homogeneity. Secondly, fluid flow patterns generated in a described dual impeller system were both photographed and simulated by VisiMix Turbulent software. Also, a comparison of these two visualization methods was performed. Experimentally obtained results showed that metastable zone width is definitely affected by the hydrodynamics in the crystallizer. This means that this crystallization parameter can be controlled not only by adjusting the saturation temperature or cooling rate, as is usually done, but also by choosing a suitable impeller spacing that will result in a formation of crystals of wanted size distribution.

Keywords : dual impeller crystallizer, fluid flow pattern, metastable zone width, mixing time, radial impeller
Conference Title : ICPCE 2018 : International Conference on Pharmacy and Chemical Engineering
Conference Location : London, United Kingdom
Conference Dates : February 15-16, 2018