

Key Parameters Analysis of the Stirring Systems in the Optimization Procedures

Authors : T. Gomes, J. Manzi

Abstract : The inclusion of stirring systems in the calculation and optimization procedures has been undergone a significant lack of attention, what it can reflect in the results because such systems provide an additional energy to the process, besides promote a better distribution of mass and energy. This is meaningful for the reactive systems, particularly for the Continuous Stirred Tank Reactor (CSTR), for which the key variables and parameters, as well as the operating conditions of stirring systems, can play a pivotal role and it has been showed in the literature that neglect these factors can lead to sub-optimal results. It is also well known that the sole use of the First Law of Thermodynamics as an optimization tool cannot yield satisfactory results, since the joint use of the First and Second Laws condensed into a procedure so-called entropy generation minimization (EGM) has shown itself able to drive the system towards better results. Therefore, the main objective of this paper is to determine the effects of key parameters of the stirring system in the optimization procedures by means of EGM applied to the reactive systems. Such considerations have been possible by dimensional analysis according to Rayleigh and Buckingham's method, which takes into account the physical and geometric parameters and the variables of the reactive system. For the simulation purpose based on the production of propylene glycol, the results have shown a significant increase in the conversion rate from 36% (not-optimized system) to 95% (optimized system) with a consequent reduction of by-products. In addition, it has been possible to establish the influence of the work of the stirrer in the optimization procedure, in which can be described as a function of the fluid viscosity and consequently of the temperature. The conclusions to be drawn also indicate that the use of the entropic analysis as optimization tool has been proved to be simple, easy to apply and requiring low computational effort.

Keywords : stirring systems, entropy, reactive system, optimization

Conference Title : ICPSE 2016 : International Conference on Process Systems Engineering

Conference Location : Stockholm, Sweden

Conference Dates : July 11-12, 2016