ENERGETIC-ECONOMICAL EFFECTS OF SUPERCRITICAL ANTISOLVENT PRECIPITATION PROCESS CONDITIONS

Diego Tresinari dos Santos[a], Maria Thereza de Moraes Santos Gomes[a], Ricardo Abel Del Castillo Torres[a], Juliana Queiroz Albarelli[a], Ademir José Petenate[b], Maria Angela de Almeida Meireles[a]

[a]LASEFI/DEA/FEA (School of Food Engineering)/UNICAMP (University of Campinas) Cidade Universitária "Zeferino Vaz", Rua Monteiro Lobato, 80, Campinas, 13083-862, Brazil

[b]EDTI – Process Improvement; Rua José PonchioVizzari, 312; Campinas, SP; CEP: 13085-170; Brazil

The effects of several operational parameters (pressure, temperature, CO_2 flow rate, solution flow rate, injector type and concentration of solute in the ethanol solution) during Supercritical AntiSolvent (SAS) precipitation process on the energy consumption cost per unit of manufactured product were investigated using experimental design technique. In this work, two different injectors were used; a completely randomized experiment would eventually require a modification of the apparatus after each experimental run. To avoid this, the experimental runs were done accordingly with a split-plot experimental design. For this study Ibuprofen sodium salt was used as a model solute and CO_2 was used as antisolvent. This supercritical fluid-based has been used successfully for several food and pharmaceutical applications since the production of small micro- and nanometer-sized particles have attracted growing interest in these industries. Focusing on energy saving, an SAS process was simulated using the SuperPro Designer simulation platform. The effect of temperature versus concentration of ethanolic solution and pressure versus solution flow rate interactions on the energy consumption cost per unit of manufactured product was demonstrated. The lowest estimated energy cost per unit of manufactured product was obtained using and ethanolic solution of 0.04 $g.mL^{-1}$at 12 MPa of pressure and a solution flow rate of 1 $mL.min^{-1}$. This result was independent of the temperature. Thus, the present work reports a systematic energetic-economic study of the supercritical antisolvent micronization process, aiming increase knowledge about this process and its further incorporation by the food and pharmaceutical industries. Acknowledgements: Diego T. Santos thanks CNPq (processes 401109/2017-8; 150745/2017-6) for the post-doctoral fellowship. Ricardo A. C. Torres thanks Capes for their doctorate assistantship. Juliana Q. Albarelli thanks FAPESP (processes 2013/18114-2; 2015/06954-1) for the post-doctoral fellowships. M. Angela A. Meireles thanks CNPq for the productivity grant (302423/2015-0). The authors acknowledge the financial support from FAPESP (process 2015/13299-0).