Numerical Simulation to Estimate the Droplet Size in Aerosol Solvent Extraction System

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ABSTRACT

The aerosol solvent extraction system (ASES) is one of the emerging processes for the production of fine particles of pharmaceutical compounds. This process involves atomization of the solution (pharmaceutical compound + organic solvent) in an antisolvent environment. The atomized droplet comes in contact with the antisolvent, the latter diffuses into the droplet and the solvent evaporates from the droplet surface. This work presents a mathematical model to calculate the dynamic size of a droplet moving in a precipitator used in the supercritical antisolvent process. The system considered for this work is carbon dioxide (CO_2)-dimethyl sulfoxide (DMSO). Two Film Theory of mass transfer is used to estimate the mass transfer to and from the droplet. This two-way mass transfer process results in extremely high, very rapid and uniform supersaturation, which leads to the formation of very small size particles with narrow size distribution. The simultaneous diffusion of CO_2 and the evaporation of solvent from the droplet cause swelling of the droplet which may be followed by shrinking. The effects of process parameters such as nozzle diameter, flow rate on droplet size are also studied in this work.

Keywords: Supercritical, Carbon Dioxide, Dimethyl Sulfoxide, Antisolvent, Droplet

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