Development of nanoparticles for pharmaceutical preparations using supercritical techniques

ABSTRACT

This review focuses on nanoparticle (NP) synthesis and particle size design using supercritical fluid (SCF) technology for pharmaceutical formulations. SCF technology is seen as a pioneering step forward in particle size design, and also plays a critical role in addressing the problem of residual solvents in pharmaceutical and biomedical research. In SCF technology, one of the most important components is environmentally friendly supercritical CO2 (scCO2) fluid, which is very common and cost-effective because nontoxic green technology is used for the formation of nanomedicine in drug delivery. In the case of pharmaceutical science, numerous complex procedures are required in order to manufacture NPs. The working principles of the rapid expansion of supercritical solutions (RESS), supercritical antisolvent (SAS), supercritical fluid extraction of emulsions (SFEE), solution-enhanced dispersion by supercritical fluids (SEDS), rapid expansion of supercritical solution into a liquid solvent (RESOLV), and particles from gas-saturated solution (PGSS) are widely used throughout the industry. Most of the supercritical (SC) approaches (total 23 methods) including the newly established methods are cited in this manuscript. This study offers a detailed overview of fundamental principles and relevant roles, advantages, and difficulties in the creation of SCF methods for the formation of NPs. It gives the clear concept to select the proper method, solvent, active ingredients, and polymers in NP preparation.