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Recrystallization and Micronization of an Active Pharmaceutical Ingredient of Nitrofurantoin Using the Supercritical Antisolvent Process

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The Supercritical AntiSolvent (SAS) process is employed in this study for the recrystallization and micronization of an Active Pharmaceutical Ingredient (API) of nitrofurantoin. This API is an antibiotic and is usually used in treating urinary tract infection. It has relatively low solubility in water and the original API has a large mean size of 202 μm. The target of this study is to enhance its dissolution behavior by reducing its mean particle size and crystallinity. The experimental procedures are similar to those in our previous studies [1, 2]. Nitrofurantoin was firstly dissolved in a mixed solvent of DMSO and ethyl acetate. This solution was introduced to a precipitation column, together with high pressure carbon dioxide, through a coaxial nozzle. Upon mixing with the high pressure carbon dioxide, the solution of nitrofurantoin in the mixed solvent had a rapid volume expansion. Recrystallization and micronization of nitrofurantoin were resulted due to the loss of solvent power in a short period of time. The micronized nitrofurantoin particles were collected at the bottom of the precipitation column after the SAS process. The properties of the micronized product were analyzed by SEM, PXRD and DSC. The optimal operation conditions of pressure, temperature, concentration of solution, flow rate of the solution, and the nozzle diameter were investigated. It is reported that nitrofurantoin particles were micronized from its original mean size of 202 μm to 2.93 μm. The intensity of crystallinity was reduced after the SAS treatment as observed by the PXRD patterns. The dissolution rate in a simulated intestinal fluid was enhanced by 3.7 times after the SAS process. It is demonstrated that the SAS process yields feasible results for the recrystallization and micronization of nitrofurantoin.

References

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