

Using Powder X-ray Diffraction Analysis for a Pharmaceutical Nanocomposite

*Shawn X. Yin, Raymond P. Scaringe
Solid-State Sciences, Bristol Myers Squibb Co.
New Brunswick, New Jersey 08903*

Spray-drying was investigated as a means of providing fast-onset formulations of poorly water-soluble drugs. Drug (BMS-347070) and an excipient (Pluronic F127) were dissolved in an organic solvent, the solution spray-dried, and the particles characterized. The materials obtained were studied by Powder X-ray Diffraction (PXRD), DSC, hot stage microscopy and SEM. Using the Scherrer equation, the average drug crystallite size is estimated to be in the range of 40 to 60 nm for co-processed BMS-347070/Pluronic F127. PXRD patterns were also analyzed by a simulation process that combines the PXRD patterns of the two individual components of the composite and compares the result with that observed. This simulation analysis indicates that the drug component is dominantly in the crystalline state. PXRD time evolution scans of the spray-dried materials suggest that the polyethylene oxide segments of Pluronic crystallize and that the polypropylene oxide segments remain amorphous, providing a size-restricted domain in which the drug crystallizes.

The reduction in drug particle/crystallite size from micron to nano-meters, coupled with wetting by the Pluronic, resulted in improved drug bioavailability.