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CONFINED NANOCRYSTALLIZATION OF ANTHRANILIC ACID IN A MESOPOROUS ZEOLITE MATRIX

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This research investigates the potential of confined crystallization for improving the performance and particle size control of active pharmaceutical ingredients (APIs). The study focuses on the crystallization of anthranilic acid within a zeolite mesoporous matrix and investigates the effects of solvent selection and the nature of the confining material on the crystal polymorphism and morphology of the API. In the process, 245 mg and 115 mg of anthranilic acid were dissolved separately in 1 mL of ethanol and acetonitrile solvents to create saturated solutions. The solutions were heated to 40 °C, stirred, and filtered to remove undissolved particles. The saturated solutions were then introduced into the zeolite matrix, with different amounts of zeolite depending on the solvent used (for ethanol 210 mg while in acetonitrile 200 mg). As the solutions cooled, anthranilic acid crystals nucleated and grew within the nanopores of the matrix, gradually increasing in size over time. Advanced characterization techniques such as powder X-ray diffraction (PXRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), and fourier transform infrared (FT-IR) spectroscopy were used to analyze the changes in the crystal structure and properties during confined crystallization. The PXRD and FT-IR analysis demonstrated that the choice of solvent significantly influenced the polymorphic form of anthranilic acid, with acetonitrile giving polymorph I, whereas ethanol gave polymorph II. From SEM and TEM analysis, confined crystallization within the zeolite matrix resulted in smaller and more uniform needle-like anthranilic acid crystals, which consisted of a diameter of 20 nm, exhibiting a high order and purity. The use of advanced analytical techniques such as PXRD, SEM, TEM, and FT-IR can facilitate the optimization of confined crystallization processes and enable the development of innovative drug delivery systems with improved efficacy and safety. The findings highlight the potential of confined crystallization as a promising strategy for enhancing the performance and control of APIs.

Keywords: Active pharmaceutical ingredient (API), Anthranilic acid (2-aminobenzoic acid), Confined crystallization, Mesoporous matrix, Zeolite