

Preparation and optimization of Nano-sized cocrystals using quality by design approach

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Abstract

The present investigation was aimed at developing a laboratory scale preparation technique for nano-cocrystals comprised of a water insoluble drug and a water soluble coformer. The challenge was to prepare a nano sized system while maintaining the integrity of the cocrystals. Carbamazepine-nicotinamide was selected as a model cocrystal for this study. Anti-solvent precipitation technique was investigated utilizing various solvents (ethanol, ethyl acetate, and acetone), anti-solvents (water, n-hexane) and stabilizers (span-80, PVPVA-64, poloxamer-407) for producing nano-cocrystals. Preliminary screening was performed based on solubility and Damkohler number which resulted in selection of acetone as a solvent and n-hexane as an anti-solvent. L-18 Hunter design was applied for studying the effect of five independent variables (type of stabilizer, concentration of stabilizer, sonication time, temperature and stirring speed) on the particle size (response variable). The experimental outcome indicated that the type of stabilizer and its concentration significantly affects the particle size of the nano-cocrystal formulation. Formulation containing 0.3% of PVPVA-64 was found to be stable with the lowest particle size i.e. $D_{10}=68.9\pm 9.5$ nm, $D_{50}=138.2\pm 16.6$ nm, and $D_{90}=260.3\pm 17.96$ nm. Further, the optimized formulation was characterized by differential scanning calorimetry, powder X-ray diffraction, and ATR-FTIR spectroscopy. A decision tree to aid in selection of solvent, anti-solvent and stabilizers for different nano-cocrystals is also presented which can be applicable for a wide range of drug and coformers with different solubility.

Biography:

Thakor Pradip kumar completed his M.S, 2016 in Pharmaceutics in NIPER Raebareli and CDRI. He pursue his Ph.D in NIPER Hyderabad from 2017.



Speaker Publications:

1. "Evolution of Nanotechnology in Delivering Drugs to Eyes, Skin and Wounds via Topical Route"; Journals Pharmaceuticals Volume 13 Issue 8 10.3390/ph13080167
2. "Preparation and optimization of nano-sized cocrystals using a quality by design approach", *CrystEngComm*, 2020,22, 2304-2314
3. Human immunodeficiency virus associated tuberculous lymphadenitis: a clinical study of 50 cases of Saurashtra region of Gujarat, India; *ijmedicine*;vol2
4. Polymer-drug conjugates: recent advances and future perspectives; *Drug Discov Today*. 2020 Jul 3;S1359-6446(20)30256-7. doi: 10.1016/j.drudis.2020.06.028.
5. COVID-19: Pathophysiology, treatment options, nanotechnology approaches, and research agenda to combating the SARS-CoV2 pandemic; *Life Sci* . 2020 Aug 23;261:118336. doi: 10.1016/j.lfs.2020.118336.

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