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Development and optimisation of a novel free-flowing and compressible co-processed excipient containing mesoporous silica and isomalt for the production of solid dispersions

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Solid dispersions with mesoporous silicon dioxide as a carrier are a promising way to improve solubility of poorly water-soluble drugs. However, mesoporous silica has poor compression and flow properties and is thus inappropriate for direct compression to produce a final dosage form. Hence, a novel co-processed material was developed consisting of mesoporous silica and a sugar alcohol isomalt acting as a binder that connects small silica particles. Such material has improved flow and compression properties that allow for direct compression into tablets, and at the same time has high enough surface area for impregnation with the active ingredient. High shear granulation with water as granulation liquid was used to produce the material and a Design of Experiment study was conducted to examine the effect of different formulation and process parameters (silica to isomalt ratio, water amount and addition rate, impeller rotation speed) on the observed responses (particle size, flow properties, compression properties, specific surface area). Models obtained after the study provided a thorough insight into factors influencing characteristics of the material, however, not all observed responses gave good models. Based on acquired models, an optimised product was developed showing satisfactory characteristics in terms of particle size, surface area, compressibility and tabletability. Ibuprofen was chosen as a model drug to be impregnated into the optimised excipient at different ratios by rotary evaporation. Thermal analysis suggested that at lower ratios, ibuprofen was completely transformed into amorphous and/or nanocrystalline form, which are both associated with improved dissolution.

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