Poster

Controlling particle properties via crystal engineering: an example on quercetin hydrates, solvates and cocrystals

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Organic crystalline particles are widely used as active ingredients (AIs) in several industrial sectors, such as, nutraceutical, pharmaceutical and agrochemical [1,2]. Effective control of crystal properties such as size and shape distribution, polymorphism, chemical purity and stability holds paramount importance, as these properties can significantly impact subsequent downstream processes like filtration, drying, and milling, while also affecting important quality attributes of the final product, such as dissolution rate and solubility [3]. A smart and efficient way to design products with tailor-made physico-chemical properties is represented by crystal engineering approaches, which can potentially be applied to a wide range of crystalline materials [4]. To design structures with targeted properties crystal engineering can rely on crystal structure visualization and modelling (e.g., synthon analysis) tools. Indeed, such tools have been successfully used to explain the relative thermodynamic stability across diverse solid forms (hydrates, solvates, polymorphs and cocrystals) of a target active ingredient. Whereas, crystal structure modelling has seldom been used to study surface features of crystals (*e.g.* rugosity and facet-specific chemistry), which are extremely important for the determination of particle surface properties such as wettability [5]. In this work we used quercetin (Figure 1, as a model compound to perform a comprehensive bulk and surface modelling of different solid forms (bulk synthon analysis, facet-specific topological analysis, and attachment energy models). The results from the simulations were validated experimentally with X-ray indexing, scanning electron microscopy, contact angle measurements and Raman microscopy. Quercetin shows a fascinating solid-state landscape including several anhydrous, hydrates and solvate forms [6], whose relative stability, crystallization behaviour and physiochemical properties are strongly related to the molecular conformation in the crystal lattice and to the crystal packing modes. This knowledge can direct the selection of crystallization parameters to achieve a specific form of quercetin, thus accelerating product and process development.

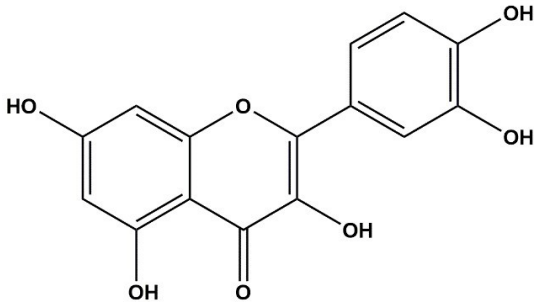

Figure 1. Molecular structure of Quercetin.

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