

THE IMPORTANCE OF SURFACE FREE ENERGY IN THE FORMULATION OF SOLID DISPERSIONS

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Surface free energy (SFE) is generally a crucial indicator related to processing or handling of pharmaceutical solids. SFE values correlate to several key functional properties of solids, such as wetting, dispersability, flowability, agglomeration, adhesion, cohesion, adsorption, phase transformation, etc. Based on this, SFE should be the principal characteristic of solids because the molecules at their surface are in a less favorable state having higher energy in comparison to the molecules in the bulk.

In this study, we described the structure of various tadalafil solid dispersions prepared by different techniques (solvent evaporation, spray drying, HME) and we related them to the changes in SFE indicating their amorphousness. Inverse gas chromatography (IGC) was used to measure SFE and therefore, various vapor probes with known properties were used to characterize the unknown surface properties of solid dispersions.

It was found that lower values of SFE correspond to more homogeneous solid dispersions, whereas higher values of SFE indicate the heterogeneous solid dispersions consisting of tadalafil amorphous clusters that were detected by confocal Raman microscopy. These findings also enable another potential usability of IGC in the pharmaceutical industry, especially in the cases in which conventional characterizing techniques (PXRD or DSC) may fail due to their limitations, e.g. in the assessment of drug-polymer miscibility in solid dispersions.

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