Investigation of the polymorphism and polymorphic stability is a routine part of the preformulation studies. Vibrational spectroscopy allows the real-time in situ monitoring of phase transformations and probes intermolecular interactions between API molecules, between API and polymer in amorphous solid dispersions or between API and coformer in cocrystals or coamorphous systems and thus plays a major role in efforts to gain a predictive understanding of the relative stability of solid-state forms and formulations. Infrared (IR), near-infrared (NIR) and Raman spectroscopies, alone or in combination with other analytical methods, are important tools for studying transformations between different crystalline forms, between the crystalline and amorphous form, between hydrate and anhydrous form and for investigating solid-state cocrystal formation. The development of simple-to-use and cost-effective instruments on the one hand and recent technological advances such as access to the low-frequency Raman range down to 5 cm^{-1}, on the other, have led to an exponential growth of the literature in the field. This review discusses the application of IR, NIR and Raman spectroscopies in the study of solid-state transformations with a focus on the literature published over the last eight years.

Fan, Y. et al. (2015). "Preformulation characterization and in vivo absorption in beagle dogs of JFD, a novel anti-obesity drug for oral delivery." *Drug Dev Ind Pharm* 41(5):801–811.

JFD (N-isoleucyl-4-methyl-1,1-cyclopropyl-1-(4-chlorine)phenyl-2-amylamine. HCl) is a novel investigational anti-obesity drug without obvious cardiotoxicity. The objective of this study was to characterize the key physicochemical properties of JFD, including solution-state characterization (ionization constant, partition coefficient, aqueous and pH-solubility profile), solid-state characterization (particle size, thermal analysis, crystallinity and hygroscopicity) and drug-excipient chemical compatibility. A supporting in vivo absorption study was also carried out in beagle dogs. JFD bulk powders are prismatic crystals with a low degree of crystallinity, particle sizes of which are within 2–10 μm. JFD is highly hygroscopic, easily deliquesces to an amorphous glass solid and changes subsequently to another crystal form under an elevated moisture/temperature condition. Similar physical instability was also observed in real-time CheqSol solubility assay. pK(a) (7.49 ± 0.01), log P (5.10 ± 0.02) and intrinsic solubility (S0) (1.75 μg/mL) at 37°C of JFD were obtained using potentiometric titration method. Based on these solution-state properties, JFD was estimated to be classified as BCS II, thus its dissolution rate may be an absorption-limiting step. Moreover, JFD was more chemically compatible with dibasic calcium phosphate, mannitol, hypromellose and colloidal silicon dioxide than with lactose and magnesium stearate. Further, JFD exhibited an acceptable pharmacokinetic profiling in beagle dogs and the pharmacokinetic parameters T(max), C(max), AUC(0-t) and absolute bioavailability were 1.60 ± 0.81 hours, 0.78 ± 0.47 μg/mL, 3.77 ± 1.85 μg.h/mL and 52.30% ± 19.39%, respectively. The preformulation characterization provides valuable information for further development of oral administration of JFD.

Gajdziok, J. and B. Vranikova (2015). "Enhancing of drug bioavailability using liquisolid system formulation." *Ceska Slov Farm* 64(3):55–66.

One of the modern technologies of how to ensure sufficient bioavailability of drugs with limited water solubility is represented by the preparation of liquisolid systems. The functional principle of these formulations is the sorption of a drug in a liquid