

USE OF THERMAL ANALYSIS TECHNIQUES FOR POLYMERIC EXCIPIENTS. SOME EXAMPLES

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A great number of excipients are polymers. Depending of their nature, they are classical fillers, binders or disintegrating agents for tableting such as starch or cellulose derivatives, gelifiants for liquid or semi-liquid forms, coating agents like cellulose esters or they can be the driving force of the performance of the drug product.

Physical interactions of crystalline polymers with the drug substance can be studied by DSC, as it is classical for solid dispersion with polyethyleneglycols. Polyvinylpyrrolidone are useful for maintaining the drug substance in a complex where the drug substance remains in amorphous state. Hydroxypropylmethylcellulose derivatives are commonly used for their swelling properties and the drug substance dissolution is delayed, giving modified release products. Film coating with modified release action is obtained with acrylic polymers and co-polymers. Microspheres for long acting release are obtained mainly with polymers and co-polymers of polylactic acid.

For all systems the physical properties of the polymer as it is and in the formulation are correlated with the molecular mass, the melting point, the glass transition and the water interaction. Most polymers used in pharmaceuticals are hygroscopic and the melting point or the glass transition is lowered by the presence of water.

Characterization

- Example of identification of different crystalline polyethyleneglycols
- Examples of identification of cellulose derivatives, of polyvinylpyrrolidone of different molecular mass
- Example of polymorphism of polyethyleneglycol 6000
- Batchwise quality: for identification purpose, the second DSC run is used after elimination of volatiles and pretreatment. For polymer with very low glass transition, the influence of impurities could not be eliminated.
- Biodegradable polymers for microspheres, characteristics of crystalline L-polylactic acid and of amorphous DL, poly-lactide-coglycolide
- Content of volatiles by TG with very good precision. Identification of residual methylene chloride or water by using TG-MS

Role of water

- Influence of water content for polyethyleneglycol and for hydroxypropylmethylcellulose
- Determination of freezable water in Hydroxypropylmethylcellulose or in a gel
- Hygroscopicity

Formulations

- Example of phase diagram with polyethyleneglycol
- Examples of determination of recrystallized drug substance from solid-solutions
- Glassy state of drug substance to be maintained => increase of Tg value of the drug substance, example of the influence of additives added studied by DSC
- Examples of aging problems

Ref :

D. Giron, Acta Pharm. Jugosl. 40 (1990), 95-157.

D. Giron, «Thermal Analysis of Drugs and Drug Products », Encyclopedia of pharmaceutical technology, Ed. J. Swarbrick and J.C. Boylan, Marcel Dekker, (1997), vol 15, p.1-79.