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Thermal Analysis Methods in Pharmaceutical Quality Control

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Thermal analysis is defined as a group of physical-chemical methods which the properties of studied material are measured as a function of temperature or time while the sample is placed under a controlled temperature program. The program may include heating or cooling (dynamic), or fixed temperature (isothermal), or a combination of these methods [1,2]. Different multi-component techniques including thermogravimetry, differential thermal analysis, differential scanning calorimetry and thermo-microscopy are available instrumentally. Nowadays, these methods has gained significant attention in both quality control and functional research on Industries such as polymers, pharmaceuticals, metals and alloys [3,4]. Thermogravimetry (TG) or Thermogravimetric analysis (TGA) is a fundamental laboratory instruments applied for investigation of the material properties in various fields such as pharmaceutical, environmental, food and petrochemical applications [5]. TGA is a technique in which the amount of weight change of a substance, is monitored either as a function of controlled temperature, or isothermally as a function of time, in an atmosphere of N2, He, air, other gas, or in vacuum [6]. The differential thermal analysis (DTA) is common thermal analysis method in which an analyte and an inert reference are heating at a certain heating rate while any temperature change is recorded. DTA is a popular tool used to characterize pharmaceuticals, foods, biologicals, organic and inorganic chemicals and briefly applied to measure endothermic and exothermic transitions as a function of temperature [7,8]. Differential scanning calorimetry or DSC is a popular thermoanalytical technique ranging from the pharmaceutical science to applied research. DSC monitors the difference in the amount of required heat to increase the temperature of a sample and reference (which should have an acceptable heat capacity in the range of scanned temperatures) as a function of temperature [9,10].

Thermo microscope or hot stage microscope (HSM) is a microscope coupled with a hot stage accessory with excellent heating and cooling systems ranging from -200°C to 500°C. For study the visual changes a color camera is connected to the microscope. This method records the surface temperature and thermal conductivity of an interface [11-13].

In pharmaceutical control all mentioned thermal techniques are of significant importance. The drug substance purity, polymorphism, stability can be easily evaluated using thermal analysis [10,14-17]. In the case of pharmaceutical excipients, the purity, glass transition temperature of polymeric materials and drug-excipient compatibility is simply monitored using these methods [18,19]. Recently kinetic analysis has been performed based on different thermal techniques such as DSC and TGA, and various models have been proposed in order to analyze the Arrhenius kinetic parameters [20-22].

References

1. Hasanzadeh D, Monajjemzadeh F, Al-Hallak MH, Soltani G, Azarmi S, et al. (2009) Thermal treating of acrylic matrices as a tool for controlling drug release. Chemical and Pharmaceutical Bulletin 57: 1356-1362.
2. Haines PJ (1995) Thermal methods of analysis: principles, applications and problems: Chapman & Hall.
3. Giron D (1995) Thermal analysis and calorimetric methods in the characterisation of polymorphs and solvates. Thermochimica acta 248: 1-59.
4. Haines PJ (2002) Principles of thermal analysis and calorimetry: Royal society of chemistry.
5. Gabbott P (2008) Principles and applications of thermal analysis: John Wiley and Sons.
6. Motola S, Agharkar SN (1992) Preformulation research of parenteral medications. Pharmaceutical dosage forms: Parenteral medications 1: 115-172.
7. Vold MJ (1949) Differential thermal analysis. Analytical Chemistry 21: 683-688.
8. Murphy C (1958) Differential thermal analysis. Analytical Chemistry 30: 867-872.
9. Höhne G, Hemminger W, Flammersheim HJ (2003) Differential scanning calorimetry: Springer Science and Business Media.
10. Monajjemzadeh F, Hassanzadeh D, Valizadeh H, Siahi-Shadbad MR, Mojarrad JS, et al. (2009) Compatibility studies of acyclovir and lactose in physical mixtures and commercial tablets. European Journal of Pharmaceutics and Biopharmaceutics 73: 404-413.
11. Majumdar A (1999) Scanning thermal microscopy. Annual review of materials science 29: 505-585.
12. Chadha R, Arora P, Bhandari S, Bala M (2012) Thermomicroscopy and its pharmaceuticals applications. Current Microscopy Contributions to Advances in Science and Technology 2:1013-1024.
13. Monajjemzadeh F, Farjami A (2014) Common Problems in Stress Testing of Pharmaceutical Preparations. J Mol Pharm Org Process Res 2: e117.
14. Monajjemzadeh F, Hamishehkar H, Zakeri-Milani P, Farjami A, Valizadeh H (2013) Design and Optimization of Sustained-Release Divalproex Sodium Tablets with Response Surface Methodology. AAPS Pharm Sci Tech 14: 245-253.
15. Hamishehkar H, Valizadeh H, Alasty P, Monajjemzadeh F (2014) Spray Drying as a Fast and Simple Technique for the Preparation of Extended Release Dipyridamole (DYP) Microparticles in a Fixed Dose Combination (FDC) Product with Aspirin. Drug research 64: 104-112.
16. Monajjemzadeh F, Ebrahimi F, Zakeri-Milani P, Valizadeh H (2014) Effects of Formulation Variables and Storage Conditions on Light Protected Vitamin B12 Mixed Parenteral Formulations. Adv pharma bulletin 4: 329.
17. Monajjemzadeh F (2014) LC-Mass as a Complementary Method in Detecting Drug-Excipient Incompatibility in Pharmaceutical Products. J Mol Pharm Org Process Res 2: e110.
18. de Barros, Lima ÍP, Oliveira TS, Mendonça CMS, Euzébio G, et al. (2014) Compatibility study between hydroquinone and the excipients used in semi-solid pharmaceutical forms by thermal and non-thermal techniques. Journal of Thermal Analysis and Calorimetry: 1-14.

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19. de Mendonça CMS, de Barros Lima IP, Soares Aragão CF, Barreto Gomes AP (2014) Thermal compatibility between hydroquinone and retinoic acid in pharmaceutical formulations Journal of Thermal Analysis and Calorimetry 115: 2277-2285.

20. Bianchi O, Fioriob R, De Martinsb JN, Zatterab AJ, Cantoc LB, et al. (2008) Assessment of Avrami, Ozawa and Avrami–Ozawa equations for determination of EVA crosslinking kinetics from DSC measurements. Polymer Testing 27: 722-729.

21. Ozawa T (2000) Thermal analysis—review and prospect. Thermochimica Acta 355: 35-42.

22. Ozawa T (1971) Kinetics of non-isothermal crystallization. Polymer 12: 150-158.