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The development of Microwave Thermal Analysis (MWTA) and its application to the study of thermal transitions of pharmaceutical compounds and their interactions with excipients

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Microwave-assisted formulation is becoming an established method of formulation in industry, providing a fast, economic and environmentally more favourable way to create products, such as those manufactured in the pharmaceutical industry. However, the effect of microwave-induced heating on a compound, or a mixture of compounds, is yet to be fully explored; possibly indicating that this method of the formulation may not be suitable in all cases. In this study, the effect of microwave heating was investigated through the application of microwave thermal analysis to six model pharmaceutical compounds and a set of four model excipients. Benzocaine, haloperidol, ibuprofen, indomethacin, ketoprofen and phenylbutazone were analysed, along with four excipients, namely β-cyclodextrin, D-mannitol, stearic acid and Syloid® silica (XDP 3050) using microwave thermal analysis. Samples were heated by microwave irradiation at 5°C/min to a minimum of 160°C, held isothermally and then slowly cooled to room temperature. Thermal profiles were analysed and compared with data obtained using differential scanning calorimetry (DSC) and hot stage microscopy (HSM). Overall, it was found that the process of microwave heating produced different thermal profiles to those seen using traditional, conductive heating. Investigating differences in thermal profiles can be a useful way to consider the effect of microwave-induced heating on formulations which can, in turn, help guide formulation choices.

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