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Recent advances in the applications of vibrational spectroscopic imaging and mapping to pharmaceutical formulations

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Abstract

Vibrational spectroscopic imaging and mapping approaches have continued in their development and applications for the analysis of pharmaceutical formulations. Obtaining spatially resolved chemical information about the distribution of different components within pharmaceutical formulations is integral for improving the understanding and quality of final drug products. This review aims to summarise some key advances of the use of these technologies over recent years, primarily since 2010. An overview of FTIR, NIR, terahertz spectroscopic imaging and Raman mapping will be presented to give a perspective of the current state-of-the-art of these techniques for studying pharmaceutical samples. This will include their application to reveal spatial information of components that reveals molecular insight of polymorphic or structural changes, behaviour of formulations during dissolution experiments, uniformity of materials and detection of counterfeit products. Furthermore, new advancements that demonstrate the continuing novel applications of spectroscopic imaging and mapping, namely in FTIR spectroscopy, for studies of microfluidic devices will be presented. Whilst much of the recently developed work has been reported by academic groups, examples of the potential impacts of utilising these imaging and mapping technologies to support industrial applications have also been reviewed.

Keywords: chemical imaging; infrared; Raman; vibrational spectroscopy; drug release

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