Temperature and structural changes of excipients during tableting

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In pharmaceutical technology temperature development is very interesting during processing of drugs and excipients, especially for materials with low melting points [1] or different polymorphic forms [2]. Until now very different temperature increases were measured for different materials with different methods [3-6]. However no detailed examinations are available about the influence of temperature on the molecular structure and the tableting behaviour of pharmaceutical materials. Thus, the aim of this work was to demonstrate the temperature increase and analyse structural changes of some excipients during tableting.

Several excipients (microcrystalline cellulose, dicalcium phosphate dihydrate, starch) were tableted on an instrumented single punch tableting machine with 11 mm flat faced punches. The surface temperature of the tablets was measured with an infrared thermoviewer and with an infrared sensor. Measurement started directly at the moment of ejection of the tablet from the die.

In order to determine structural changes of the tableted materials, powder samples and tablets of each material were examined by FT-Raman spectroscopy.

Both temperature measurement methods exhibited a temperature increasing due to the tableting process. Firstly, temperature of the tablet surface increases. Afterwards temperature decreases fast. This indicates that most probably the temperature increase inside the tablet and the heat emission to the environment are two parallel processes. For materials with a similar tableting behaviour general trends were visible.

Raman spectra of the materials show more or less differences between the powders and the tablets. Directly after tableting these changes are weak. They become stronger during storage. Thus, the changes are induced by tableting and the formation of the tablet continues.

The results of this study show that there is a temperature increase inside the tablet which causes structural changes which can contribute to the tablet formation.

References

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