A new approach for compressibility and compactibility characterization of materials pure and in mixture

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The aim of the study was to find a new approach to characterise compressibility and compactibility of powders simultaneously and thus to integrate compressibility and compactibility. This was evaluated for the pure materials and binary mixtures. For the pure materials a correlation with thermal properties of the materials was also evaluated.

Compressibility is the ability of a powder bed to be reduced in volume due to a given stress. Compactibility is the ability of a powder bed to cohere into a compact with a defined strength.

To characterise compressibility 3D modelling has been shown to be an efficient method to analyse the three important variables gained during the tableting process (force, time and displacement) simultaneously in one step. Further this method is unique since from the fitting process three parameters result which are able to describe the deformation with regard to time (time plasticity d), with regard to pressure (pressure plasticity e) and with regard to instantaneous elasticity during decompression (twisting angle ω).

Decompression after ejection of the tablet from the die is further involved in the formation of the final tablet and will additionally be evaluated.

To characterise compactibility the most often used method is the characterisation by compactibility plots in which crushing force or tensile strength are plotted versus compaction pressure.

The key solution is now to combine both methods.

The results showed that a clear distinguishing of materials deforming by brittle fracture from more ductile materials and from those with viscoelastic deformation is possible. The method gives insight into the dependency of compactibility from the compression process. Compactibility can be characterised with respect to time dependent tablet formation, with respect to pressure dependent tablet formation and with respect to the influence of fast and slow elastic decompression on tablet formation.

The method was also applied to binary mixtures of excipients at the same maximum relative density. The results show that also for mixtures the dependency of compactibility from the compression process is clearly visible and a differentiation is possible.

For the pure materials it was further possible to correlate this dependence of compactibility from the compression process to material characteristics e.g. the glass transition temperature.

In conclusion, with this technique a further step for integration of compactibility and compressibility has been made.

References

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