RIETVELD STRUCTURAL AND MICROSTRUCTURAL CHARACTERIZATION OF PHARMACEUTICAL PRODUCTS USING THE PROGRAM MAUD

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Today pharmaceutical laboratories require sophisticated tools for the full characterization of new products as well as for quality control in the production cycle. With the Rietveld program Maud[1] we have already proved it is an efficient way to analyze diffraction spectra to obtain a complete characterization of the sample under investigation. The program has been customized for the pharmaceutical field including some specific methods and routines.

Maud as a Rietveld based program allows all the usual characterizations: crystal structure analysis and polymorph quantifications, but it has been extended for additional analyses to obtain information on some key properties of these products.

As an example cyclodextrins are widely used as host compounds. But one polymorph is particularly suited for its toroidal shape, the β-cyclodextrin (β-CD), that can form an inclusion complex with some drug molecules. The quantity, efficiency and properties of this carrier depend strongly on the water content and its microstructure. Through Maud it is possible to fully characterize the compound by a unique diffraction analysis. In particular it is possible to study the number of water molecules at different ambient conditions, the residual crystallinity, the crystallite size and defect densities, and classical crystallographic parameters.

The analysis of crystalline content has been enhanced by the integration of an absorption based method[2] and the quantification can be done without the use of an internal or external standard, allowing in principle to distinguish between the non-crystalline carrier and the amorphous part in the drug if the amorphous scattering characteristics are different.

In the crystal structure of one or more compounds is unknown Maud allows the quantitative analysis to be done anyway by a new method based on electron maps full pattern fitting. This new methodology can be used easily as a Rietveld like procedure, without standards, made more accurate by the use of a standard or in a calibrate procedure.

[1]The Maud program, http://www.ing.unitn.it/~luttero/maud

[2]P. Bergese, I. Colombo, D. Gervasoni & L. E. Depero, J. Appl. Cryst. (2003). **36**, 74-79.