Application of nanotechnology in medicine

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Abstract

X-difractometry (XRD) is widely used in material science like the one of the most sensitive and foolproof method in nanotechnology. But XRD also have numerous applications in medicine, optics, electronics, chemistry and biology. In this work the crystal structure of industrial produced drug Midodrine (Gutron) has been investigated by X-ray methods and comparing with placebo forms obtained from sucrose. Properties such as lattice parameters, chemical composition and crystal phase of that samples were monitored by X-ray powder diffraction on a Siemens D-500 XRPD difractometer with Cu Kα1,2 radiation, at room temperature. The measurements were performed in the range 2-60^0 2θ in a continuous scan mode with a step width of 0.02^0 and 0.5 s/step. The results were analyzed using the software package Powder Cell. The difference in structure between sucrose and placebo forms was noticed.

Introduction

X-difractometry (XRD) is one of the most sensitive and foolproof methods for solid-state characterization as the results are obtained directly from the molecular arrangements of the crystalline material.

We use XRD for precision measurements of drugs used in medicine. In this work we analyzed industrial produced drug Midodrine and comparing with placebo forms obtained from sucrose. The samples were monitored by X-ray powder diffraction on a Siemens D-500 XRPD difractometer with Cu Kα1,2 radiation, at room temperature. .

Results and discussion

The XRD patterns of samples of sucrose, Gutron 2.5mg and Gutron 2.5mg tab. were found to be monophase (Fig. 1.). X-ray powder diagrams of sucrose and Gutron 2.5mg show a difference only in the intensity of the diffraction line. Based on the data of d-values and angles 2θ from the database JCPDS card number 24-1977 a good agreement is obtained for experimental and calculated diffraction patterns.

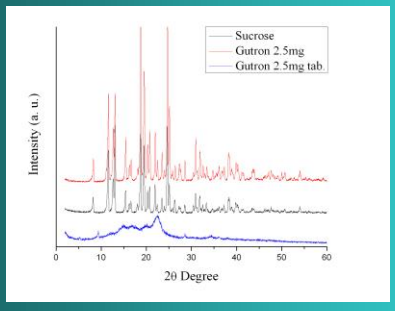

Fig.1. *XRD patterns of sintered sucrose, Gutron 2.5mg and Gutron 2.5mg tab.*

Table 1 Results refinement of Gutron unit cell parameters using the software package Powder Cell [1]

Sample	Sucrose	Gutron 2.5mg	Gutron 2.5mg tab.
Unit cell parameters (Å)	*a*=7.7408, *b*=8.6944, *c*=10.8461	*a*=7.7445, *b*=8.6854, *c*=10.8431	*a*=7.7242, *b*=8.6788, *c*=10.8245
Volume (Å ^{3})	*V*=711.57	*V*=710.73	*V*=707.0678
β	102.9037	102.9754	102.9908
Rp	18.18	22.92	22.35
Rwp	23.93	33.09	27.37
Rexp	18.57	28.81	5.39

Table 1 presents the values of the parameters and the volume of the unit cell sucrose, Gutron 2.5mg and Gutron 2.5mg tab.

Comparing the lattice parameters of sucrose, Gutron 2.5mg and Gutron 2.5mg tab., it can be seen that Gutron 2.5mg tab. has least of all the parameters of the unit cell and that the volume of the unit cell sucrose was a slightly higher than the volume of the unit cell Gutron 2.5mg. Small changes in the size of the unit cell parameters and a difference in the intensity of the diffraction line may be the result of the presence of dopant in sucrose lattice.

Conclusion

From our results presented in Table 1 we obtained the values of the unit cell parameters of samples show a difference.

It is interesting to notice that according to Fig.1 and Table 1., we have the difference in structure between sucrose and placebo forms of sucrose. It is essentially a change in the crystal structure of sucrose in reducing size unit cell and the opposite pattern – increase unit cell. Change alone unit cell of crystal can be caused by installing the structure of other atoms (ions) in the correct place host or influenced by the environment of physical fields (waves) that stretch or shrink it.

References:

[1] http://www.ccp14.ac.uk/ccp/web-mirrors/powdcell/a_v/v_1/powder/e_cell.html.