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Supporting information for article:

Solid forms and β-cyclodextrin complexation of turinabol

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Table 4 Hydrogen bond geometry for studied crystal structures (Å, º)

Structure	**D-H···A**	**D-H**	**H···A**	**D···A**	**<(D-H···A)**
TBOL-1	O2-H2···O3	0.820	2.121(2)	2.933(3)	171.1(6)
	O3-H3···O1	0.843	2.081(1)	2.828(3)	147.3(7)
	C1-H1···O2	0.930	2.648(2)	3.520(1)	156.3(3)
TBOL-2	O2A-H2A···O1B	0.820	2.179(8)	2.983(2)	167.3(3)
	C6A-H6AB···O1B	0.970	2.608(2)	3.563(3)	168.1(5)
	C20B-H20C···O1A	0.961	2.719(3)	3.442(2)	132.6(1)
	C19B-H19C···O2B	0.960	2.614(5)	3.561(2)	168.6(1)
TBOL-3	O1-H1···O1A	0.854	1.935(2)	2.757(6)	162.2(9)
	O3-H3···O2	0.840	1.885(5)	2.682(4)	157.2(1)
	O2B-H2B···O2	0.821	1.972(4)	2.607(2)	133.6(4)
	O2A-H2A···O1B	0.820	2.233(2)	3.040(3)	167.5(8)
	C6A-H6AB···O1B	0.970	2.668(8)	3.635(3)	175.1(7)
	C20A-H20F···C4A C-H···π	0.960	2.847(5)	3.568(3)	132.7(6)
	C2-H2E···C2B C-H···π	0.960	2.835(3)	3.725(4)	154.6(2)
TBOL-4	O1-H1···O2B	0.832	1.984(2)	2.813(2)	174.5(2)
	O2B-H2B···O2A	0.830	2.147(4)	2.961(3)	166.3(3)
	C1A-H1A···O1A	0.930	2.692(1)	3.371(2)	130.5(1)
	C6A-H6AB···O1B	0.970	2.662(2)	3.563(2)	159.5(9)
	C20A-H20F···F3	0.960	2.625(5)	3.344(1)	131.9(1)
	C16B-H16B···Cl1A	0.970	2.723(4)	3.538(2)	141.8(6)
	C7A-H7AB···C4B C-H···π	0.970	2.891(2)	3.789(5)	154.5(1)

3.6 FT-IR analysis

As a further evidence of the formation of the inclusion complex, the IR spectra of the starting compounds (chlorodehydromethyltestosterone and cyclodextrin) were compared with the spectra of the final inclusion complex (Fig. 7).

Considering the FTIR spectra of cyclodextrin, the wide band seen at 3387 cm^{-1} correspond to symmetrical and asymmetrical stretching of –OH groups of the cyclodextrin and water of crystallization; 2926 cm^{-1} band is related to C-H stretching. The 1650 cm^{-1} band is corresponding to H-O-H bending of water molecules embedded in cyclodextrin (Wang et al., 2014).

The spectrum of turinabol as starting compound has two pronounced bands, specific to O-H stretching. The first band with a maximum at 3429 cm^{-1} confirms the existence of water found in the crystal structure, being the corresponding O-H stretching of water molecules. The second band (3533 cm^{-1}) is associated with the stretching of O-H hydroxyl group of steroid molecule. Between 2831-2975 cm^{-1} the multiple bands are characteristic to symmetric and asymmetric C-H of CH_3, CH_2 and CH groups. The band at 1654 cm^{-1} is specific to stretching of carbonyl C=O in ketone functional group.

In the case of turinabol complex, the broad O-H band is shifted to slightly lower wave numbers for (3371 cm^{-1}) compared to 3387 cm^{-1} for the pure cyclodextrin and the band is slightly asymmetric in complex due to overlap of O-H stretching from steroid embedded in the cyclodextrin.

For the inclusion complex, the 2932 cm^{-1} band shows two shoulders at 2889 and 2972 cm^{-1}. These bands are due to C-H stretching of CH_2 and CH_3 groups and differ in shape compared to both the cyclodextrin and turinabol spectrum due to the interactions between steroid and cyclodextrin.
The 1654 cm^{-1} band corresponding to C=O stretching in ketone group is very slightly shifted to 1657 cm^{-1} and decreased in intensity.

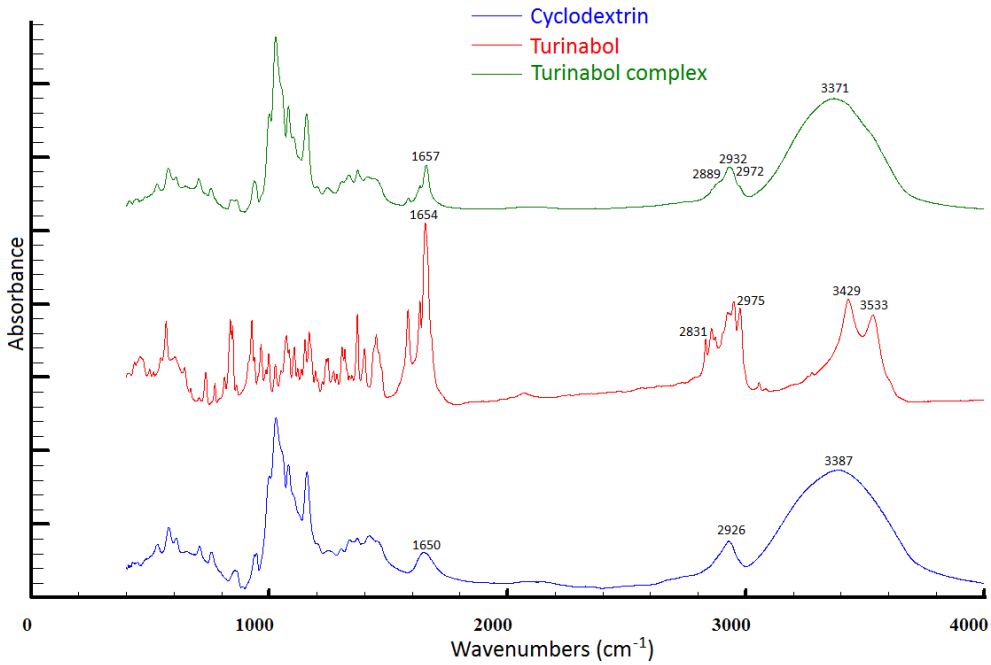

Figure 1 FT-IR spectra comparison of start compounds and cyclodextrin complex

DTA/TGA thermal analysis of TBOL-3

In order to highlight the presence of water and acetic acid in the TBOL-3 crystal, the thermal analysis DTA / TGA was performed and is presented in Fig 8 (Supporting Information). From the DTA curve it is observed that there is an endothermic process with a peak at 89.5 °C which is associated in the TGA diagram with a mass loss of 8.40%. This indicates concomitant loss of water and acetic acid. A very slight weight loss is further observed between 89-148 °C (1.54%) being associated with the loss of acetic acid remaining in the sample and the endothermic peak at 148 °C corresponds to the melting point of steroid molecules being approximately equal to the melting point of pure turinabol (147 °C). The mass loss recorded up to 148 °C is 9.94%. On the other hand a molecule of acetic acid represents 8.03% of the molecular mass of the compound TBOL-3 and the water molecules O1 and O2 which being in special positions each participate with 0.5 in the component of the asymmetric unit so in total we would have a water molecule in the asymmetric unit whose mass represents 2.41%.
The calculated mass loss for acetic acid and one water molecule is 10.4% and the experimental mass loss is 9.94%. Therefore, it can be concluded that the TBOL-3 crystal contains one molecule of acetic acid and one molecule of water.

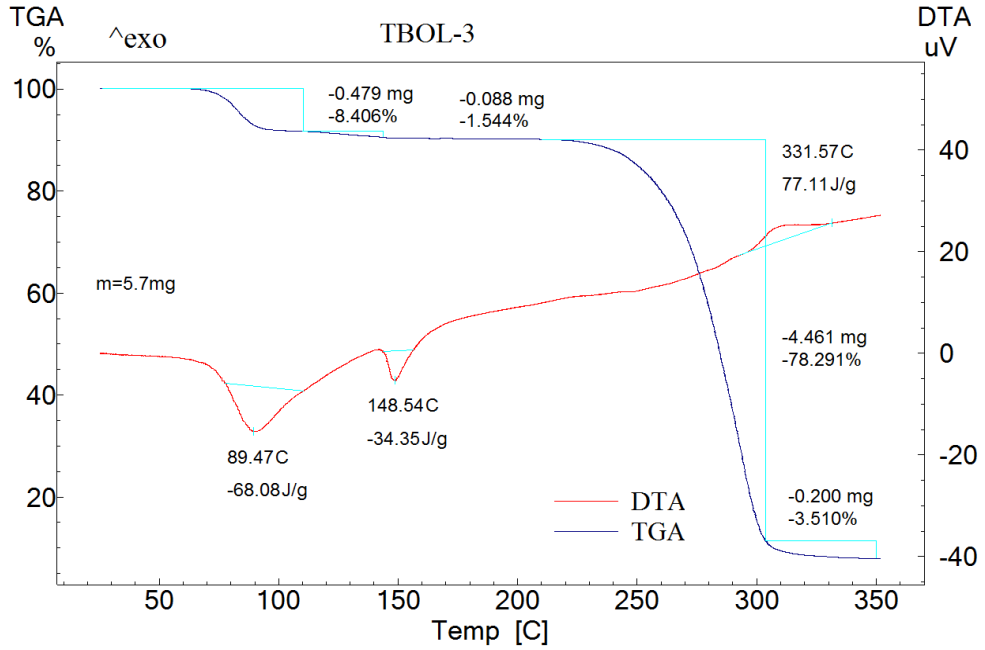

Figure 2 DTA/TGA thermal analysis for TBOL-3

Reference

Wang X., Luo Z. & Xiao Z. (2014). *Carbohydr Polym.* ***101,*** 1027-1032.