Electronic Supplementary Material (ESI) for CrystEngComm

Polymorphic transformation of artemisinin by high temperature extrusion

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The 3D crystal structures of both polymorphs were obtained from the Cambridge Structural Database (CDS) with codes QNGHSU (orthorhombic) and QNGHSU01 (triclinic). Geometry optimisation was performed using Universal, CVFF, PCFF and Dreiding force fields with built in and equilibrated charges (QeQ) and the calculated values were compared with the experimental values. The force field results are shown in Table 1.

Force fields	Orthorhombic			Triclinic						Average error
	a	b	c	a	b	c	α	β	γ	
Experimental	24.0	9.4	6.4	9.9	15.3	9.9	90.9	103.9	93.2	
Dreiding + QeQ	24.2	9.5	6.5	9.8	16.2	10.0	89.8	102.0	90.0	
Mean error	0.8	1.0	2.9	-0.6	5.7	1.5	-1.2	-0.9	-3.2	2.5
Universal + QeQ	24.1	9.1	6.4	9.7	15.1	9.9	90.3	103.2	96.9	
Mean error	0.2	-3.3	0.8	-1.2	-1.3	0.9	-0.7	0.2	4.0	1.9
CVFF (Built in charge)	25.8	8.8	6.4	10.0	14.5	10.1	90.0	105.4	90.1	
Mean error	7.3	-6.0	1.1	2.1	-4.8	3.0	-1.0	2.4	-3.3	4.0
PCFF (Built in charge)	25.7	8.8	6.2	9.9	14.7	10.0	89.8	103.6	91.8	
Mean error	6.8	-5.8	-1.1	0.9	-4.1	1.4	-1.2	0.7	-1.5	3.4
CVFF + QeQ	25.0	9.0	6.4	9.7	15.3	9.9	89.9	102.4	97.7	
Mean error	3.9	-4.6	0.9	-1.5	0.3	0.6	-1.1	-0.5	4.8	2.7
PCFF + QeQ	24.1	9.5	6.4	9.6	15.4	9.8	90.3	100.9	90.2	
Mean error	0.1	0.5	1.0	-3.0	0.6	-0.4	-0.7	-2.0	-3.2	1.7

*** The average error is calculated by taking the square root of sum of the squared error and dividing by 9.**

Table 1. Geometry optimisation calculation for orthorhombic and triclinic forms of artemisinin

The PCFF force field with QEq charges was found to calculate lattice parameters which are in closest agreement with experiment and this force field was used in all further calculations.

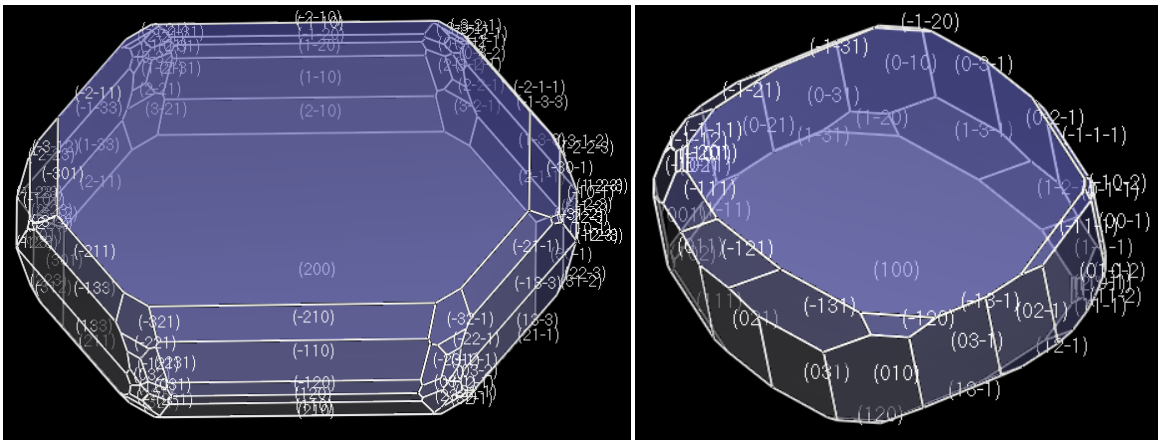
BFDH, growth and equilibrium morphologies of both polymorphs were calculated using the Morphology module (shown in Table 2). The predicted growth and equilibrium morphologies were similar, with the {200} and {100} faces dominating the morphologies of the orthorhombic and triclinic faces respectively.

Orthorhombic		Triclinic	
BFDH			
hkl	Total facet area (%)	hkl	Total facet area (%)
200	36.6	010	21.9
110	37.8	001	11.2
101	23.4	100	10.6

Growth Morphology			
hkl	Total facet area (%)	hkl	Total facet area (%)
200	58.3	100	27.7
110	23.7	001	10.9
101	10.0		
Equilibrium morphology			
hkl	Total facet area (%)	hkl	Total facet area (%)
200	44.1	100	18.8

Table 2. Results of morphology calculations using different methods

In equilibrium morphology crystal habits were dominated by the {200} faces for the orthorhombic form and by the {100} faces for triclinic form, with percent areas of 88% and 37% respectively.



A **B**

Figure 1. Predicted equilibrium morphology of the orthorhombic (A) and the triclinic form (B).

Furthermore to investigate the effect of solvents like acetone ethanol, methanol and water on the surface of the crystals, sorption module was used to calculate adsorption energy. The sorption module simulates a pure adsorbate in a sorbent framework by using the Metropolis Monte Carlo method. The calculated adsorption energy for different solvents on the (100) surface of the triclinic form and the (200) surface of the orthorhombic form are shown in Table 3.

Solvents	Adsorption energy for the orthorhombic (200) surface (kca/mol)	Adsorption energy for the triclinic (100) surface (kca/mol)
Acetone	-16.30	-7.10
Ethanol	-15.75	-6.27
Methanol	-14.27	-5.68
Water	-11.76	-5.97

Table 3. Adsorption energies of solvents on the orthorhombic (200) and triclinic (100) surface of artemsinin