Acta Crystallographica Section E
Structure Reports Online
ISSN 1600-5368

[(5-Fluoro-2,4-dioxo-1,2,3,4-tetrahydropyrimidin-1-yl)acetamido]acetic acid–4,4′-bipyridine (2/1)

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Key indicators

Single-crystal X-ray study
T = 298 K
Mean σ(C–C) = 0.006 Å
R factor = 0.083
wR factor = 0.226
Data-to-parameter ratio = 12.2

For details of how these key indicators were automatically derived from the article, see http://journals.iucr.org/e.

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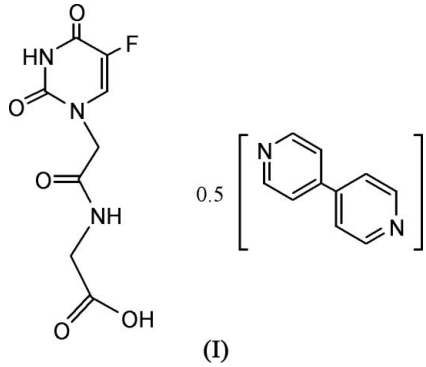
Received 14 April 2006
Accepted 2 May 2006

In the title complex, $C_8H_8FN_3O_5\cdot0.5C_{10}H_8N_2$, one [(5-fluoro-2,4-dioxo-1,2,3,4-tetrahydropyrimidin-1-yl)acetamido]acetic acid molecule and one half 4,4′-bipyridine molecule comprise the asymmetric unit. The 4,4′-bipyridine molecule has inversion symmetry. All bond lengths and angles in both molecules show normal values. An extensive three-dimensional network of intermolecular N—H···O and O—H···N hydrogen bonds stabilizes the crystal packing.

Comment

5-Fluorouracil (5FU) is an antimetabolite with good antimicrobial and antitumor activity, most frequently used for treatment of solid tumors, including breast, colorectal, and gastric cancers (Hulme *et al.*, 2005; Wang *et al.*, 2003; Cai Bill *et al.*, 2003). However, because of its poor tumor selectivity and severe side effects, such as myelo-suppression, intestinal toxicity and skin toxicity, many derivatives of 5FU have been synthesized to improve its topical delivery and reduce the toxic side effects (Trujillo *et al.*, 2001; Liu *et al.*, 2002; Xiong *et al.*, 2006). 5-Fluorouracil-1-acetic acid is a member of that family (Li *et al.*, 2000; Hu *et al.*, 2005). On the other hand, as a spacer molecule, 4,4′-bipyridine acts not only as a bridging ligand for metal complexes, but also as a host molecule in the formation of inclusion compounds (Tong *et al.*, 2000; Lu *et al.*, 2001). As a result, a great deal of attention has been focused on its metal complexes and inclusion complexes (Zhu *et al.*, 2003). We have synthesized a dipeptide derivative of 5FU, 2-(5-fluorouacil-1-aceto)aminoacetic acid {systematic name: [(5-fluoro-2,4-dioxo-1,2,3,4-tetrahydropyrimidin-1-yl)acetamido]-acetic acid}, as the title molecular complex, (I), in an attempt to extend the research field of 5FU and better understand the behavior of 4,4′-bipyridine in the preparation of its metal complexes and inclusion complexes.



(I)

In (I), the asymmetric unit is composed of one 5FU molecule and one half 4,4′-bipyridine molecule (Fig. 1); the 4,4′-

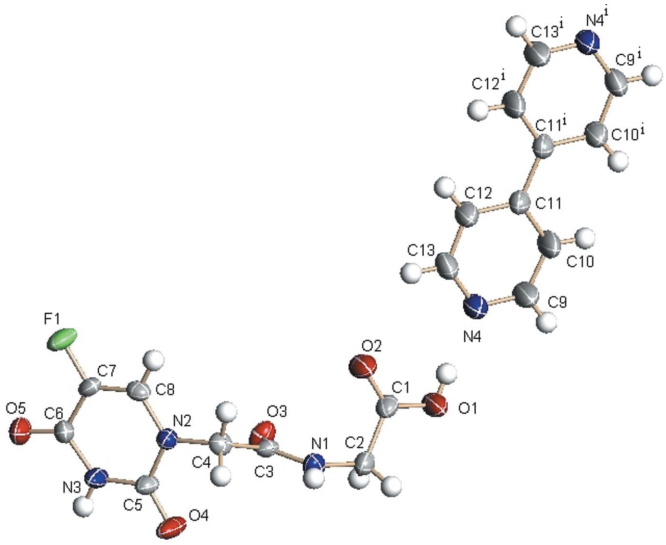


Figure 1
View of (I), showing the atom-numbering scheme and displacement ellipsoids drawn at the 50% probability level [symmetry code: (i) $-x$, $-y+1$, $-z$].

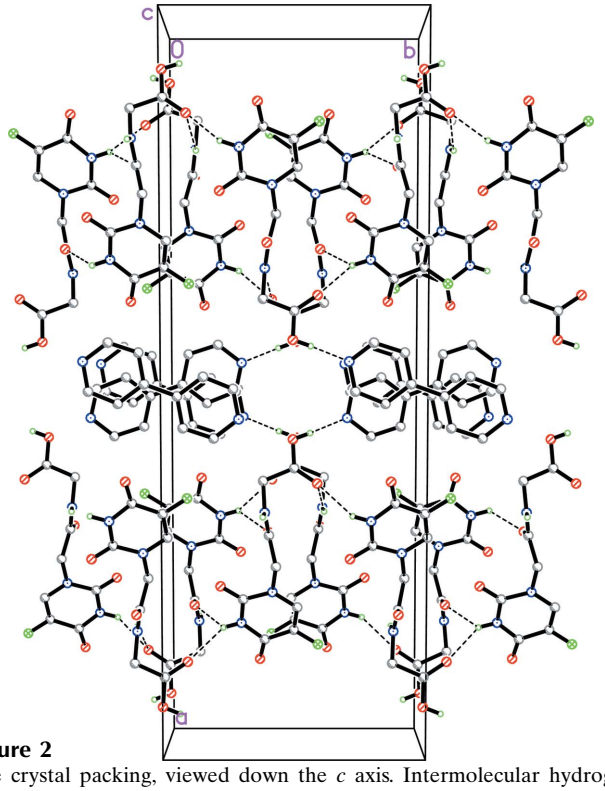


Figure 2
The crystal packing, viewed down the *c* axis. Intermolecular hydrogen bonds are shown as dashed lines. H atoms not involved in hydrogen bonding have been omitted.

bipyridine molecule has inversion symmetry. The bond lengths in the pyridine rings are between those of typical single and double bonds, indicating electron delocalization in the rings. The two conjugated rings in the 4,4′-bipyridine molecule are linked by a single bond C11—C11^{i} = 1.494 (8) Å [symmetry code: (i) $-x$, $-y+1$, $-z$]. Atoms C5, C6, C7, C8, N2 and N3 in the 5FU molecule are essentially coplanar, with an r.m.s. deviation of 0.0039 Å. The N1—C3 bond length [1.337 (4) Å] is shorter than a typical C—N bond [*ca* 1.443 (4) Å; Jin *et al.*, 2004], but longer than a typical double C=N bond (*ca* 1.269 Å), indicating π–π conjugation of atoms O3, C3 and N1.

In the crystal structure, an extensive three-dimensional network of intermolecular N—H···O and O—H···N hydrogen bonds (Table 1) stabilizes the crystal packing (Fig. 2).

Experimental

The key compound 5FU was synthesized according to the known method (Liu *et al.*, 2002). The title complex was obtained by a hydrothermal method from a mixture of 5FU (3 mmol, 0.74 g) and 4,4′-bipyridine (3 mmol, 0.47 g), being heated to 412 K in a 30 ml Teflon-lined stainless steel reactor for 3 d. The system was cooled slowly to room temperature after the reaction, and colourless rod-shaped crystals were collected.

Crystal data

$C_8H_8FN_3O_5\cdot0.5C_{10}H_8N_2$
M_r = 323.27
Monoclinic, $C2/c$
a = 31.969 (2) Å
b = 11.264 (9) Å
c = 7.863 (6) Å
β = 96.071 (2)°
V = 2816 (3) Å^3
Z = 8
D_x = 1.525 Mg m^{-3}
Mo $K\alpha$ radiation
μ = 0.13 mm^{-1}
T = 298 (2) K
Rod, colourless
0.34 × 0.26 × 0.14 mm

Data collection

Bruker APEX area-detector diffractometer
φ and ω scans
Absorption correction: multi-scan (*SADABS*; Bruker, 2002)
T_{min} = 0.958, T_{max} = 0.979
7271 measured reflections
2543 independent reflections
2337 reflections with $I > 2\sigma(I)$
R_{int} = 0.030
θ_{max} = 25.2°

Refinement

Refinement on F^2
$R[F^2 > 2\sigma(F^2)]$ = 0.083
$wR(F^2)$ = 0.226
S = 1.31
2543 reflections
209 parameters
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.095P)^2 + 5.058P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max}$ = 0.47 e Å^{-3}
$\Delta\rho_{min}$ = −0.33 e Å^{-3}

Table 1
Hydrogen-bond geometry (Å, °).

D—H···A	D—H	H···A	D···A	D—H···A
O1—H1···N4	0.82	1.79	2.609 (5)	177
N1—H1A···O2^{i}	0.86	2.53	3.212 (5)	137
N3—H3···O3^{ii}	0.86	2.27	2.899 (4)	130
N3—H3···O2^{iii}	0.86	2.38	2.978 (4)	127

Symmetry codes: (i) $x, -y+2, z+\frac{1}{2}$; (ii) $-x+\frac{1}{2}, -y+\frac{5}{2}, -z$; (iii) $-x+\frac{1}{2}, y+\frac{1}{2}, -z+\frac{1}{2}$.

All H atoms were positioned geometrically and allowed to ride on their parent atoms at distances of Csp^2—H = 0.93 Å, with U_{iso}(H) = 1.2U_{eq}(C), Csp^3—H = 0.97 Å, with U_{iso}(H) = 1.5U_{eq}(C), O—H = 0.82 Å, with U_{iso}(H) = 1.2U_{eq}(O), and N—H = 0.86 Å, with U_{iso}(H) = 1.2U_{eq}(N).

Data collection: *SMART* (Bruker, 2002); cell refinement: *SAINT* (Bruker, 2002); data reduction: *SAINT*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *SHELXTL* (Bruker, 2002); software used to prepare material for publication: *SHELXL97*.

We acknowledge financial support by the Zhejiang Provincial Natural Science Foundation of China (No. Y405078) and the National Natural Science Foundation of China (No. 20571057).

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