X-ray powder diffraction data for Ethyl (*Z*)-2-chloro-2-[2-(4-methoxyphenyl) hydrazin-1-ylidene]acetate, $C_{11}H_{13}ClN_2O_3$

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X-ray powder diffraction data, unit-cell parameters, and space group for Ethyl (*Z*)-2-chloro-2-[2-(4-methoxyphenyl)hydrazin-1-ylidene]acetate, $C_{11}H_{13}ClN_2O_3$, are reported [$a = 13.308(4)$ Å, $b = 9.908(5)$ Å, $c = 4.753(4)$ Å, $\alpha = 90°$, $\beta = 91.510(8)°$, $\gamma = 90°$, unit-cell volume $V = 626.64$ Å^3, $Z = 2$, $\rho_{cal} = 1.361$ g cm^{-3}, and space group $P2_1$]. All measured lines were indexed and are consistent with the $P2_1$ space group. No detectable impurities were observed. © *2016 International Centre for Diffraction Data*. [doi:10.1017/S0885715616000695]

Key words: pharmaceutical intermediate, anticoagulant, apixaban

I. INTRODUCTION

Apixaban (Eliquis®) is a novel oral pyrazole-based direct FXa inhibitor; this drug was developed by Bristol-Myers Squibb and Pfizer to treat and prevent thrombotic disorder (Watson *et al*., 2011). Since May 2011, apixaban has been approved for venous thrombus embolism prevention in adult elective hip or knee replacement patients in various countries, such as the USA, China, Brazil, Australia, New Zealand, and some European countries (Deeks, 2012). The title compound is an intermediate in the synthesis of the anticoagulant, apixaban (Jiang and Ji, 2013).

The single crystallographic data of the title compound [$a = 4.7480(2)$ Å, $b = 9.9256(4)$ Å, $c = 13.3084(4)$ Å, $\alpha = 90°$, $\beta = 91.468(3)°$, $\gamma = 90°$, unit-cell volume $V = 626.98(4)$ Å^3, $Z = 2$, $\rho_{cal} = 1.360$ g cm^{-3}, and space group $P2_1$] was obtained by Asiri *et al.* (2012). To date, the detailed X-ray powder diffraction (XRD) data for the title compound have not been reported.

II. EXPERIMENTAL

A. Sample preparation

The sample (Figure 1) was prepared using 4-methoxyaniline (Ji *et al*., 2011). The melting point and measured density of the title compound are 101–102 °C and 1.355 g cm^{-3}, respectively. Crystallization of the title compound at room temperature was successful using methanol as solvent. Then, part of crystals were dried and ground into powder.

B. Diffraction data collection and reduction

Powder XRD measurement was performed at room temperature using an X'Pert PRO diffractometer (PANalytical Co., Ltd., The Netherlands) with a PIXcel 1D detector and Cu$K\alpha$ radiation (generator setting: 40 kV and 40 mA). The diffraction data were collected over the angular range from 4° to 50° 2θ with a step size of 0.01313° 2θ and a counting time of 50 ms step^{-1} (Figure 2).

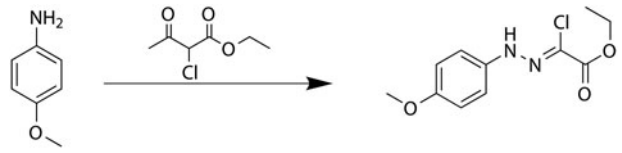

Figure 1. Synthesis of the title compound.

The software package Material Studio 8.0 (Accelrys Co. Ltd., CA, USA) was used to process the data in the Analytical & Testing Center (Sichuan University, Chengdu, China). The powder XRD pattern was pre-treated by subtracting the background, smoothing, and stripping off the $K\alpha_2$ component. Automatic indexing results were obtained by the DICVOL91 method (Boultif and Louër, 1991). The following figures of merit were achieved: $F_{18} = 75.0$ (0.0071, 34) (Smith and Snyder, 1979) and $M_{18} = 40$ (de Wolff, 1968). The indexing results were then refined using Pawley (Pawley, 1981), which involves assigning the Miller indices

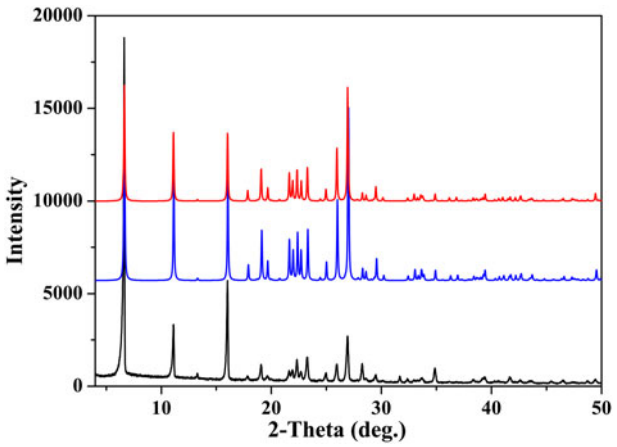

Figure 2. (Color online) XRD pattern of the title compound using Cu$K\alpha$ radiation (black line) and the simulated pattern of ours (blue line) and Asiri *et al.* (red line).

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TABLE I. Indexed X-ray powder diffraction data for the title compound.

$2\theta_{obs}$ (°)	d_{obs} (Å)	I_{obs}	h	k	l	$2\theta_{cal}$ (°)	d_{cal} (Å)	I_{cal}	$\Delta 2\theta$
6.6389	13.3030	100	1	0	0	6.6386	13.3035	100	0.0003
11.1163	7.9528	18	1	1	0	11.1251	7.9466	23	−0.0088
13.2828	6.6602	4	2	0	0	13.2997	6.6518	1	−0.0169
16.0139	5.5299	30	2	1	0	16.0349	5.5227	38	−0.0210
17.8784	4.9572	3	0	2	0	17.8891	4.9543	2	−0.0107
19.0995	4.6429	6	1	2	0	19.1002	4.6428	8	−0.0007
19.6641	4.5109	3	1	0	−1	19.6574	4.5124	2	0.0068
21.6205	4.1069	4	1	1	−1	21.6221	4.1066	4	−0.0016
21.9225	4.0510	5	1	1	1	21.9279	4.0500	4	−0.0054
22.3296	3.9781	8	2	2	0	22.3568	3.9733	11	−0.0272
22.6972	3.9145	4	2	0	−1	22.6914	3.9155	4	0.0059
23.2750	3.8186	8	2	0	1	23.2724	3.8190	9	0.0025
24.9688	3.5633	4	2	1	1	24.9672	3.5635	3	0.0016
25.9667	3.4285	6	0	2	1	25.9614	3.4292	10	0.0052
26.7939	3.3245	7	4	0	0	26.7828	3.3259	2	0.0110
26.9383	3.3070	14	1	2	1	26.9510	3.3055	22	−0.0127
28.2907	3.1519	6	4	1	0	28.2810	3.1530	6	0.0097
28.6190	3.1165	2	3	1	−1	28.6010	3.1185	2	0.0180
29.4987	3.0256	3	2	2	1	29.5077	3.0247	4	−0.0090
32.4005	2.7609	2	4	2	0	32.3951	2.7614	2	0.0054
32.9914	2.7128	2	0	3	1	33.0016	2.7120	1	−0.0103
33.6085	2.6644	2	1	3	−1	33.5980	2.6652	1	0.0104
33.8054	2.6493	2	1	3	1	33.8025	2.6495	1	0.0029
34.8559	2.5718	5	5	1	0	34.8862	2.5697	5	−0.0303
38.3616	2.3445	2	4	3	0	38.3773	2.3436	1	−0.0156
39.1626	2.2984	2	3	3	1	39.1641	2.2983	1	−0.0015
39.4121	2.2844	3	5	1	−1	39.4052	2.2848	2	0.0068
41.7493	2.1617	2	3	4	0	41.7320	2.1626	1	0.0173
46.5549	1.9492	2	6	1	1	46.5255	1.9503	1	0.0294
47.4609	1.9141	1	5	3	−1	47.4696	1.9137	1	−0.0087
48.7477	1.8665	1	7	1	0	48.7481	1.8665	1	−0.0004
49.4567	1.8414	2	6	3	0	49.4704	1.8409	2	−0.0137

The d-values were calculated using Cu$K\alpha_1$ radiation ($\lambda = 1.54056$ Å).

(h, k, l) to each observed peak in the experimental powder XRD pattern.

C. Single-crystal XRD

XRD data for the title compound were collected on an Xcalibur, Eos diffractometer. The crystal was kept at 293.15 K during data collection. The structure was solved with olex2 (Dolomanov *et al*., 2009), a structure solution program using charge flipping and refined with the ShelXL (Sheldrick, 2008) refinement package using least-squares minimization.

III. RESULTS

Pawley refinement results confirmed that the title compound is monoclinic with space group $P2_1$ and unit-cell parameters: $a = 13.308(4)$ Å, $b = 9.908(5)$ Å, $c = 4.753(4)$ Å, $\alpha = 90°$, $\beta = 91.510(8)°$, $\gamma = 90°$, unit-cell volume $V = 626.64$ Å^3, $Z = 2$, and $\rho_{cal} = 1.361$ g cm^{-3}. The values of $2\theta_{obs}$, d_{obs}, I_{obs}, h, k, l, $2\theta_{cal}$, d_{cal}, and $\Delta 2\theta$ are listed in Table I. The results were in good agreement with the single crystallographic data of Asiri *et al.* and ours [$a = 4.7454(3)$ Å, $b = 9.8938(7)$ Å, $c = 13.3001(7)$ Å, $\alpha = 90°$, $\beta = 91.605(5)°$, $\gamma = 90°$, unit-cell volume $V = 624.19(7)$ Å^3, $Z = 2$, and $\rho_{cal} = 1.366$ g cm^{-3}] (CCDC:1505270). The detail single crystallographic data of the title compound and the experimental data were listed in Table SI. The comparison of the experimental powder XRD pattern with the simulated patterns of Asiri *et al.* and ours is shown in Figure 2. Results showed that both single-crystal and powder diffraction methods can get the similar structure data.

SUPPLEMENTARY MATERIAL

The supplementary material for this article can be found at https://doi.org/10.1017/S0885715616000695

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