Synthesis, Structural, and Docking Studies of O - Flurocyanoacetanilide. (2- Cyano -N-(Furan-2-Ylmethyl) Acetamide)

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***Abstract* – The title compound have been prepared, characterized and crystallized to determine their crystal structures. The compounds crystallize in space groups, $P2_1/c$, monoclinic with unit cell parameters, a= 4.8093(4) Å, b= 14.9495(16) Å, c= 11.4969(11) Å, β = 93.482(3)º, V = 825.06(14)Å^3 containing four asymmetric molecules. The molecules are packed in the crystal lattice with hydrogen bonding of the type C-H---O. Oxygen atom O1 is involved in the hydrogen bonding with bridge distances 3.3960(17) Å and 2.8483(16)Å respectively.**

Index Terms – Activity, Antibacterial, Characterization, Crystal, Acetone, Fluoro Aniline, Hydrogen bonding and Structure

1. INTRODUCTION

Furan is a heterocyclic organic compound, consisting of a five-membered aromatic ring with four carbon atoms and one oxygen. The classes of compounds containing such rings are also referred to as furans. The five-member furan ring adopts an envelope-like conformation. All bond lengths [1] and angles are within normal ranges. Acylamide compounds have gained widely attention due to their important medical activity. Recently, the synthesis and medical activities of some heterocyclic derivatives containing the acylamide moiety have been reported [2] & [4]. In continuation of our work is on the synthesis of acetamide derivatives [3]. A number of furan and acylamide derivatives have been synthesized, characterized and reported to have significant and diverse biological activities such as antimicrobial [5], analgesic [6], anti-inflammatory [7], antioxidant [8], antitumor 9] and local anesthetic [10] activities.

2. PREPARATION AND CHARACTERIZATION OF COMPOUND

2.1 Synthesis of O-flurocyanoacetanilide

An equi-molar mixture of O-fluro aniline and ethyl cyano acetate were mixed in a conical flask and the mixture was heated under micro wave irradiation at 700w for 3 minutes with an interval of 20 second each time and mixture was poured to a beaker cooled and the solid obtained was size reduced washed with ethane and recrystallized from acetone: water mixture (70:30 ratio).

3. CRYSTAL STRUCTURE DETERMINATION OF COMPOUND

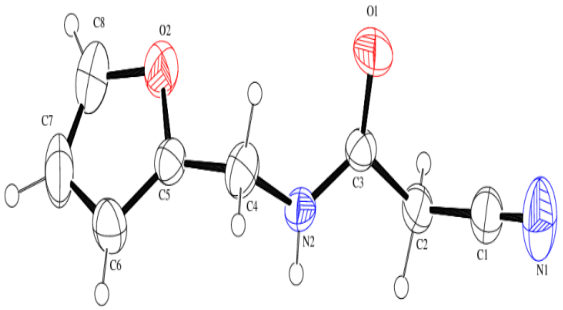

Fig.1 An ORTEP diagram with 50% thermal ellipsoid probability for the compound

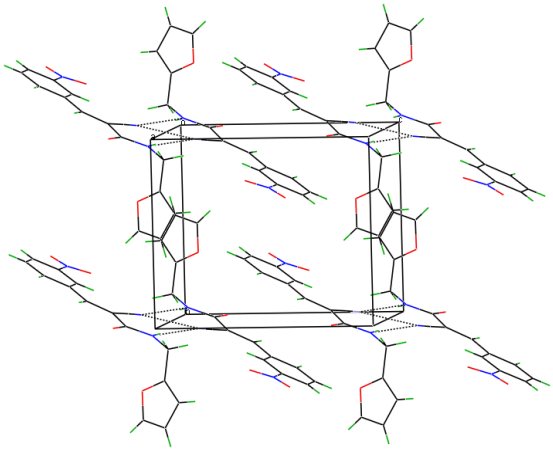

Fig. 2 - Crystal packing diagram for the compound

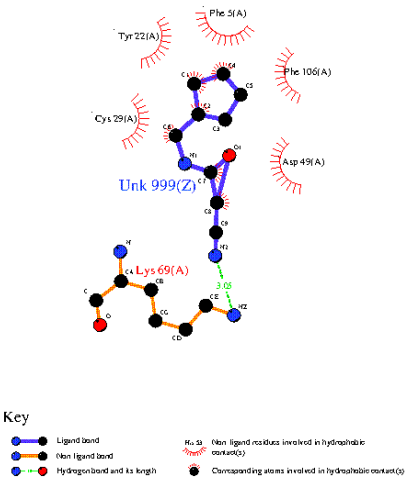

Fig. 3 Ligplot of the compound showing the molecular interactions

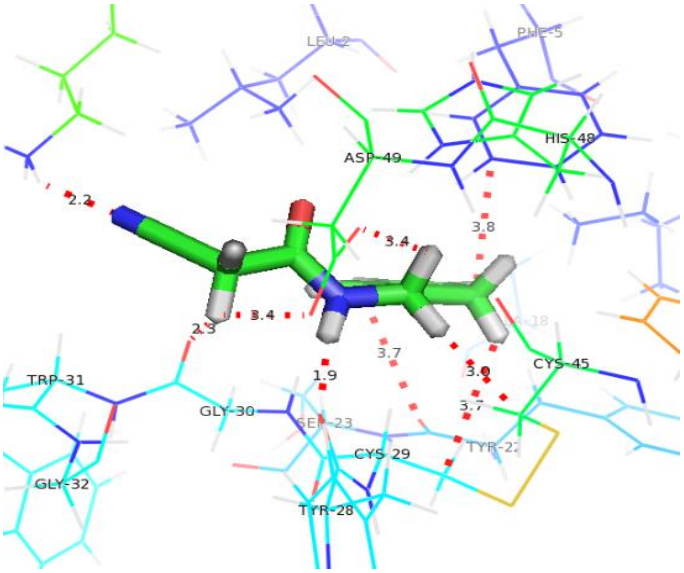

Fig. 4 Compound showing the molecular interactions

TABLE 1
CRYSTAL DATA FOR COMPOUND

Parameter	Compound
Empirical formula	$C_8 H_8 N_2 O_2$
Formula weight	164.16
Temperature	293(2) K
Wavelength	0.71073 Å
Crystal system, space group	Monoclinic, P21/c
Unit cell dimensions	a = 4.8093(4)Å alpha = 90° b = 14.9495(16)Å beta = 93.482(3)° c = 11.4969(11)Å gamma = 90°.
Volume	825.06(14) $Å^3$
Z, Calculated density	4, 1.322 Mg/m^3
Absorption coefficient	0.098 mm^{-1}
F(000)	344
Crystal size	0.30 x 0.20 x 0.20 mm
Theta range for data collection	2.24 to 24.98°
Limiting indices	-5<=h<=5, -17<=k<=17, -12<=l<=13
Reflections collected / unique	7302 / 1455 [R(int) = 0.0265]
Completeness to theta	24.98 99.90%
Absorption correction	Semi-empirical from equivalents
Max. and min. transmission	0.988 and 0.946
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	1455 / 0 / 113
Goodness-of-fit on F^2	1.076
Final R indices [I>2sigma(I)]	R1 = 0.0364, wR2 = 0.0950
R indices (all data)	R1 = 0.0463, wR2 = 0.1029
Largest diff. peak and hole	0.146 and -0.131 e. $Å^3$

4. RESULTS AND DISCUSSION

The final atomic fractional coordinate ($x10^4$ Å) and their equivalent isotropic displacement parameters ($Å^2x10^3$) of the non hydrogen atoms are given in **Table 2**. The bond distances and bond angles are given in **Table 3** for the molecule. It is seen from the table that the bond distances and angles in the compound within the normal range of e.s.ds. The molecules are packed in the unit cells nicely by inter and intra hydrogen bondings in **Table 4**. The oxygen O atom in compound is involved in hydrogen bonding of the type: C(2)–H(2A)---

O(1), 3.3960 (17) Å and N(23–H(2)----O(1) with hydrogen bond distance 2.843(16)Å. The compound, due to extensive hydrogen bonding network, the molecules are arranged in a spiral manner in the unit cell and packing of molecule parallel to the longest x-axis. The packing consideration of the molecule due to extensive hydrogen bonding leads to stability of the molecule in the unit cell. The antibacterial activity may be attributed to the inter and intra hydrogen bonding interactions and also the propensity of the molecules to pack together as dimmers involving N-H---O and C-H···O bonding interactions lead to the possible variation in the nature of packing motifs (fig. 4). These kind of interactions involving N-H---O and C-H···O interactions may be responsible for the biological activity of the molecule which is responsible for molecular basis for drug design as observed in the case of crystal structure of atovaquone [11].

TABLE 2

ATOMIC COORDINATES ($X10^4$) AND EQUIVALENT ISOTROPIC DISPLACEMENT PARAMETERS (A^2 X 10^3)

Atoms	X	y	Z	U(eq)
C(1)	3983(4)	685(1)	12780(2)	59(1)
C(2)	2629(3)	418(1)	11671(1)	51(1)
C(3)	3693(3)	992(1)	10705(1)	44(1)
C(4)	2437(3)	2039(1)	9129(1)	57(1)
C(5)	1117(3)	1802(1)	7978(1)	48(1)
C(6)	-1009(4)	2132(1)	7321(2)	70(1)
C(7)	-1248(4)	1599(2)	6295(2)	81(1)
C(8)	729(5)	993(2)	6400(2)	78(1)
N(1)	5079(5)	909(1)	13628(2)	94(1)
N(2)	1785(3)	1413(1)	10046(1)	47(1)
O(1)	6196(2)	1036(1)	10576(1)	71(1)
O(2)	2222(2)	1091(1)	7430(1)	65(1)

TABLE 3

D – H A	d(D – H)	d(H A)	d(D A)	<(DHA)
C(2)-H(2A)...O(1)#1	0.97	2.56	3.3960(17)	145
N(2)-H(2)...O(1)#1	0.801(18)	2.054(18)	2.8483(16)	171.3(17)

BOND LENGTHS [A] AND ANGLES [DEG]

Atoms	Length
C(1)-N(1)	1.131(2)
C(1)-C(2)	1.453(2)
C(2)-C(3)	1.516(2)
C(3)-O(1)	1.2234(16)
C(3)-N(2)	1.3153(19)
C(4)-N(2)	1.4578(19)
C(4)-C(5)	1.476(2)
C(5)-C(6)	1.328(2)
C(5)-O(2)	1.3601(18)
C(6)-C(7)	1.422(3)
C(7)-C(8)	1.314(3)
C(8)-O(2)	1.355(2)
N(1)-C(1)-C(2)	178.0(2)
C(1)-C(2)-C(3)	109.58(13)
O(1)-C(3)-N(2)	124.18(14)
O(1)-C(3)-C(2)	119.85(13)
N(2)-C(3)-C(2)	115.97(12)
N(2)-C(4)-C(5)	113.25(13)
C(6)-C(5)-O(2)	109.61(15)
C(6)-C(5)-C(4)	134.05(17)
O(2)-C(5)-C(4)	116.34(13)
C(5)-C(6)-C(7)	106.53(17)
C(8)-C(7)-C(6)	106.79(17)
C(7)-C(8)-O(2)	110.30(18)
C(3)-N(2)-C(4)	123.42(13)
C(8)-O(2)-C(5)	106.76(14)

TABLE 4

HYDROGEN BONDS [A AND DEG] °

5. CONCLUSION

Substituted acylamide with electron withdrawing and methoxy groups play a vital role in their biological activity as antibacterial. The results of the present research indicate that the molecule is nicely packed in the unit cell with extensive hydrogen bonding network. They exhibit a greater antibacterial activity. It may be interesting to see that more different substituted groups on the acylamide molecule could be a future investigation followed by their three-dimensional structure determination.

6. ACKNOWLEDGMENT

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