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Crystal Structure and Supramolecular Architecture of Antiallergic Diphenylene Diethyl Dioxalamates

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Materials and instrumentation

All reagents and solvents were purchased from commercial sources and used as received. ^{1}H and ^{13}C NMR spectra were recorded on a Varian Mercury 300 (^{1}H, 300.08; ^{13}C, 75.46 MHz) instrument in $CDCl_3$ solutions, using $SiMe_4$ as internal reference, chemical shifts (δ) are in ppm and ^{n}J(H-H) in Hertz.

IR spectra were recorded neat at 25 °C using a Perkin Elmer Spectrum GX series with FT system spectrophotometer using the ATR device. Melting points were measured on an Electrothermal IA 9100 apparatus and were uncorrected.

Synthesis and characterization of 1-3

N,N′-(4,4'-methanediyl-di-phenyl)-bis-diethyl dioxalamate (**1**) as **1**•¼($C_2H_2O_4$)•½H_2O. To a mixture of 4,4′-diaminodiphenylmethane (3.00 g, 15.1 mmol) in THF (50 mL) and TEA (5.27 mL, 37.8 mmol) were added dropwise ethyl 2-chloro-2-oxoacetate (4.22 mL, 37.8 mmol), under vigorous stirring, at 5–10 °C. After stirring for an additional 24 h at 25 °C, the solid was removed and washed with THF to give **1**•¼($C_2H_2O_4$)•½H_2O (5.26 g, 80.2% yield with respect to **1**) as a white solid. Mp: 144–146 °C, IR ν(neat) (cm^{-1}): 3367, 3340 (N-H), 2979 (C-H Ar), 1729, 1698 (C=O). ^{1}H NMR ($CDCl_3$), δ: 10.75 (s, 2H, NH), 7.65 (d, 4H, ^{3}J = 8.2), 7.20 (d, 4H, ^{3}J = 8.46), 3.81 (s, 2H), 4.29 (q, 4H, O-CH_2, ^{3}J = 7.18), 1.31 (t, 6H, CH_2-CH_3, ^{3}J = 7.18). ^{13}C NMR, δ: 161.3 (C9), 156.0 (C8), 138.4 (C4), 136.1 (C1), 129.5 (C3, C5), 121.3 (C2, C6), 40.6 (C13); 63.0 (C11), 14.5 (C12).

N,N′-(4,4′-oxy-di-p-phenylene)-bis-diethyl dioxalamate (**2**). Prepared as described for **1**, starting from 3.00 g of 4,4′-oxydianiline (15.0 mmol), 4.59 mL of TEA (30.0 mmol) and 6.10 mL of ethyl 2-chloro-2-oxoacetate (30.0 mmol). To obtain 4.05 g of **2** (67.5% yield) as a white solid. Mp: 163–165 °C, IR ν (neat) (cm^{-1}): 3268 (N-H), 2985 (Ar), 1729, 1663 (C=O). ^{1}H NMR ($CDCl_3$), δ: 9.01 (s, 2H, NH), 6.96 (d, 4H, ^{3}J = 8.9), 7.60 (d, 4H, ^{3}J = 8.9), 4.36 (q, 4H, O-CH_2, ^{3}J = 7.1), 1.37 (t, 6H, CH_2-CH_3, ^{3}J = 8.9). ^{13}C NMR ($CDCl_3$), δ: 161.2 (C9), 154.6 (C8), 154.1 (C4), 132.1 (C1), 121.8 (C3, C5), 119.5 (C2,C6), 63.9 (C11), 14.1 (C12).

N,N′-(4,4'-biphenylene)-bis-diethyl dioxalamate (**3**). Prepared as described for **1**, starting from 1.00 g of benzidine (5.4 mmol), 20 mL of THF, 1.89 mL of TEA (10.9 mmol) and 1.51 mL of 2-chloro-2-oxoacetate (10.9 mmol) to obtain 0.94 g of **3** (45.1% yield) as a brown solid. Mp: 117-119 °C. IR ν

(neat) (cm^{-1}): 3352, 3276 (N-H), 2990 (Ar), 1724, 1686 (C=O). ^{1}H NMR ($CDCl_3$), δ: 10.9 (s, 2H, NH), 7.85 (d, 4H, ^{3}J = 7.04), 7.69 (d, 4H, ^{3}J = 8.5), 4.33 (q, 4H, O-CH_2, ^{3}J = 5.28), 1.33 (t, 6H, CH_2-CH_3, ^{3}J = 5.28). ^{13}C NMR, δ: 161.2 (C9), 156.1 (C8), 137.4 (C4), 136.3 (C1), 127.3 (C3, C5), 121.5 (C2, C46), 63.1 (C11), 14.4 (C12).

Table S1. Selected bond distances (Å) and angles (deg) for **1-3**.

Bond distances (Å)					
	1a	**1b**	**2**	**3a**	**3b**
C8-C9	1.533(3)		1.522(3)	1.536(4)	
C21-C22	1.536(3)				
C33-C34		1.539(3)			
C46-C47		1.532(3)			
C28-C29					1.533(4)
C48-C49					1.532(3)
Angles (°)					
C2-C1-N7-C8	−152.1(2)		−16.3(3)	−166.8(3)	
C15-C14-N20-C21	−166.8(2)				
C4-C13-C17-C16	−86.4(2)				
O8-C8-C9-O9	163.5(2)		−165.4(2)	−162.3(3)	
O21-C21-C22-O22	−178.6(2)				
C4-C13-C17	111.1(2)				
C3-C4-O13-C4			−134.1(2)		
C4-O13-C4			118.6(2)		
C27-C26-N32-C33		178.0(2)			
C44-C39-N45-C46		175.4(2)			
C29-C38-C42-C43		43.0(3)			
O33-C33-C34-O34		−170.5(2)			
O46-C46-C47-O47		174.9(2)			
C29-C38-C42		115.9(2)			
C3-C4-C4-C5				2.0(5)	
C22-C21-N27-C28					−157.0(2)
C42-C41-N47-C48					−164.8(2)
O28-C28-C29-O29					177.1(2)
O48-C48-C49-O49					175.6(2)
C23-C24-C44-C45					14.1(3)

Table S2. Intramolecular interactions in **1**$_2$•½($C_2H_2O_4$)•H_2O, **2** and **3**.

Comp.	**D—H···A**	**D—H/Å**	**H···A/Å**	**D···A/Å**	**D—H···A/°**	**Motif**
1$_2$•½($C_2H_2O_4$)•H_2O	N7-H7···O9	0.88	2.31	2.701(2)	106.60	*S(5)*
	N20-H20···O22	0.88	2.23	2.666(3)	110.00	*S(5)*
	C6-H6···O8	0.95	2.43	2.942(2)	114.00	*S(6)*
	C19-H19···O21	0.95	2.34	2.933(3)	120.00	*S(6)*
	N32-H32···O34	0.88	2.24	2.679(2)	110.00	*S(5)*
	N45-H45···O47	0.88	2.27	2.690(3)	108.90	*S(5)*
	C31-H31···O33	0.95	2.31	2.923(3)	122.00	*S(6)*
	C40-H40···O46	0.95	2.32	2.925(3)	121.00	*S(6)*
2	N7-H7···O9	0.86	2.28	2.689(2)	109.00	*S(5)*
	C2-H2···O8	0.93	2.36	2.929(3)	119.00	*S(6)*
3	N7-H7···O9	0.86	2.31	2.711(3)	108.24	*S(5)*
	C6-H6···O8	0.93	2.33	2.911(4)	120.00	*S(6)*
	N27-H27···O29	0.86	2.29	2.698(3)	108.90	*S(5)*
	N47-H47···O49	0.86	2.28	2.698(3)	109.50	*S(5)*
	C26-H26···O28	0.93	2.40	2.919(3)	115.00	*S(6)*
	C46-H46···O48	0.93	2.34	2.910(3)	119.10	*S(6)*

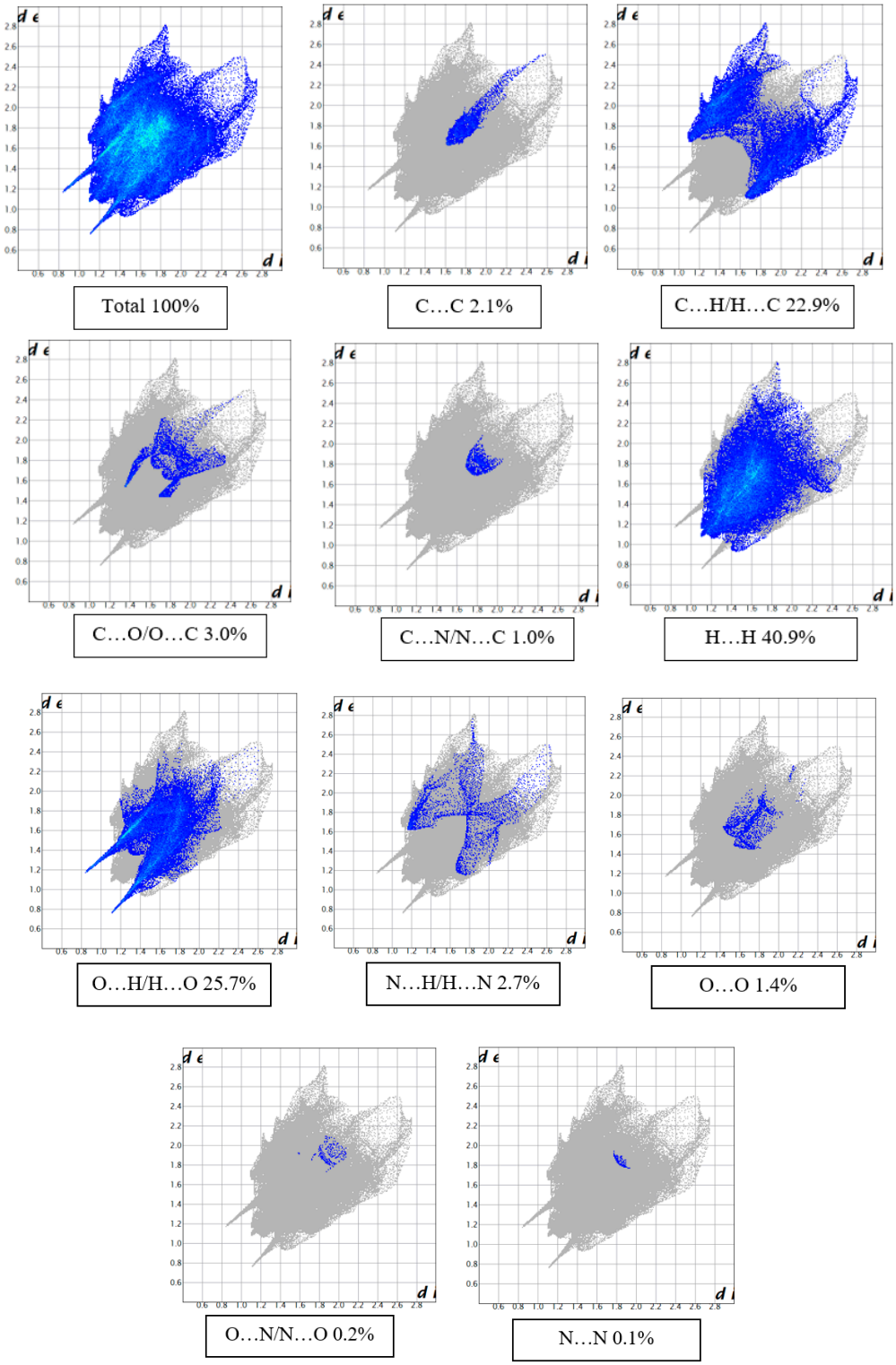

Figure S1. Fingerprints plots of the total and specific intermolecular contacts of **1**.

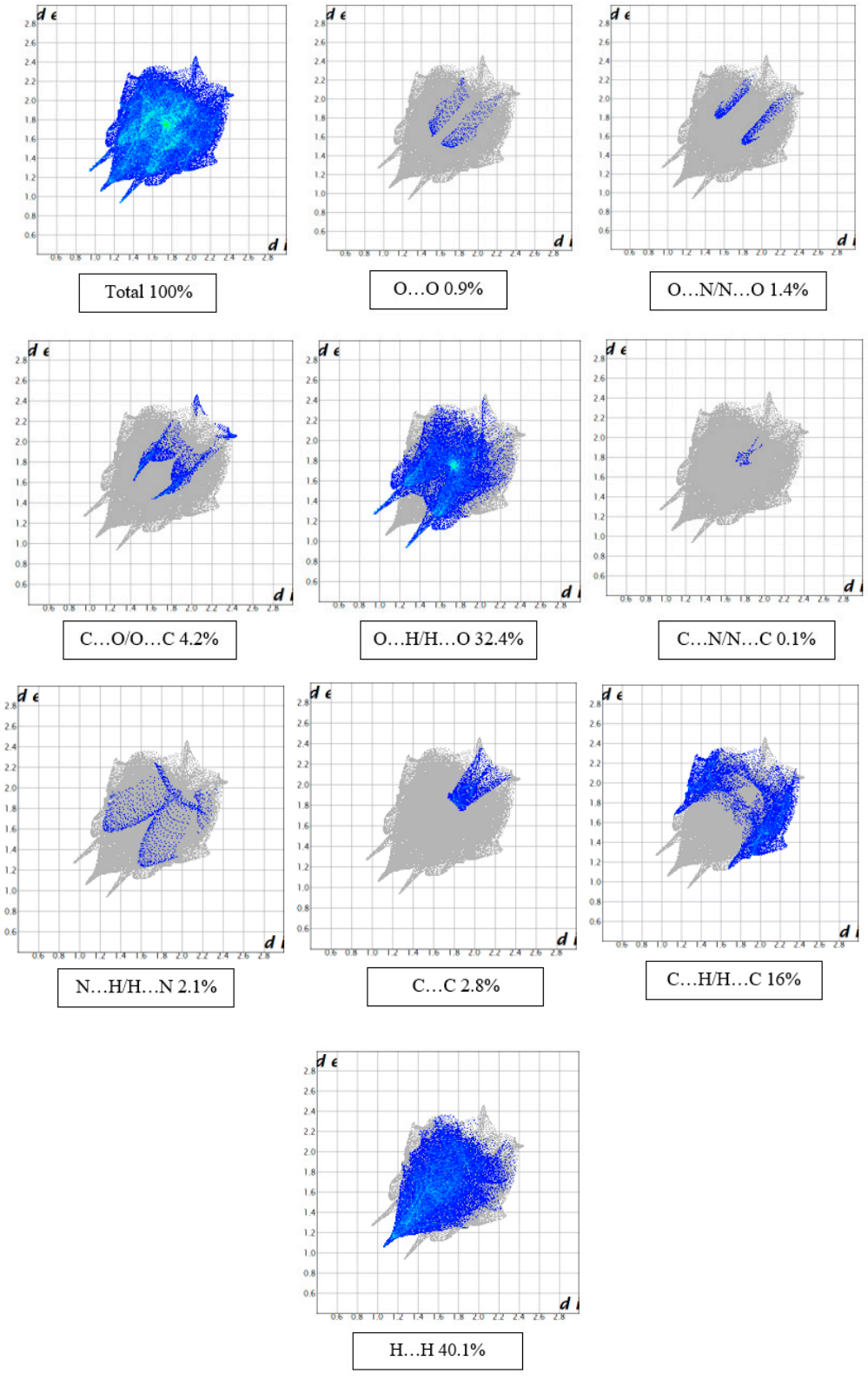

Figure S2. Fingerprints plots of the total and specific intermolecular contacts of **2**.

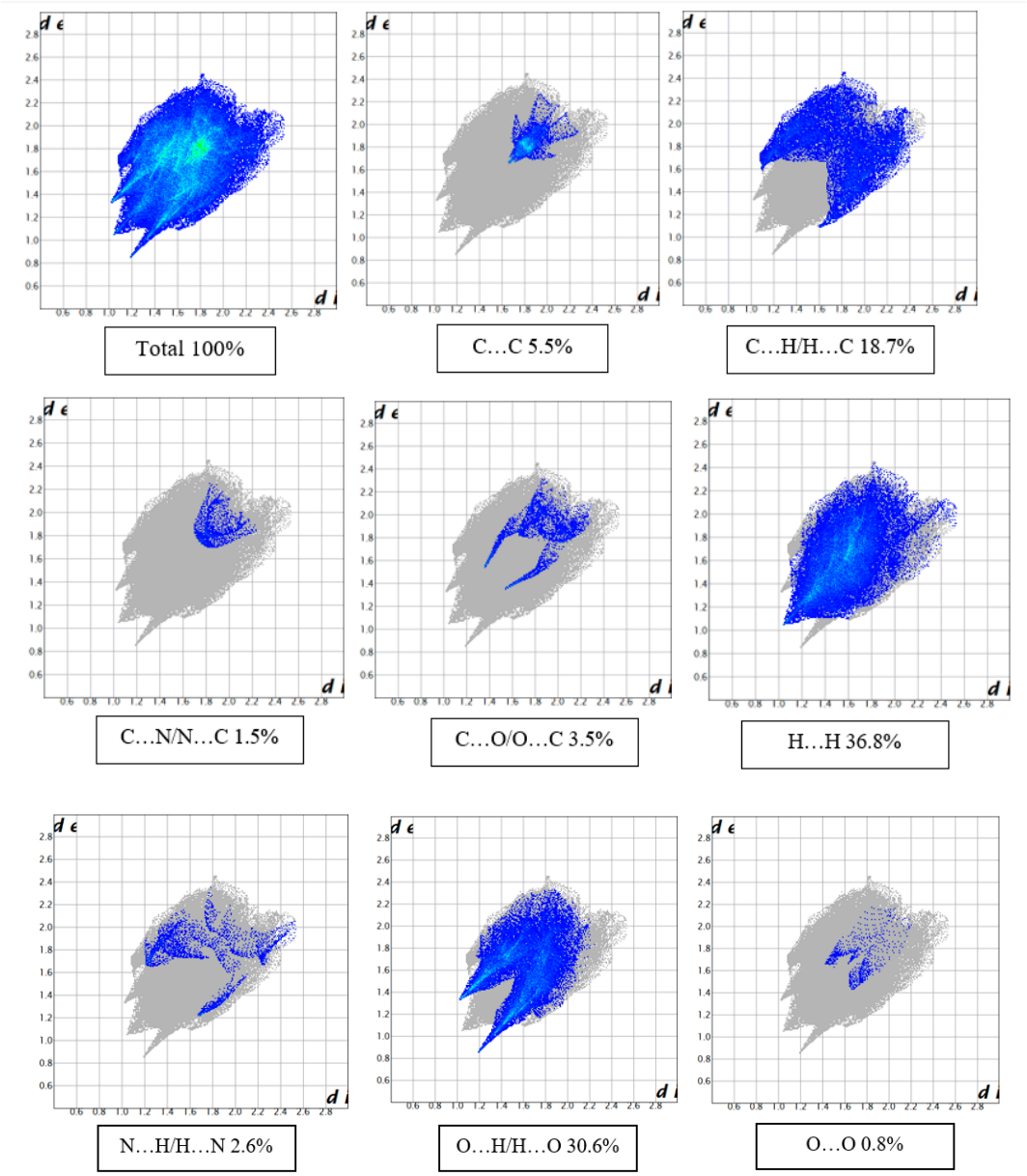

Figure S3. Fingerprints plots of the total and specific intermolecular contacts of **3**.