

# **Electronic Supplementary Information**

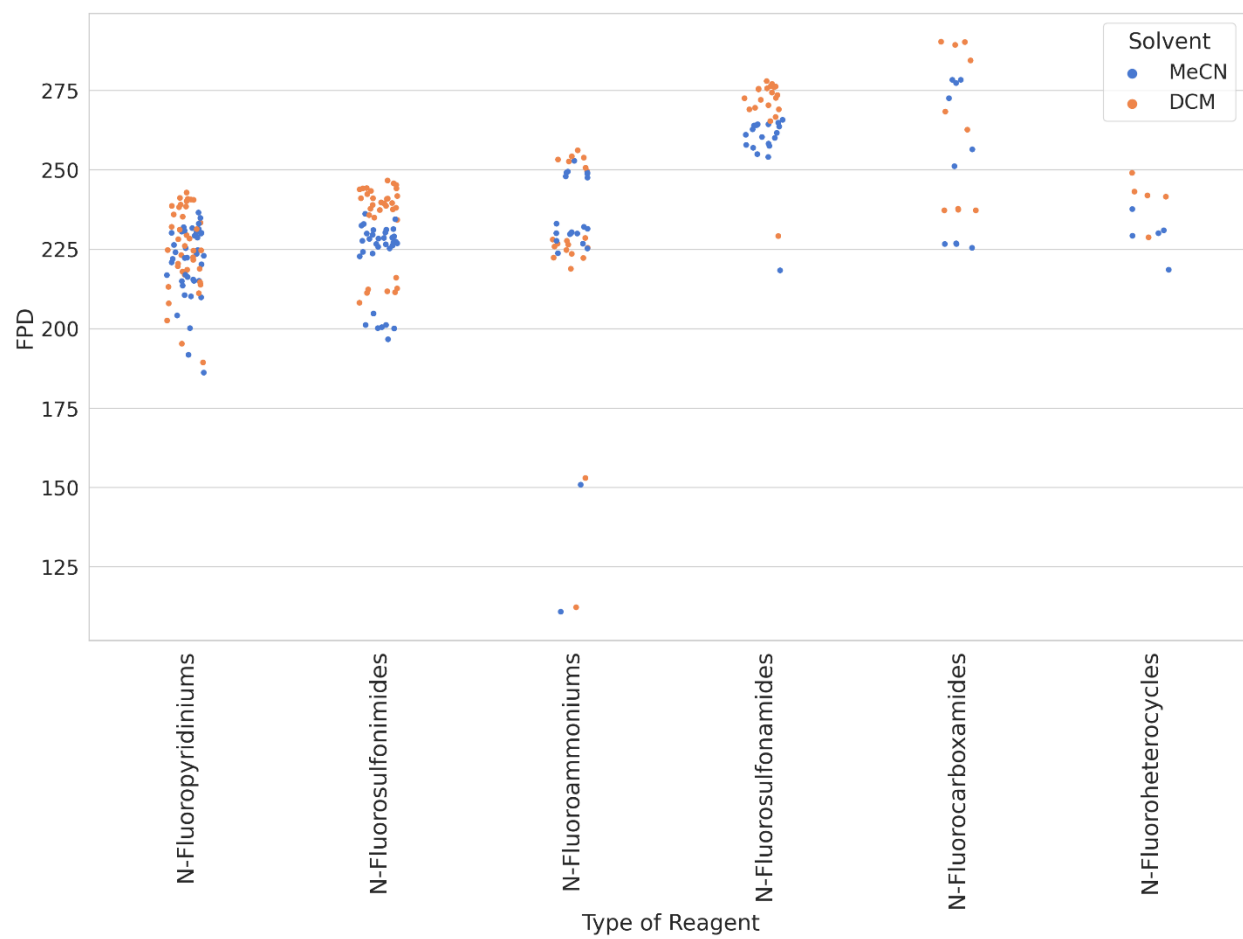
# **A Machine Learning Approach for Predicting the Fluorination Strength of Electrophilic Fluorinating Reagents**

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**Figure S1:** Plot showing distribution of FPD values across different categories of N-F fluorinating reagents.

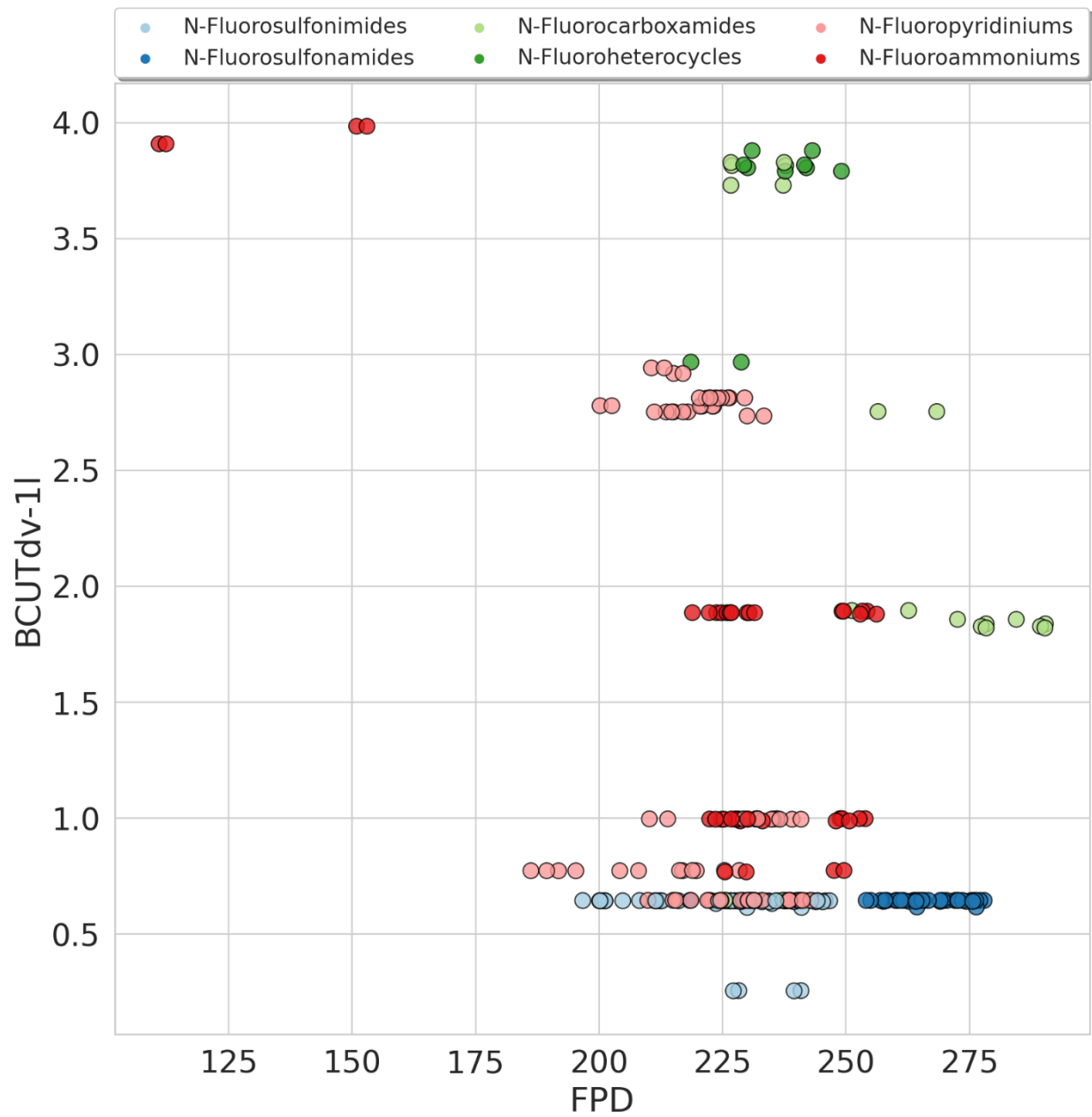


Figure S2. Scatter plot between BCUTdv-1I vs FPD.

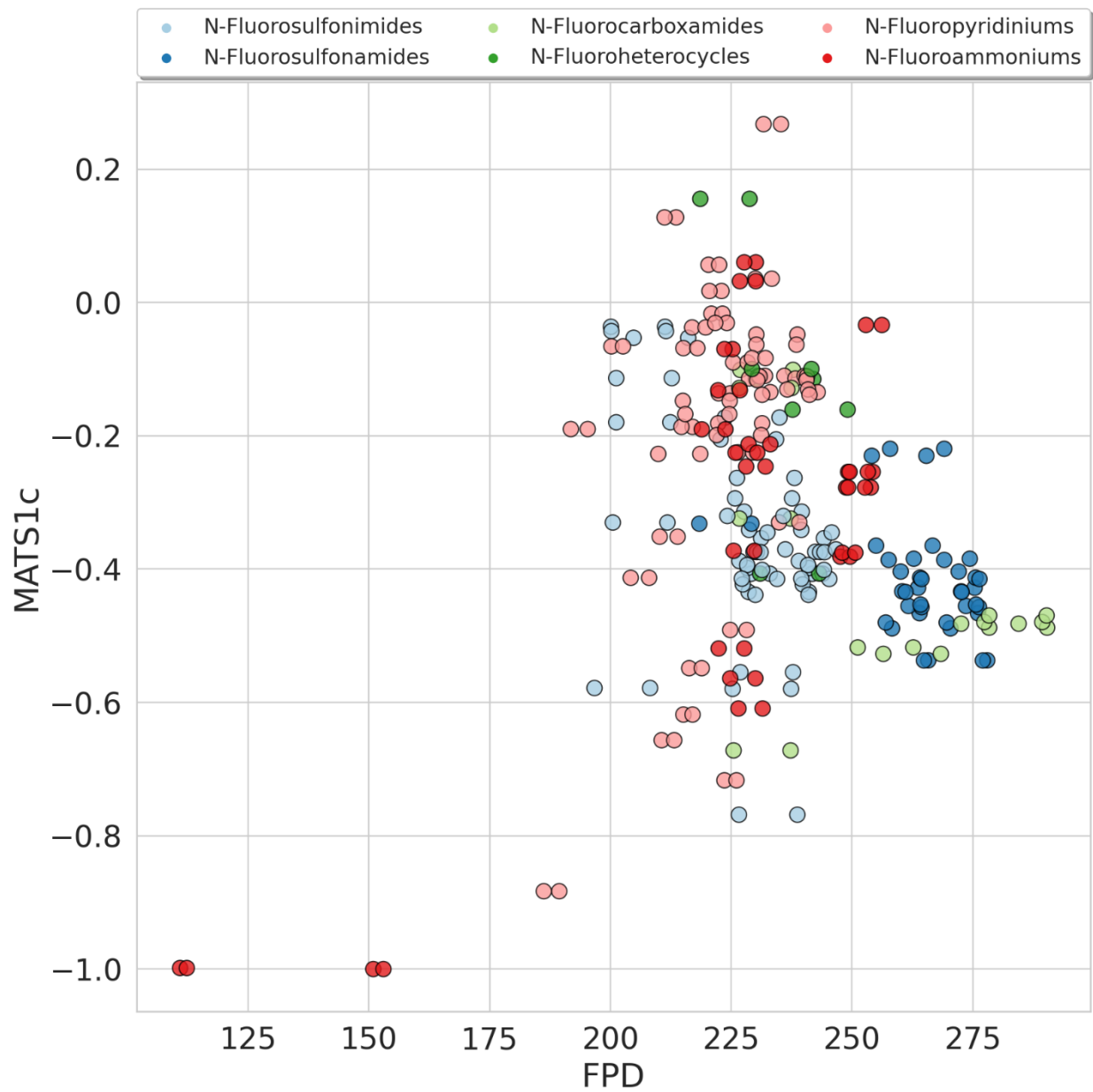


Figure S3. Scatter plot between MATS1c vs FPD.

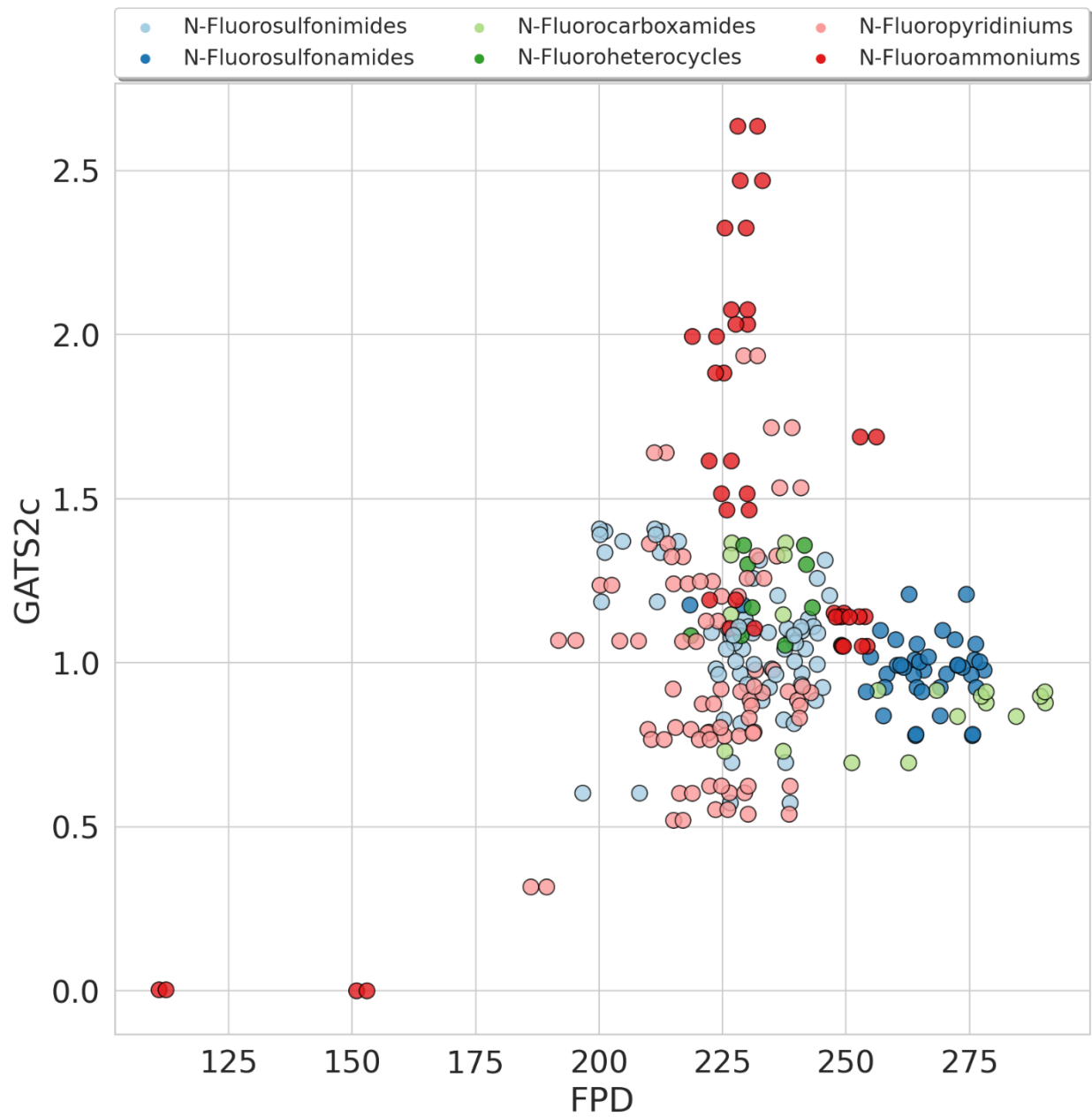


Figure S4. Scatter plot between GATS2c vs FPD.

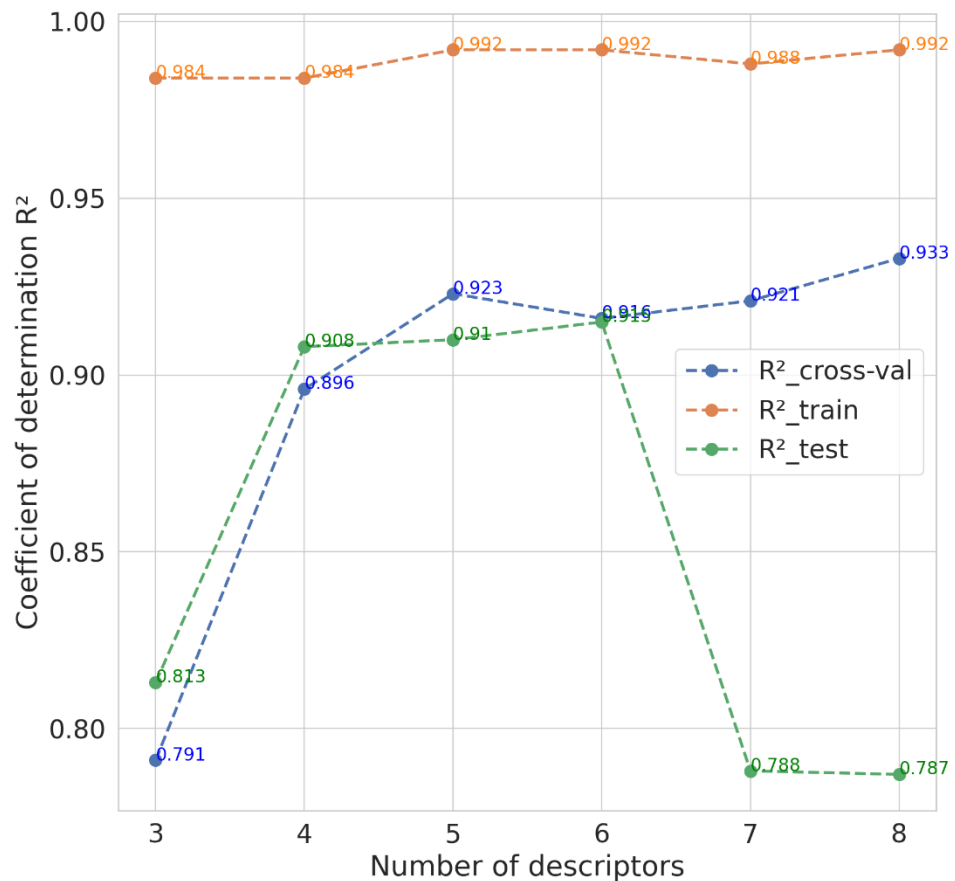
**Table S1. Train test split data.**

Type of Reagent	Total no. of FPD values	No of FPD values	No of FPD values	%age of FPD values
		Training set	Test set	Test set
N-Fluoropyridiniums	80	68	12	15%
N-Fluorosulfonimides	68	58	10	14.7%
N-Fluoroammoniums	42	36	6	14.3%
N-Fluorosulfonamides	40	34	6	15%
N-Fluorocarboxamides	20	16	4	20%
N-Fluoroheterocycles	10	8	2	20%
Total	260	220	40	15.4%

**Table S2. Model evaluation metrics using layered approach where each feature was added sequentially to the dataset and metrics were noted.**

No. of desc.	R <sup>2</sup> _cross-val	rmse_cross-val	R <sup>2</sup> _train	R <sup>2</sup> _test	rmse_test	Descriptor(s)
<b>NN Model</b>						
3	0.844	8.58	0.886	0.923	5.81	TOS + Solvent+BCUTc-1h
4	0.921	6.62	0.941	0.93	5.56	TOS + Solvent+BCUTc-1h+ BCUTdv-1l
5	0.955	4.76	0.97	0.93	5.48	TOS + Solvent+BCUTc-1h+ BCUTdv-1l + GATS2c
6	0.963	4.04	0.983	0.967	3.84	TOS + Solvent+BCUTc-1h+ BCUTdv-1l + GATS2c + MATS1c
7	0.976	2.84	0.995	0.909	6.35	TOS + Solvent+BCUTc-1h+ BCUTdv-1l + GATS2c + MATS1c + AATS0Z
8	0.99	2.28	0.997	0.927	5.7	TOS + Solvent+BCUTc-1h+ BCUTdv-1l + GATS2c + MATS1c + AATS0Z + MATS2d
<b>RF Model</b>						
3	0.791	10.82	0.984	0.813	9.04	TOS + Solvent+BCUTc-1h
4	0.896	7.49	0.984	0.908	6.37	TOS + Solvent+BCUTc-1h+ BCUTdv-1l
5	0.923	6.3	0.992	0.91	6.27	TOS + Solvent+BCUTc-1h+ BCUTdv-1l + GATS2c
6	0.916	7.03	0.992	0.915	6.12	TOS + Solvent+BCUTc-1h+ BCUTdv-1l + GATS2c + MATS1c
7	0.921	6.58	0.988	0.788	9.69	TOS + Solvent+BCUTc-1h+ BCUTdv-1l + GATS2c + MATS1c + AATS0Z
8	0.933	6.27	0.992	0.787	9.7	TOS + Solvent+BCUTc-1h+ BCUTdv-1l + GATS2c + MATS1c + AATS0Z + MATS2d





**Figure S5.** Plot describing  $R^2$  scores for layered approach for the RF model, where x axis represents total number of descriptors (3 = 'TOR' + Solvent + BCUTc-1h; 4 = 3 + BCUTdv-1l; 5 = 4 + GATS2c; 6 = 5 + MATS1c; 7 = 6 + AATS0Z; 8 = 7 + MATS2d).

**Table S3. Actual and predicted FPD values along with the absolute error for test set predictions for NN model.**

Name of the Reagent	Type of Reagent	Solvent	Actual	Predicted	Abs. Error
1-fluoro-4-nitropyridin-1-ium	N-Fluoropyridiniums	DCM	222.5	222.4	0.1
1-fluoro-2,4,6-trimethylpyridin-1-ium	N-Fluoropyridiniums	MeCN	236.6	236.7	0.1
1-fluoroquinuclidin-1-ium	N-Fluoroammoniums	DCM	256.2	256.1	0.1
2-fluoro-2H-benzo[d][1,3,2]dithiazole 1,1,3,3-tetraoxide	N-Fluorosulfonimides	DCM	235.8	236.1	0.3
1,3,3,4,4-pentafluoropyrrolidine-2,5-dione	N-Fluorocarboxamides	DCM	237.5	237.9	0.4
1-fluoro-2,4,6-trimethylpyridin-1-ium	N-Fluoropyridiniums	DCM	240.9	240.5	0.4
2-fluoro-2H-benzo[d][1,3,2]dithiazole 1,1,3,3-tetraoxide	N-Fluorosulfonimides	MeCN	224.2	224.6	0.4
2-fluoro-3,3-dimethyl-6-nitro-2,3-dihydrobenzo[d]isothiazole 1,1-dioxide	N-Fluorosulfonamides	MeCN	254.1	254.6	0.5
4-(tert-butyl)-1-fluoropyridin-1-ium-2-sulfonate	N-Fluoropyridiniums	MeCN	231.4	230.7	0.7
1-fluoro-4-hydroxy-1,4-diazabicyclo[2.2.2]octane-1,4-dium	N-Fluoroammoniums	MeCN	226.8	225.9	0.9
(1S,2S,4S)-1-fluoro-4-methyl-2,3-diphenyl-1,4-diazabicyclo[2.2.2]octane-1,4-dium	N-Fluoroammoniums	DCM	226.8	225.9	0.9
(6R,7aS)-1-fluoro-7a,8,8-trimethylhexahydro-3H-3a,6-methanobenzo[c]isothiazole 2,2-dioxide	N-Fluorosulfonamides	DCM	275.7	274.5	1.2
2-fluoro-3,3-dimethyl-6-nitro-2,3-dihydrobenzo[d]isothiazole 1,1-dioxide	N-Fluorosulfonamides	DCM	265.4	264.2	1.2
(6R,7aS)-1-fluoro-7a,8,8-trimethylhexahydro-3H-3a,6-methanobenzo[c]isothiazole 2,2-dioxide	N-Fluorosulfonamides	MeCN	264.2	263.0	1.2
perfluoropiperidine	N-Fluoroheterocycles	DCM	241.6	242.8	1.2
1-fluoro-2,6-bis(methoxymethyl)pyridin-1-ium	N-Fluoropyridiniums	DCM	232.1	233.4	1.3
perfluoro-1,3,2-dithiazinane 1,1,3,3-tetraoxide	N-Fluorosulfonimides	MeCN	200.2	201.5	1.3
(1S,2S,4S)-1-fluoro-4-methyl-2,3-diphenyl-1,4-diazabicyclo[2.2.2]octane-1,4-dium	N-Fluoroammoniums	MeCN	230.1	228.6	1.5
perfluoropiperidine	N-Fluoroheterocycles	MeCN	229.3	230.8	1.5

1-fluoroazocan-2-one	N-Fluorocarboxamides	MeCN	278.4	276.8	1.6
1-fluoro-2,6-bis(methoxymethyl)pyridin-1-ium	N-Fluoropyridiniums	MeCN	229.3	231.0	1.7
perfluoro-1,3,2-dithiazinane 1,1,3,3-tetraoxide	N-Fluorosulfonimides	DCM	211.5	213.4	1.9
1-fluoro-4-hydroxy-1,4-diazabicyclo[2.2.2]octane-1,4-dium	N-Fluoroammoniums	DCM	222.3	220.3	2.0
1,3,3,4,4-pentafluoropyrrolidine-2,5-dione	N-Fluorocarboxamides	MeCN	226.7	228.8	2.1
4-(tert-butyl)-1-fluoropyridin-1-ium-2-sulfonate	N-Fluoropyridiniums	DCM	241.2	238.9	2.3
4-bromo-N-fluoro-N-(phenylsulfonyl)benzenesulfonamide	N-Fluorosulfonimides	MeCN	228.3	230.8	2.5
1-fluoro-4-nitropyridin-1-ium	N-Fluoropyridiniums	MeCN	220.3	217.7	2.6
4-bromo-N-fluoro-N-(phenylsulfonyl)benzenesulfonamide	N-Fluorosulfonimides	DCM	240.9	243.9	3.0
N-fluoro-N,4-dimethylbenzenesulfonamide	N-Fluorosulfonamide	MeCN	264.4	261.2	3.2
1-fluoroazocan-2-one	N-Fluorocarboxamides	DCM	290.3	287.0	3.3
N-fluoro-N,4-dimethylbenzenesulfonamide	N-Fluorosulfonamide	DCM	276.3	273.0	3.3
1-fluoroquinuclidin-1-ium	N-Fluoroammoniums	MeCN	252.9	249.5	3.4
4-(tert-butyl)-N-((4-(tert-butyl)phenyl)sulfonyl)-N-fluorobenzenesulfonamide	N-Fluorosulfonimides	MeCN	231.4	228.0	3.4
4-bromo-N-((4-bromophenyl)sulfonyl)-N-fluorobenzenesulfonamide	N-Fluorosulfonimides	MeCN	227.2	230.9	3.7
4-bromo-N-((4-bromophenyl)sulfonyl)-N-fluorobenzenesulfonamide	N-Fluorosulfonimides	DCM	239.5	243.7	4.2
4-(tert-butyl)-N-((4-(tert-butyl)phenyl)sulfonyl)-N-fluorobenzenesulfonamide	N-Fluorosulfonimides	DCM	244.2	239.6	4.6
3-chloro-1-fluoro-5-(trifluoromethyl)pyridin-1-ium-2-sulfonate	N-Fluoropyridiniums	MeCN	215.5	220.7	5.2
3-chloro-1-fluoro-5-(trifluoromethyl)pyridin-1-ium-2-sulfonate	N-Fluoropyridiniums	DCM	224.6	230.9	6.3
2,6-dicyano-1-fluoropyridin-1-ium	N-Fluoropyridiniums	DCM	202.6	215.1	12.5
2,6-dicyano-1-fluoropyridin-1-ium	N-Fluoropyridiniums	MeCN	200.2	214.3	14.1
Average					2.6

