Supporting Information

Hydrothermally Shape-Controlled Synthesis of TiO_2/Graphene for Fluoride Adsorption Studies

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2.2. Synthesis of GO

Basically, the modified Hummers methods was utilized for the synthesis for graphene oxide. Firstly, we have taken the 5 g of graphite powder than added 2.5 g of $NaNO_3$ further mix with the 60 ml of sulfuric acid in 5 L of conical flask with continues stirring in an ice bath containing the temperature around 10 ºC for 30 min. consequently, added 15 g of $KMnO_4$ with slowly mixing for 3h. Further the homogenous solution was transferred over the water bath at 30 ºC temperature for 1 h. Afterward 100 mL of distilled water was mixed carefully, the temperature of the mixture was kept under 60 ºC for next 6 h till appearance of bright yellow color from the yellowish-brown color of solution. mixture. Then 30% of moderate H_2O_2 were added with continuous stirring for 2 h until superfluous potassium permanganate was eliminated. Obtained mixture was filtered through Whatman filter paper 42. Collected residue consecutively cleaned by 3% HCl and the distilled water till filtrate become free from the sulfate ions which confirmed by the barium chloride test. Obtained pure residue further dried by vacuum freeze-drying.

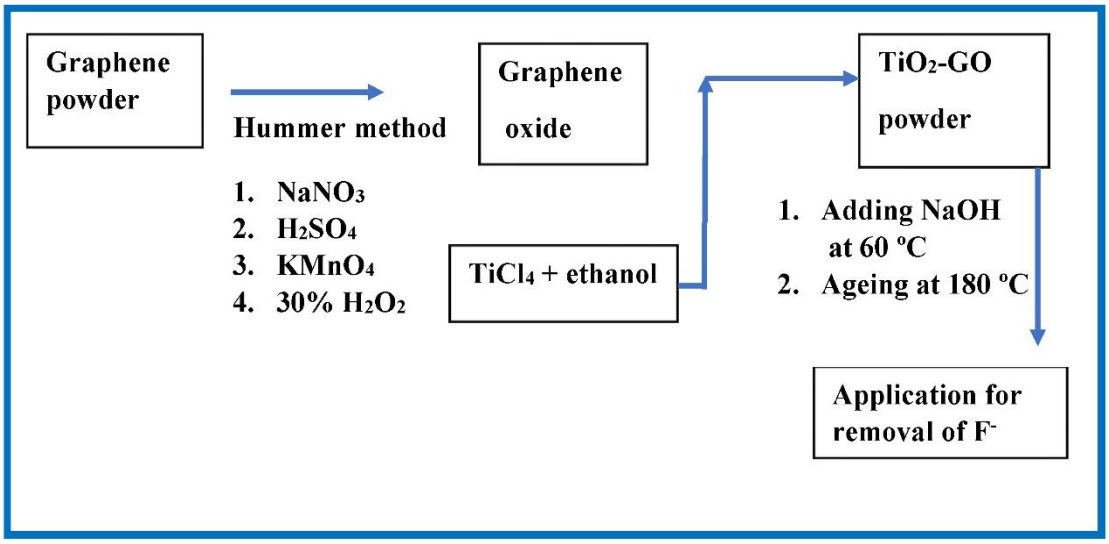

Figure S1. Flow chart of GO synthesis.

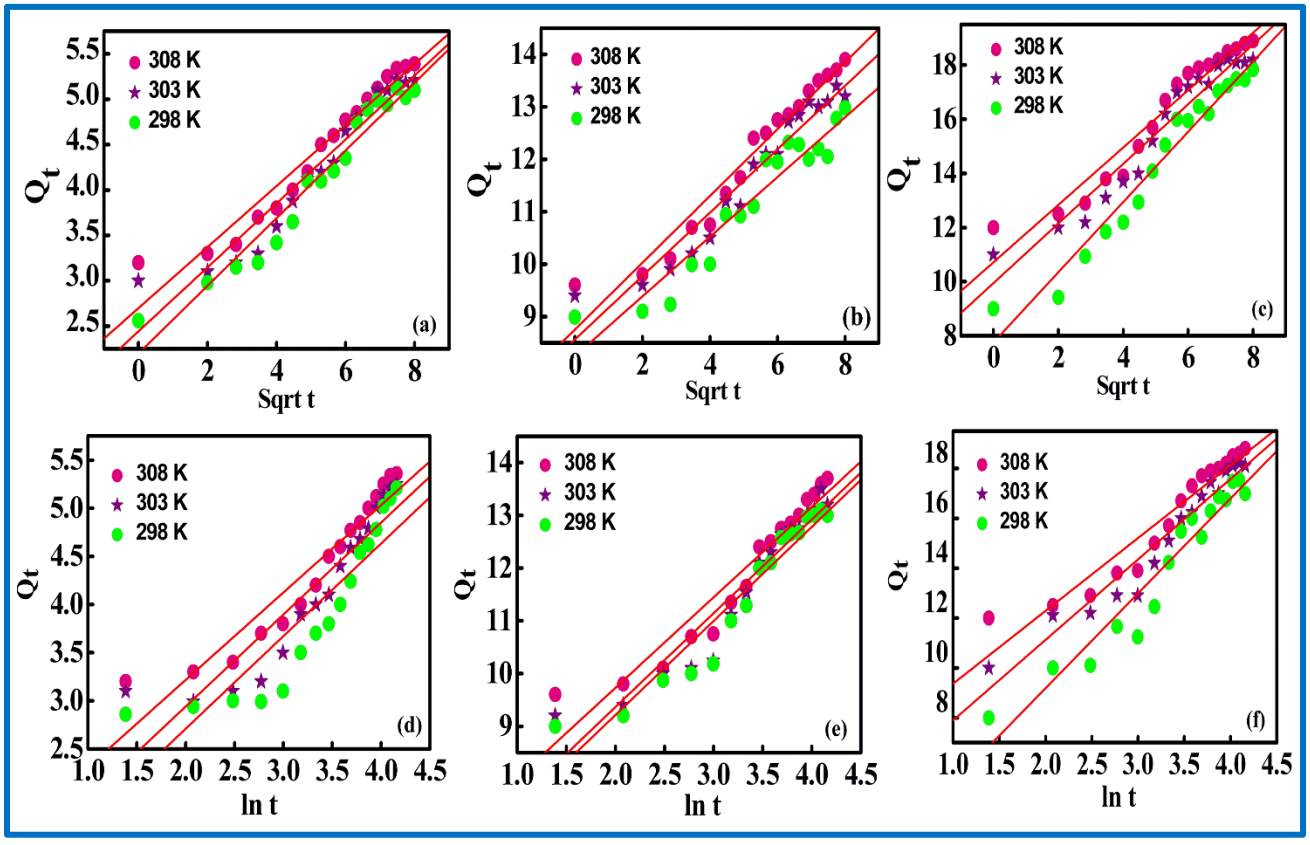

Figure S2. IPD and elovich kinetics models at three concentration 10, 20, 30 mg/L at different temperatures 308, 303, 298 K (a-f).

Table S1. Detail of Chemicals, CAS Reg. No. and Suppliers

Component	CAS Reg. No.	Suppliers	Purity	Purification method
Titanium chloride	7550-45-0	Sigma Aldrich Chemicals Private Limited	99 %	None
Graphite powder	7782-42-5	Sigma Aldrich Chemicals Private Limited	-	None
Sodium fluoride	7681-49-4	Sigma Aldrich Chemicals Private Limited	99 %	None
Hydrochloric acid	7647-01-0	Sigma Aldrich Chemicals Private Limited	30-35 %	None
Ethanol solution	64-17-5	Sigma Aldrich Chemicals Private Limited	99.5 %	None

Table S2. Peak Positions, Area and % Concentration of Different Bonded Peaks

	C1S scan		
Bonding	Peak position	Area	% concentration
Pristine GO			
C-C	284.03	4009.1	35.70
C-O	286.56	2805.1	24.98
C=O	288.10	4198.2	37.38
O=C-O	289.50	217.7	1.94
TiO_2-GO before			
C-C	284.90	625.9	59.81
C-O	286.40	332.4	21.85
C=O	289.37	563.3	37.02
TiO_2-GO after			
C-C	283.95	2103.0	41.14
C-O	285.26	348.2	9.90
C=O	287.39	1065.3	30.29
	O1S scan		
Pristine GO			
O=C-OH	531.85	2151.1	81.64
C-OH	530.86	326.8	12.40
C=O	533.74	156.9	5.95
TiO_2-GO before			
M-O_2^-	529.36	6481.4	48.06
Ti-O-Ti	530.25	3898.1	35.64
H_2O	532.52	244.3	2.23
Ti-OH	314.0	531.76	14.41
TiO_2-GO after			
M-O_2^-	530.01	4948.9	35.67
Ti-O-Ti	530.95	7667.0	55.39
H_2O	531.87	611.0	4.41
Ti-OH	530.10	614.0	2.87
	Ti 2p scan		
Ti 2p scan before			
Ti $2p_{3/2}$	458.42	5642.9	63.38
Ti $2p_{1/2}$	464.11	2423.3	30.04
Ti 2p scan after			
Ti $2p_{3/2}$	457.76	4253.9	71.85
Ti $2p_{1/2}$	463.50	1667.0	28.15
	F 1S scan		
TiO-F	687.90	5041.1	71.47
F1S after	684.46	2825.73	28.53

Table S3. The Outcomes of Adsorbent with Real Water Analysis

Optimized constituents	Before adsorption	After adsorption
pH	8.9	7
TDS/mg/L	836	402
F^-/mg/L	10.23	1.40
SO_4^{2-}/mg/L	92	81
HCO_3^-/mg/L	98	75
PO_4^{3-}/mg/L	82.3	42.2
Cl^-/mg/L	55.1	33.9