**Adsorption efficiency of graphene oxide towards cyanine dyes with different alkyl chain lengths**

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**Kinetic models**

pseudo-first-order model: *Log (qe – qt) = logqe – (k1/2.303) t*  (1)

pseudo-second-order model*: t /qt = 1/k2qe2 + t/qe* (2)

where qe is the amount of cyanine dye adsorbed at equilibrium and qt is its amount adsorbed (mol g−1) at time t. k1(min−1) and k2 (g mol−1 min−1) are pseudo-first and pseudo-second order rate constants [1].

Weber–Morris intraparticle diffusion model equation is,

*qt = kp t0.5 + C* (3)

kp is the rate constant of intraparticle diffusion rate (mol/g min0.5) and C is constant (mol g−1) referring to the thickness of the boundary layer.

The Boyd kinetic equation is expressed as [2],

*F = 1 − [(6/π2) exp (−Bt)]*  (4)

F is the fraction of solute adsorbed at time t and B is a mathematical function of F where

*F = qt / qe* (5)

From Equs. 5 & 6, the kinetic expression is,

*Bt= −0.4977 – ln (1 − F)* (6)

**Isotherm models**

Langmuir: *Ce/qe = (1/qmax KL) + Ce/qmax* [3](7)

Freundlich: *ln qe= ln KF + (1/n) ln Ce* [4] (8)

Dubinin-Radushkevich: *lnqe = ln qm – B ε2* [5](9)

Temkin and Pyzhev: *qe= B1 ln KT + B1 ln Ce*[6](10)

where, KL is the Langmuir constant associated to the adsorption energy (L g−1), qm is the maximum amount of dye adsorbed to form monolayer (mol g−1), KF is the Freundlich constant which shows roughly the adsorption capacity, 1/n is the intensity of adsorption, ε is the Polanyi potential that equals to *RT ln (1+1/Ce)*, B is a constant related to the mean free energy of adsorption (mol2 J-2) [18], B1 is constant equals to RT/ b, and KT is the Temkin constant



**Fig. S1** Plot of qt vs. t0.5 for the adsorption of [R5, R7, and R10] = 9 x 10-5 M onto GO nanosheets (0.01g) at pH = 7 and 25ºC.

Fig. 2. Boyd Plot for the adsorption of [R5, R7, and R10] = 9 x 10-5 M onto GO nanosheets (0.01g) at pH = 7 and 25ºC

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