# Hydrothermal Carbonization of Agan Nut Shell: Functional Mesoporous Carbon with Excellent Performance in the Adsorption of Bisphenol A and Diuron

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**Supplementary Information**

**(Equation 3-12)**

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* ***Calculations***

The amount of BPA and diuron adsorbed per unit mass of adsorbent at any time *t, Qt* (mg g−1) and at equilibrium, Q*e* (mg g−1) was calculated using the following mass-balance equations:

 (3)

 (4)

The percent (%) BPA and diuron removal was estimated using Eq. (5):

 (5)

* **Theory**
* ***Adsorption isotherms***

The Langmuir, Freundlich, and isotherm models were used to describe the temperature dependent equilibrium adsorption data of BPA and diuron [1, 2].

Langmuir :

 (6)

Freundlich:

 (7)

Adsorption feasibility:

 (8)

* ***Adsorption kinetics***

In the present study, three most commonly used rate equations, namely the pseudo-first-order (PFO), the pseudo-second-order (PSO), and intra-particle diffusion, were applied to understand the adsorption kinetics [3, 4].

Pseudo-first-order:

 (9)

Pseudo-second-order:

 (10)

Intra-particle diffusion :

 (11)

* ***Thermodynamic parameters***

Thermodynamic parameters such as Gibbs free energy change (∆*G*O, kJ mol−1), enthalpy (∆*H*O, kJ mol−1) and entropy (∆*S*O, J mol−1 K−1) were calculated using Eqs. (12) and (13) [5].

 (12)

(13)

**References**

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