Supplementary Material

Hybrid material based on an amorphous-carbon matrix and ZnO/Zn for the solar photocatalytic degradation of basic blue 41

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Table S1. Summary of kinetics model for the analysis of the kinetic data of BB41 adsorption.

Kinetic model	Equation	Reference
Pseudo-first-order	$\log(BB41_{ads\text{-}eq} - BB41_{ads\text{-}t}) = \log(BB41_{ads\text{-}eq}) - (k_1/2.303)\,t$	81
Pseudo-second-order	$(1/\,BB41_{ads\text{-}eq} - BB41_{ads\text{-}t}) = (1/BB41_{ads\text{-}eq}) + k_2\,t$	82
Intraparticle diffusion	$BB41_{ads\text{-}t} = C + k_p\,t^{1/2}$	83,84

The pseudo-first-order model showed in Eq. (1) where k_1 is the pseudo-first-order rate constant (min^{-1}) for the adsorption. $BB41_{ads\text{-}t}$ is the amount of BB41 adsorbed (in µmol) at time t (min) and $BB41_{ads\text{-}eq}$ is the amount adsorbed at equilibrium (in µmol).

$$dBB41_{ads}/dt = k_1(BB41_{ads\text{-}eq} - BB41_{ads\text{-}t}) \tag{1}$$

The integration of Eq. (1) at the initial conditions ($n_{ads} = 0$ at $t = 0$) yields the Eq. (2):

$$\log(BB41_{ads\text{-}eq} - BB41_{ads\text{-}t}) = \log(BB41_{ads\text{-}eq}) - (k_1/2.303)\,t \tag{2}$$

In addition, a pseudo-second-order equation may be expressed by Eq. (3):

$$dBB41_{ads}/dt = k_2(BB41_{ads\text{-}eq} - BB41_{ads\text{-}t})^2 \tag{3}$$

Where k_2 is the pseudo-second-order rate constant ($µmol^{-1}.min^{-1}$) for the adsorption. Applying the initial conditions, Eq. (3) can be integrated to obtain:

$$(1/BB41_{ads\text{-}eq} - BB41_{ads\text{-}t}) = (1/BB41_{ads\text{-}eq}) + k_2.t \tag{4}$$

The influence of the intraparticle diffusion phenomena upon the adsorption capacity of BB41 was verified keeping in mind that the fractional approach to equilibrium change is done according to a function of $(D_t/r^2)^{1/2}$, where r is the radius of adsorbent particle, and D is the effective diffusivity of solute within the particle. Thus, the initial rate according to the intraparticle diffusion model (IPD) is obtained from the liner regression of the curve $BB41_{ads\text{-}t} = f(t^{1/2})$, expressed by the Eq. (5), where k_p is the IPD rate constant ($µmol\ min^{-0.5}$), and C is a constant (µmol) attributed to the extension of the boundary layer thickness.

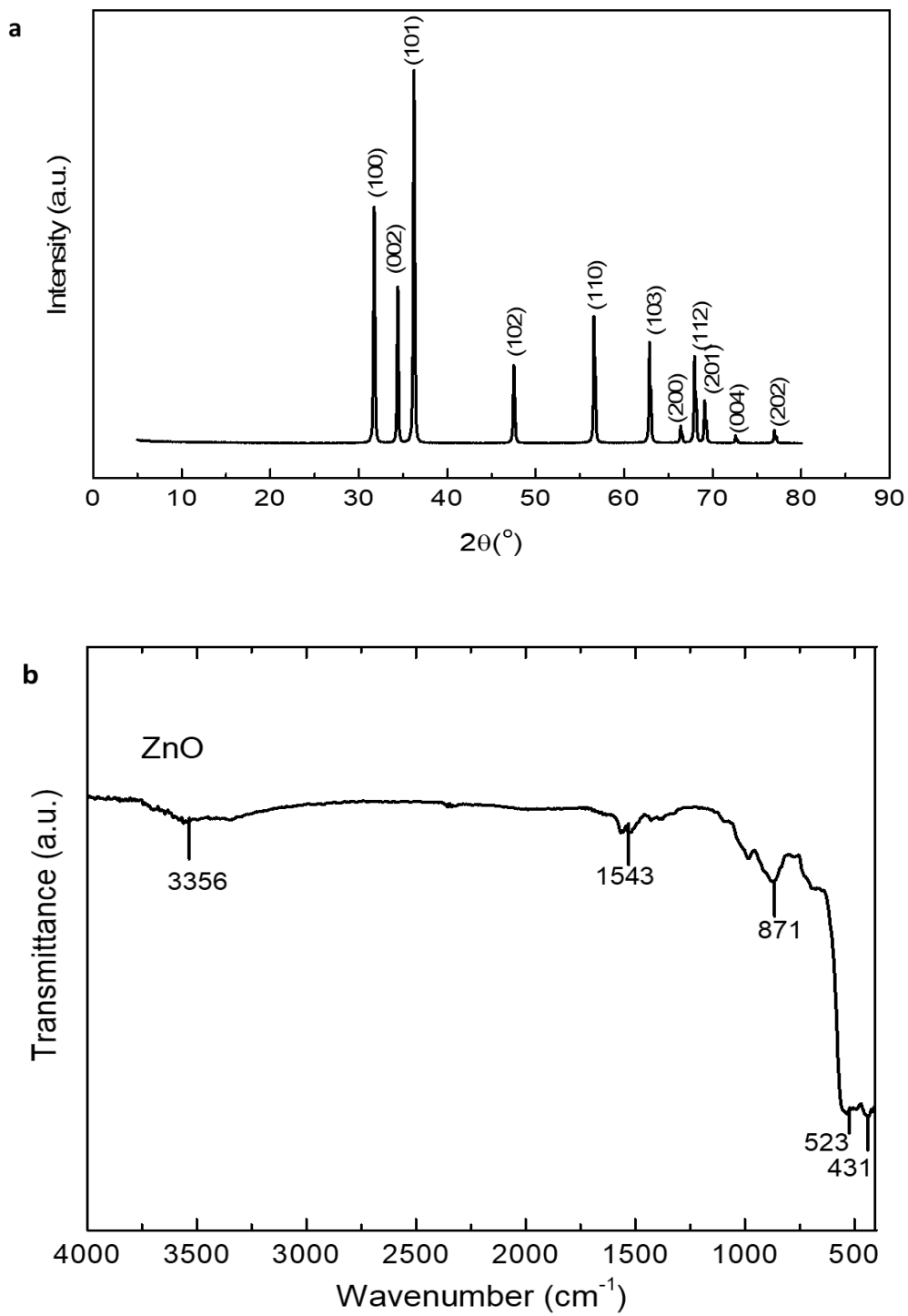$$BB41_{ads\text{-}t} = C + k_p\,t^{1/2} \tag{5}$$

Figure S1. Characterization of commercial ZnO. (a): XRD pattern. (b): FTIR spectra.
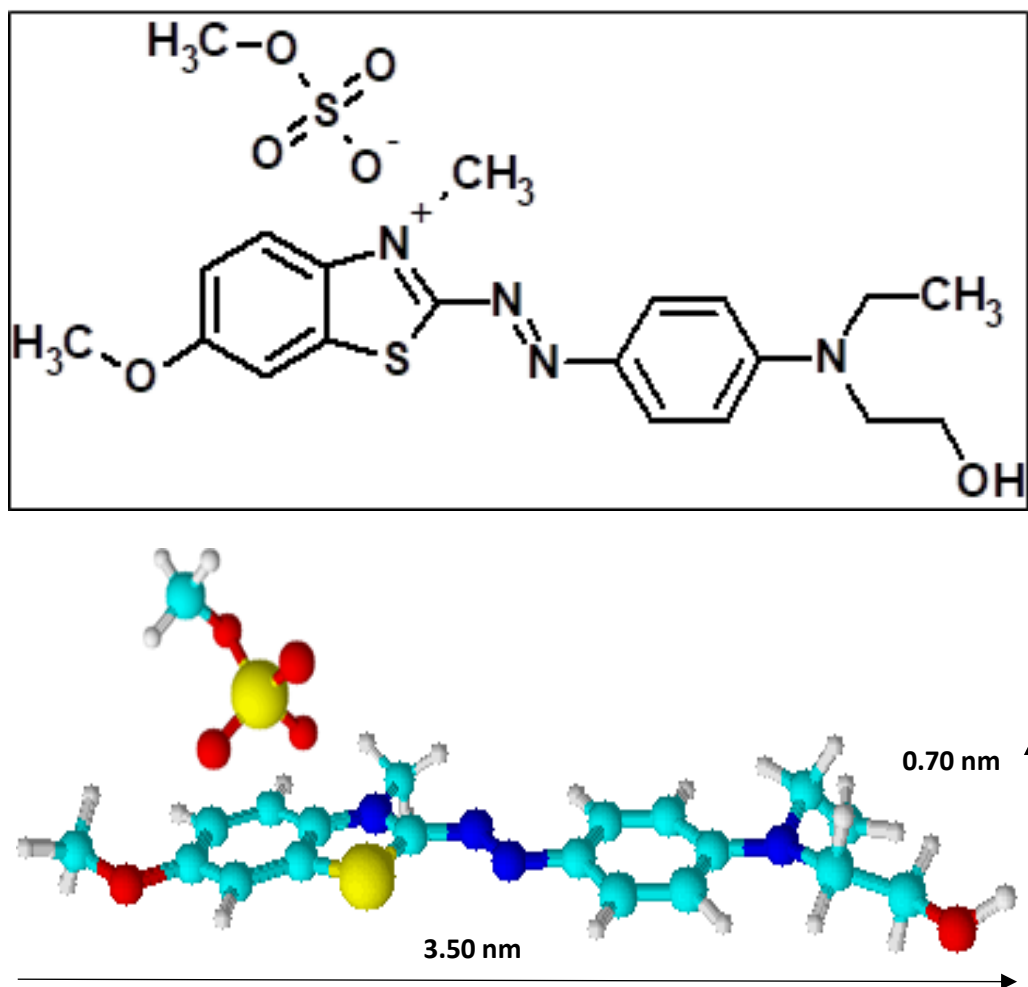
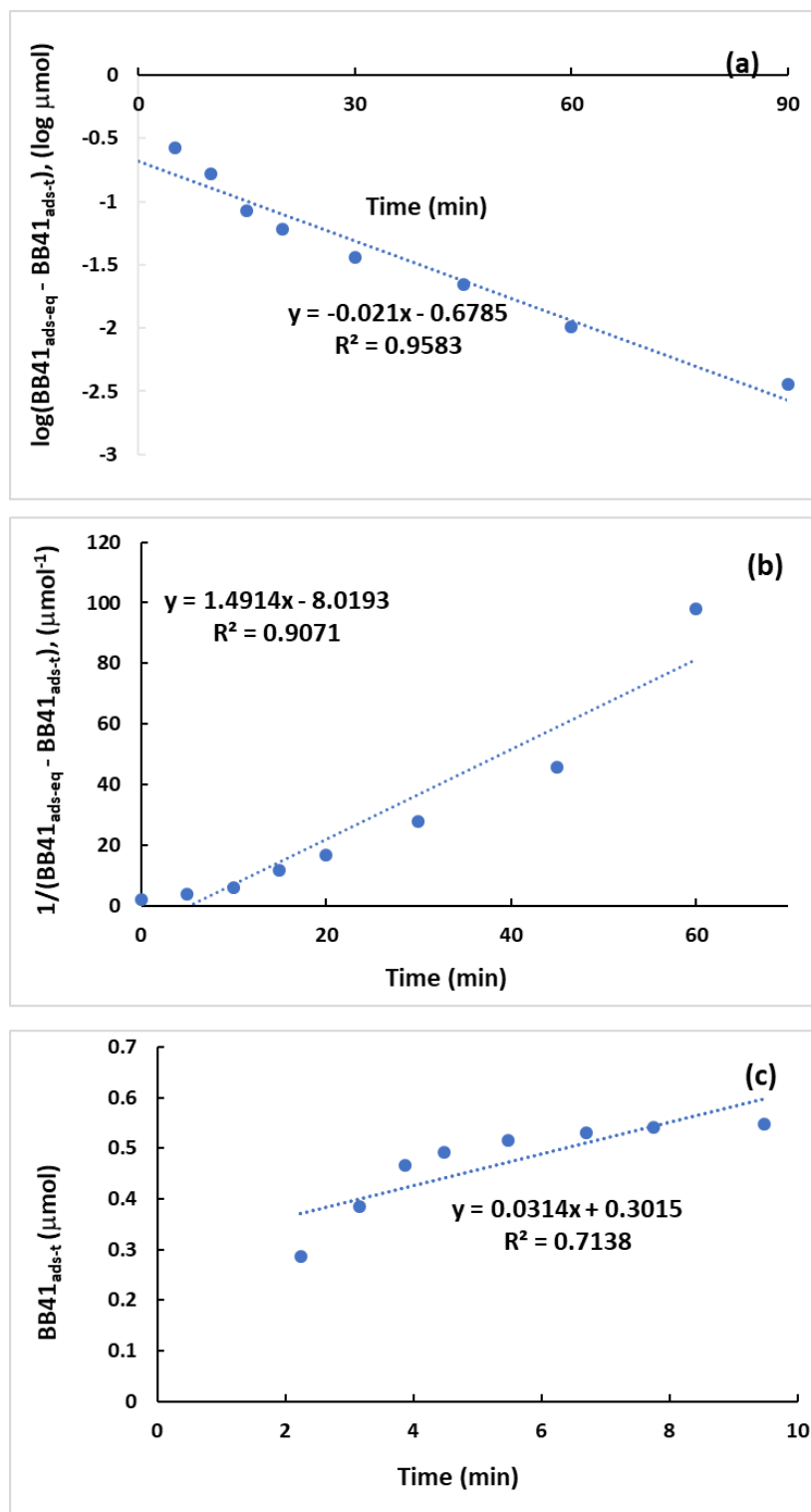**Figure S2.** Molecular structure of basic blue 41.

Figure S3. Kinetic treatment of the data of BB41 adsorption on C-amorphous. (a): Pseudo-first order. (b): Pseudo-second order. (c): IPD model.
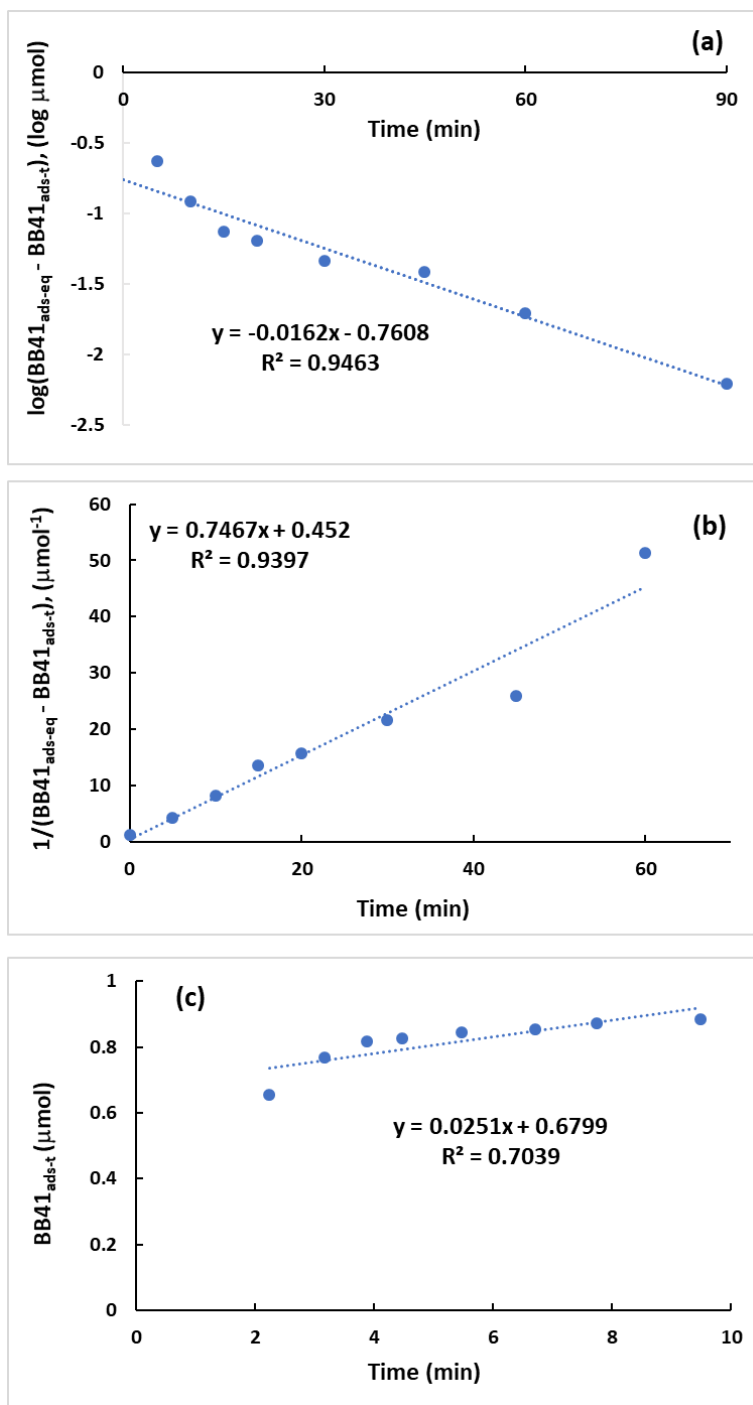
Figure S4. Kinetic treatment of the data of BB41 adsorption on C/Zn. (a): Pseudo-first order. (b): Pseudo-second order. (c): IPD model.
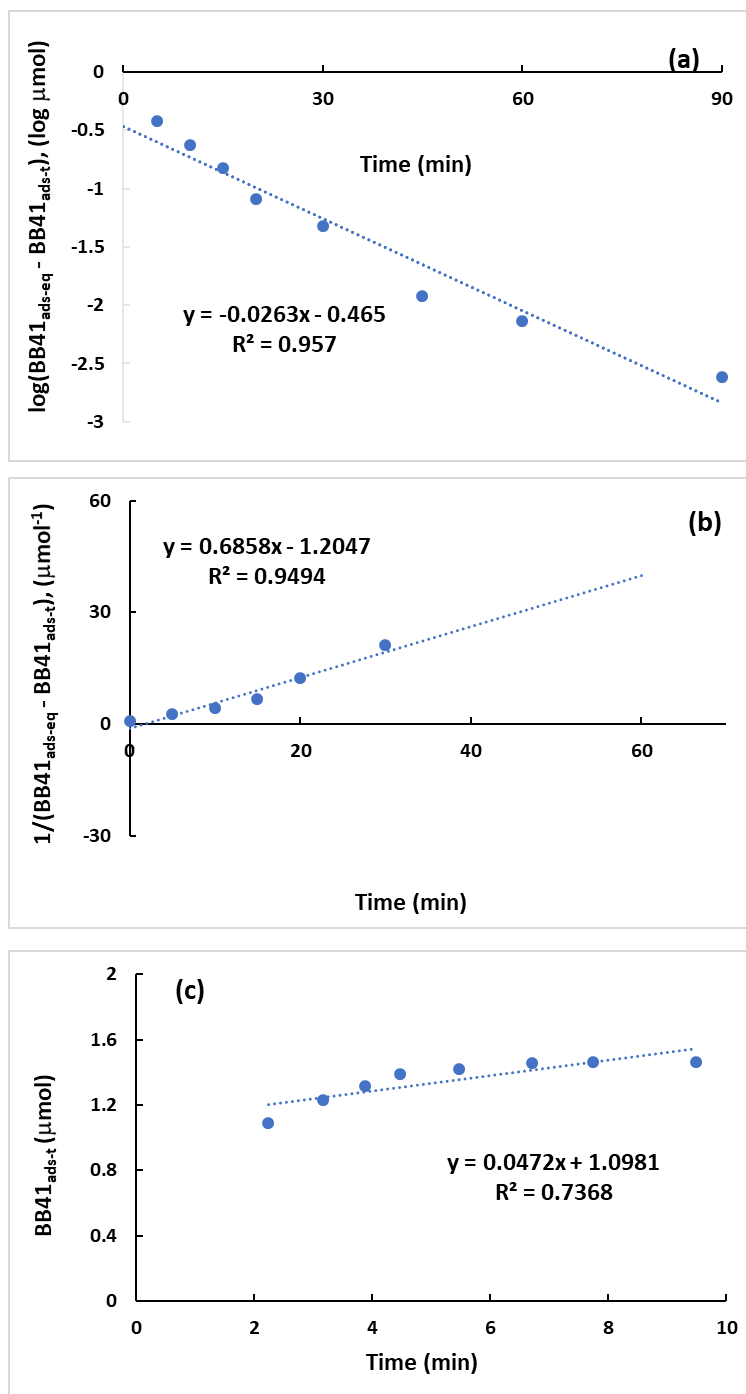
Figure S5. Kinetic treatment of the data of BB41 adsorption on C/ZnO/Zn. (a): Pseudo-first order. (b): Pseudo-second order. (c): IPD model.
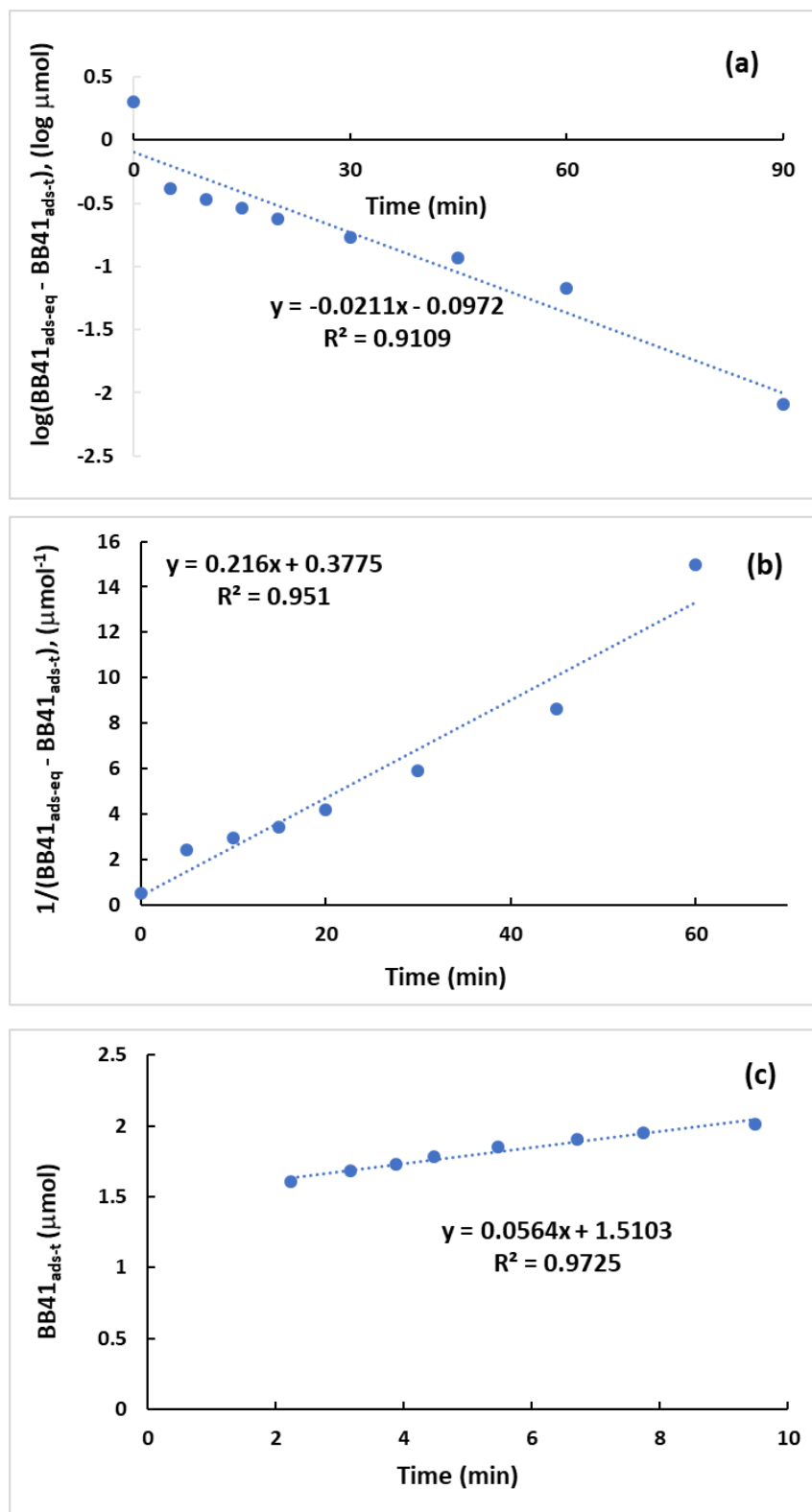
Figure S6. Kinetic treatment of the data of BB41 adsorption on ZnO. (a): Pseudo-first order. (b): Pseudo-second order. (c): IPD model.