Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Dual adsorbent-photocatalytic Keratin-TiO_2 nanocomposite for trimethoprim removal from wastewater.

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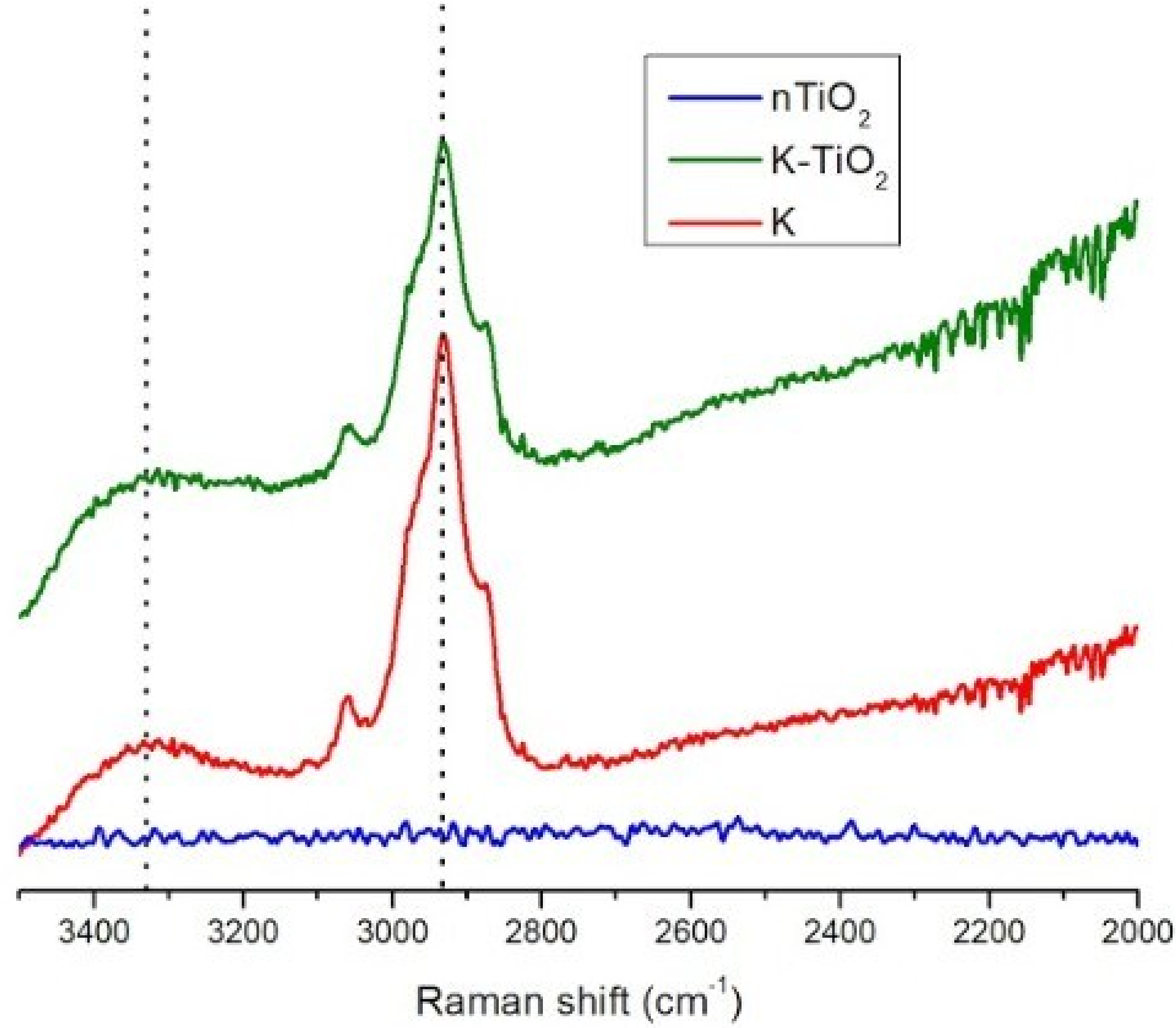

Figure S1. FT-Raman spectra of $nTiO_2$, K and K-TiO_2 10%.

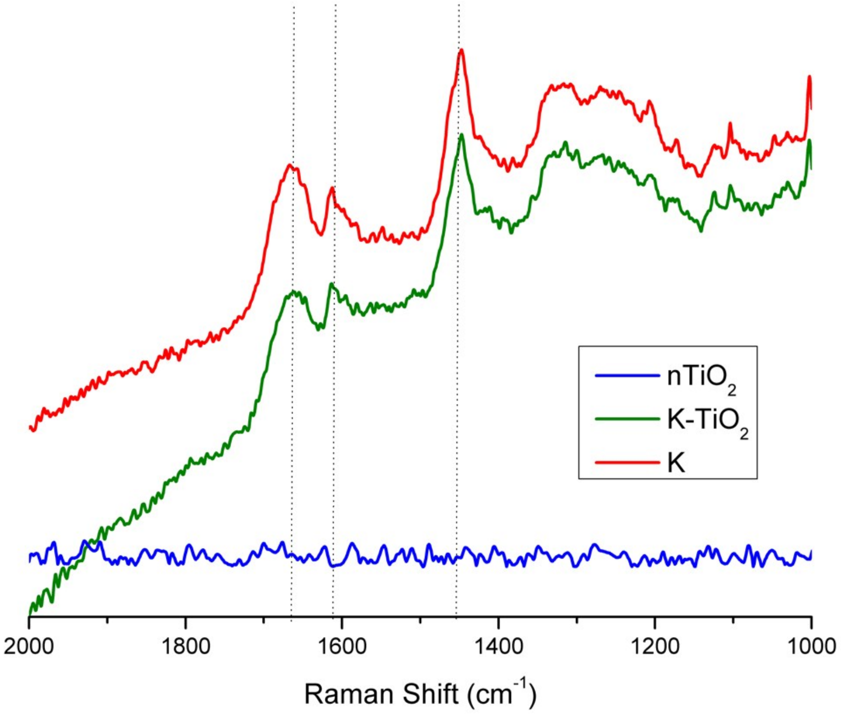

Figure S2. FT-Raman spectra of nTiO$_2$, K and K-TiO$_2$ 10%.

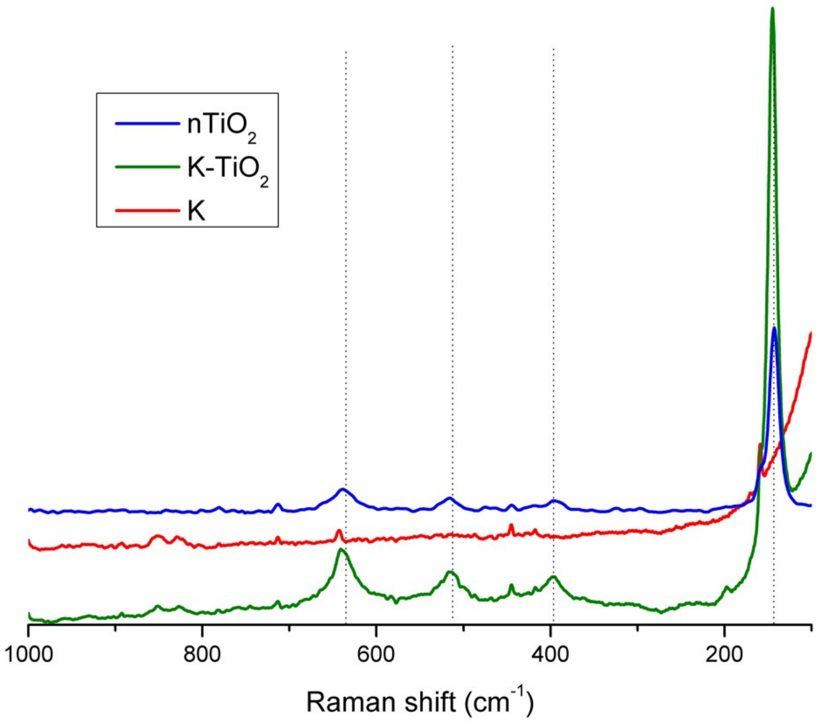

Figure S3. FT-Raman spectra of nTiO$_2$, K and K-TiO$_2$ 10%.

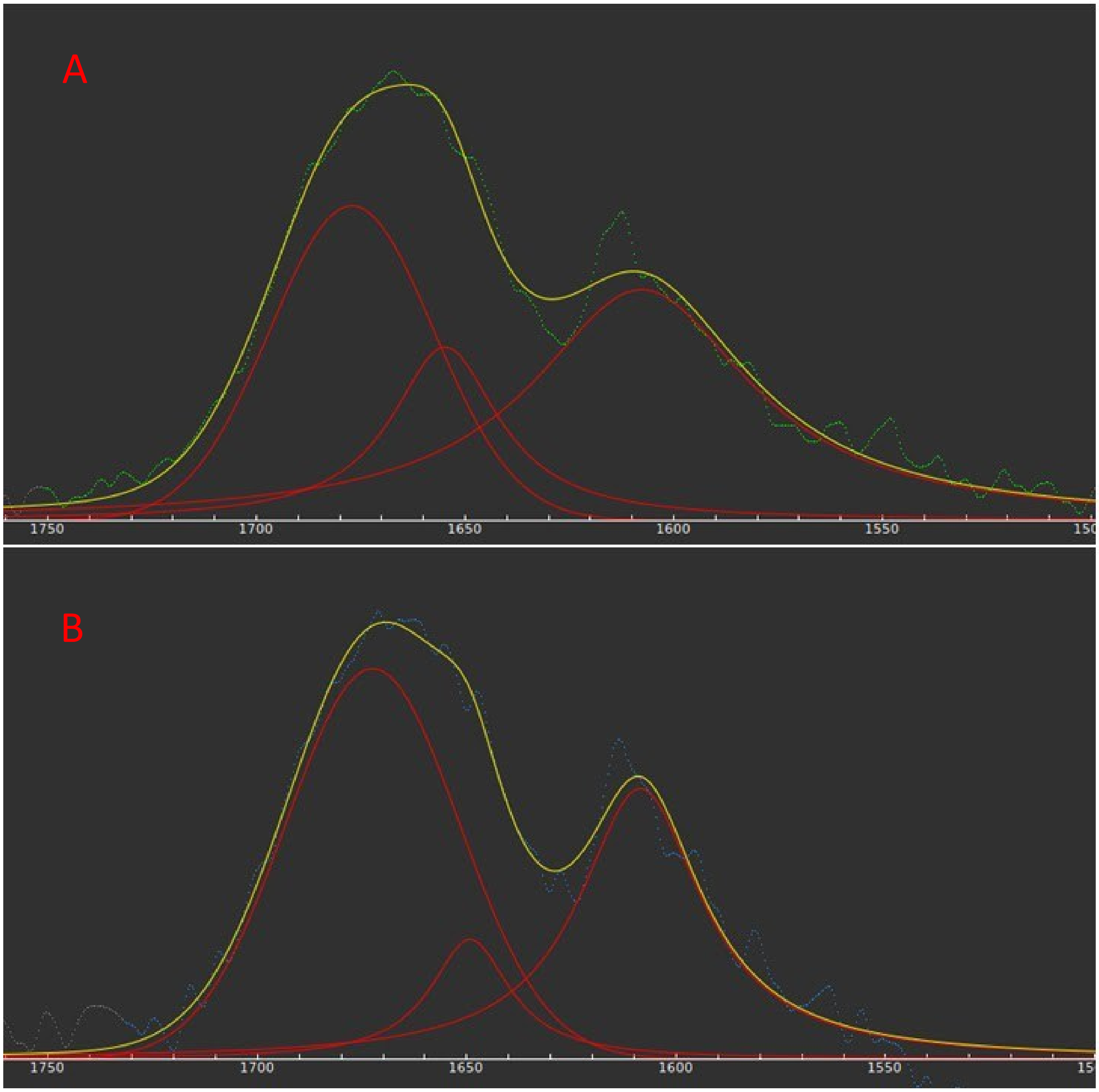

Figure S4. Deconvolution of amide I band in A) K and B) K-TiO_2 10 %

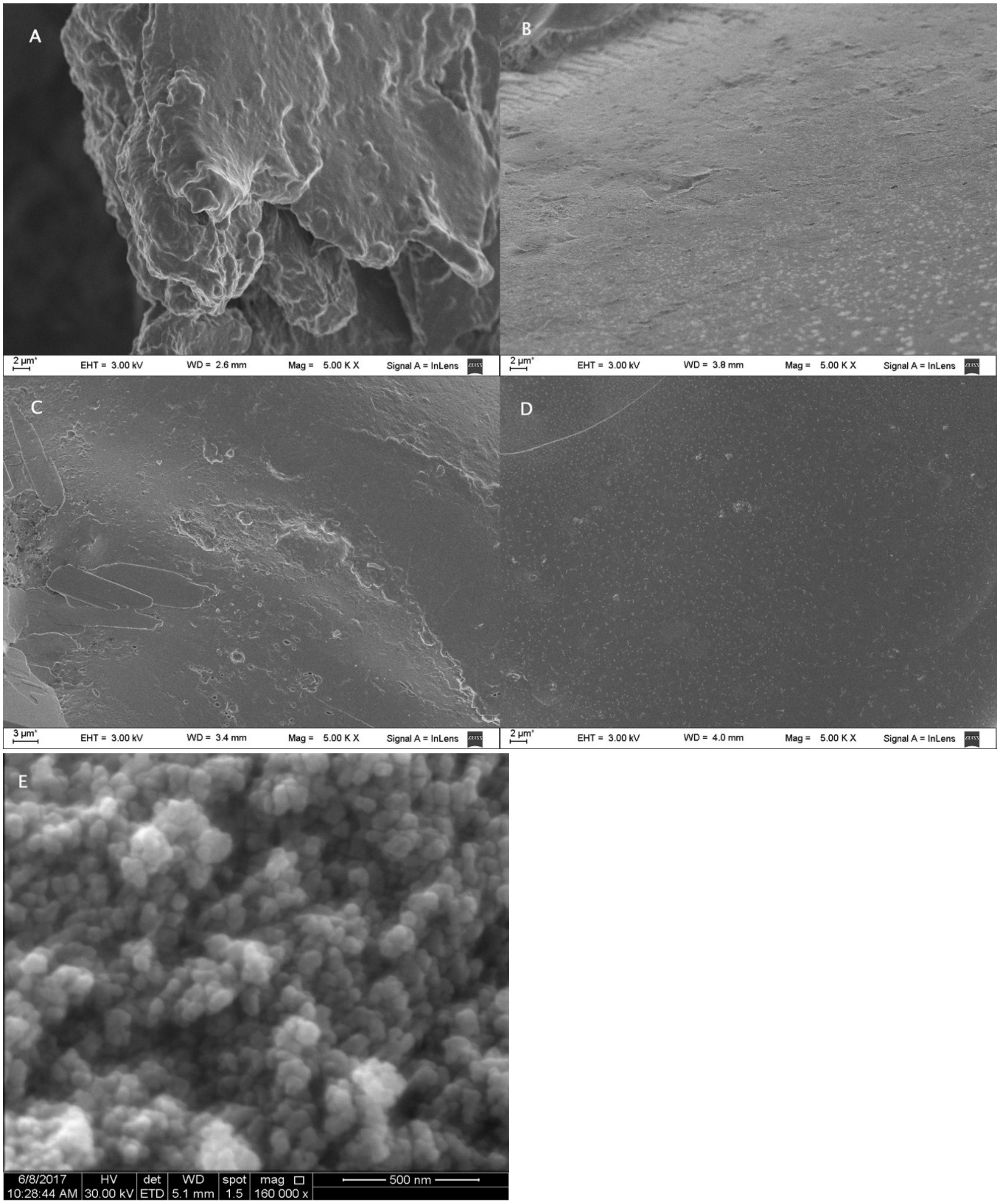

Figure S5. SEM Images of A: K, B: K-TiO_2 1%, C:K-TiO_2 5% and D: K-TiO_2 10%, E:nTiO_2

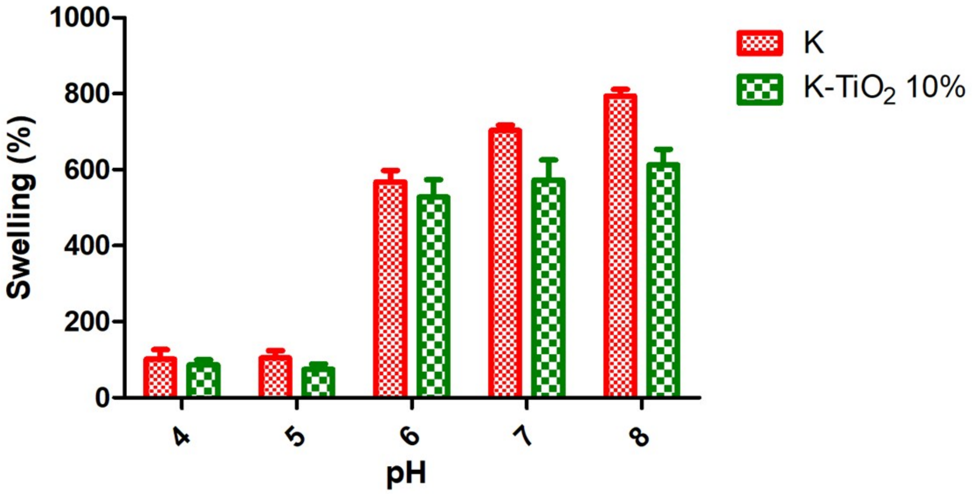

Figure S6. Swelling (%) of K and K-TiO_2 10% at different pH values.

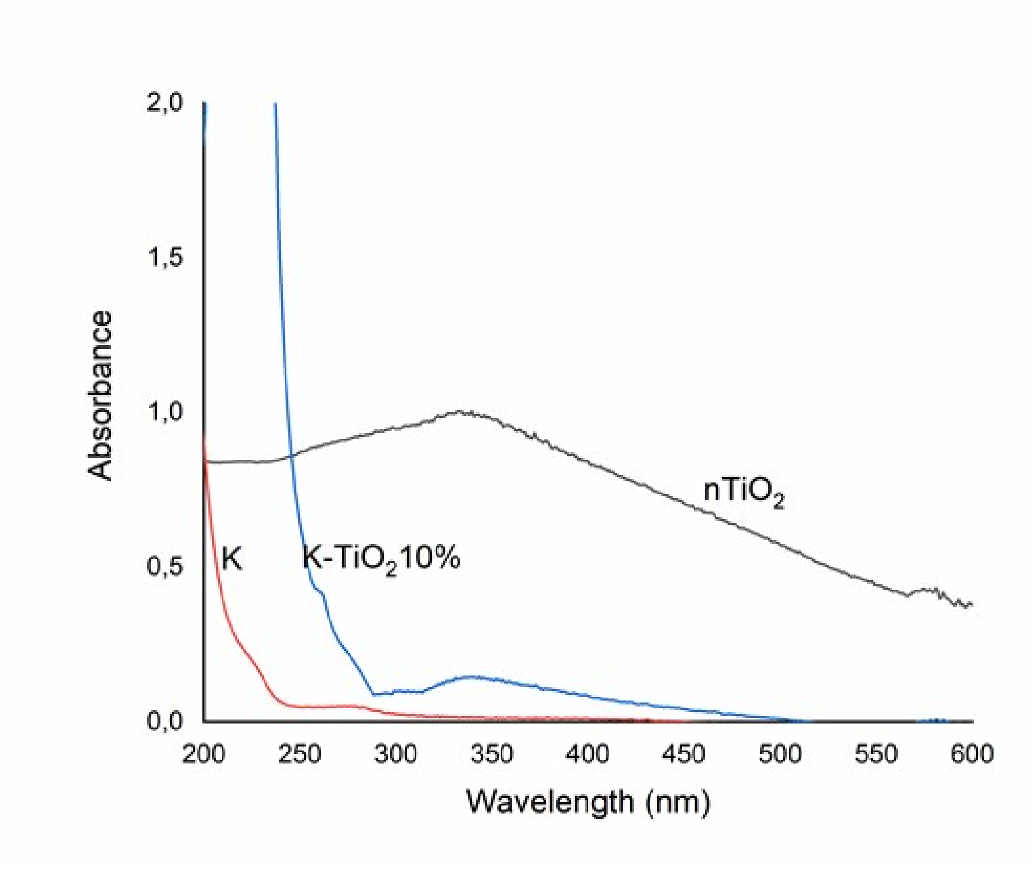

Figure S7. UV-Vis spectra of $nTiO_2$, K and –TiO_2 10%

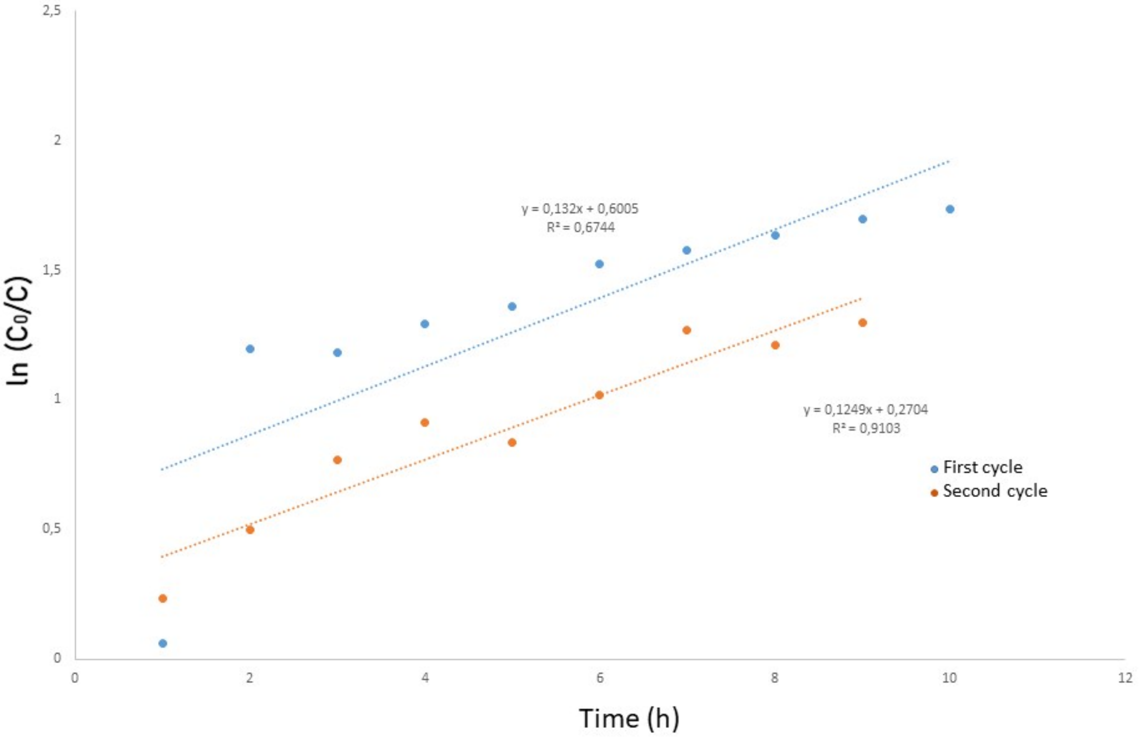

Figure S8. Degradation kinetics of Trimethoprim with K-TiO_2 10%the first and the second cycle; showing apparent rate constants (slope = k_{app}) and regression coefficients (R^2).

Kinetic model

The Langmuir-Hinshelwood (L–H) kinetics model is often used to describe the photocatalytic degradation of pollutants (Eq.1)[1,2]

$$r = \frac{dC}{dt} = \frac{kKC}{1+KC} \qquad (1)$$

where r is the degradation rate of the reactant, C the trimethoprim concentration, t the illumination time, k the reaction rate constant, and K is the adsorption coefficient of the reactant.

If the initial Trimethoprim concentration (C_o) is a milimolar solution the equation can be simplified to an apparent first-order equation (Eq 2):

$$\ln\frac{C_0}{C} = kKt = k_{\text{app}}\, t \qquad (2)$$

The graphic of ln C_o/C versus time represents a linear function which slope is the apparent first - order rate constant k_{app}.

The L-H model was designed to explain the dependence of the reaction rate with the initial pollutant concentration. The L-H expressions are useful to describe the photocatalysis in any of the following four situations: (a) the reaction occurs when both the radicals and the pollutant are adsorbed to the surface, (b) the reaction takes place between a radical attached to the surface and the pollutant molecule is in the solution, (c) the reaction happen when the pollutant molecule is linked to the catalyst and the radical is in the solution and (d) the reaction occurs when both species are in solution. In all the situations, the rate equation is similar to that derived from the L–H model, which has been useful to describe the process, although it is not possible to find out whether the process occurs on the surface, in the solution or at the interface.

1 M. E. Villanueva, G. J. Copello and V. C. Dall'Orto, *New J. Chem.*, 2018, **42**, 15405–15412.
2 N. Guettaï and H. Ait Amar, *Desalination Environ.*, 2005, **185**, 439–448.