Supplementary materials

**Synergistic effect of a spinel ferrite on the adsorption capacity of nano bio-silica for the removal of methylene blue**

Sunday Joseph Olusegun1\*, Erico Tadeu Fraga Freitas2, Luciano Roni Silva Lara1, Nelcy Della Santina Mohallem1\*\*

*1Universidade Federal de Minas Gerais, Departamento de Química, Laboratório de Materiais Nanoestruturados,Belo Horizonte, Brazil*

*2Universidade Federal de Minas Gerais, Centro de Microscopia, 31.270-901, Belo Horizonte, Brazil*

*E-mail: \**[arewasegun@gmail.com](mailto:arewasegun@gmail.com), \*\*nelcy@ufmg.br

**Kinetic studies**

Equations that define these models are listed below; pseudo-first order (S1), pseudo-second order (S2) and Elovich (S3).

S1

S2

S3

where and are the initial adsorption rate (mg g-1 min-1) and extent of surface coverage (g mg-1) respectively. And and are amount of MB adsorbed at time ‘t’ and at equilibrium time respectively, andare the rate constant of pseudo-first order and second order kinetic models respectively.

**Adsorption isotherm**

Equation S4 (Langmuir) and equation S5 (Freundlich).

S4

S5

In these equations, stands for the equilibrium concentration in bulk solution (mg L-1), is the amount of methylene blue that was adsorbed (mg g-1), is the maximum adsorption capacity (mg g-1) of the adsorbent, is equilibrium constant of Langmuir (L g-1), is the Freundlich constant (mg g-1 (mg L-1)-1/nF ), is the dimensionless exponent of Freundlich.

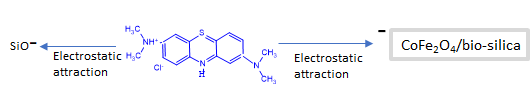
The nature of adsorption was determined by using the linear form of Dubinin–Radushkevich (D–R) isotherm in equations below.

S6

S7

S8

The parameters in the equations are defined as follow: is D-R adsorption capacity (mg g-1), is D-R constant ( J-2), ε Polanyi potential, E is the mean energy of adsorption (kJ mol-1), R is gas constant (J mol-1 K-1), T is temperature (K). Mean energy of adsorption was evaluated from the slope of the plot of versus (Fig. **S2**).



**Fig. S1:** Electrostatic attraction between MB and the adsorbents.

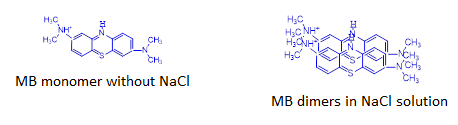




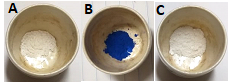
**Fig. S2.** D-R isotherm for the adsorption of MB on BSIL, SCOF100 and SCOF 700.



**Fig. S3.** Effect of ionic strength on the adsorption of MB on SIL and SCOF.



**Fig. S4.** Monomer and dimers molecules of MB.



**Fig. S5**: Pictures of BSIL before adsorption (A), after adsorption (B) and after MB-loaded BSIL was calcined.