**Supplementary Materials**

**Table 1S.** Specification of MB and BF dyes and their λmax by UV-VIS detection.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Dye** | **Chemical formula** | **Molecular weight** | **Color index** | **λmax** |
| **Methylene blue** | C16H18ClN3S | 319.85 g/mol | 52015 | 665 nm |
| **Basic fuchsin**  Diagram, engineering drawing  Description automatically generated | C20H20N3·HCl | 337.86 g/mol | 42500 | 545 nm |

**Table 2S.** Various investigated kinetic isotherm models for removal of MB and BF by BCCW-NB nanobiosorbent

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| --- | --- | --- | --- |
| **Kinetic model** | **Linear form** | **Parameter definition** | **Plot** |
| Pseudo-first order | ln (qe – qt ) = ln qe – k1t | qe and qt are the adsorbed amount of MB and BF dyes (mg g-1) at equilibrium and at time t (min), respectively, k1 is pseudo-first order rate constant (min−1). | ln(qe−qt) vs. the time (t) |
| Pseudo-second order | t ⁄ qt = 1 ⁄ k2qe2 + t ⁄ qe | qe and qt are the adsorbed amount of MB and BF dyes (mg g-1) at equilibrium and at time t (min), respectively, k2 stands for the second order rate constant of adsorption (g/(mg min) | t/qt vs. time (t), |
| The intra-particle diffusion | qt = kid t ½  + C | kid is the intraparticle diffusion rate constant (mg g−1 min−1/2 ). C is the thickness of the boundary laye (mg g−1) | (qt) vs. (t1/2) |
| The Elovich |  | α is for the initial rate of adsorption (mg g−1 min) and β is the activation energy of chemisorption and surface coverage | qt vs. ln t |
| The Boyd | B t = - 0.4977 – ln (1 – F)  F = q t / q e | qe and qt is mass of MB and BF dyes adsorbed at quilibrium and at time t (mg/g), F for the fraction of solute adsorbed at time t, and Bt  is the mathematical function of F | Bt were plotted vs. time t |

**Table 3S.** Various investigated isotherm models using in adsorption of MB and BF by BCCW-NB nanobiosorbent

|  |  |  |  |
| --- | --- | --- | --- |
| Adsorption model | Linear form | Parameter definition | Plot |
| Langmuir | **Separation factor**:  RL = 1 ⁄ 1+bCₒ  Unfavorable if (RL>1), favorable (0< RL<1), linear (RL = 1) or irreversible (RL=0) | Co and Ce is for to the initial and equilibrium concentrations (mg L−1), respectively. qe is the adsorbed dye quantity (mg g−1) at equilibrium. qmax (mg g−1) and b (L mg−1) are the maximum capacity of adsorption and Langmuir constants | Ce/qe vs. Ce |
| Freundlich |  | qe is the amount of adsorbed solute and Ce is for the equilibrium solute concentration. KF (mg g−1) is Freundlich constant, n is the intensity of the adsorbents. | log qe vs. log Ce |
| Temkin | qe = (RT ⁄ bT ) ln aT + (RT ⁄bT) ln ce  qe = B ln at + B ln Ce  B = | bT (mg L−1) is the Temkin isotherm constant, aT (L g−1) is the Temkin isotherm equilibrium binding constant and B is for a constant which expresses the adsorption heat (J/mol) | qe vs. ln Ce |
| Dubinin–Radushkevich (D–R) | ln qe = ln qs – ( Kad Ɛ2 )  Ԑ =RT ln (1 + 1⁄Ce) | qs (mg g−1) is for the saturation capacity, Kad denotes the D–R isotherm constant that is for the mean adsorption free energy per mole of adsorbate (mol2/kJ2). Ԑ is for the Polanyi potential, R is the universal gas constant (8.314 J/mol K−1) and T absolute temp. Kelvin | ln qe versus ε2 |
| Scatchard | (qe / Ce ) = Q ⃘b – qe b | qe and Ce are the equilibrium adsorption capacity of the adsorbent and equilibrium concentration respectively, Qo and b are adsorption isotherm parameters | ( qe / Ce ) verses qe |