**Green synthesis of loofah-based biosorbent via radiation**

**grafting for effective removal of methylene blue**

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Supporting information

Table S1: Elemental analysis of LFs and LFs-PSSS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Materials | [Element](javascript:;) [content](javascript:;) (%) | | | |
| C | H | N | S |
| raw-LFs | 44.19 | 4.82 | 17.25 | 20.36 |
| LFs | 43.24 | 5.79 | 0.09 | 0.14 |
| LFs-PSSS | 52.93 | 6.27 | 0.00 | 0.08 |

Table S2. Mathematical equations using in kinetic and diffusion data analysis.

|  |  |  |  |
| --- | --- | --- | --- |
| Kinetic model | Equations | Linear form | Equ No. |
| Pseudo-first-order |  |  | (7) |
| Pseudo-second-order |  |  | (8) |
| Weber-Morris |  |  | (9) |

where *q*t and *q*e (mg/g-1) stand for MB adsorbtion capacity at time *t* and equilibrium, separately; *k*1 (min-1) and *k*2 (g·mg−1·min-1) represent equilibrium constants for pseudo-first-order as well as pseudo-second-order models, separately; *C* indicates boundary layer thickness, and *k*id (mg·g−1 ·min−1/2) denotes the rate constant for Weber–Morris models (Li et al., 2021).

Table S3: Parameters of MB intra-particle diffusion model onto LFs-PSSS under various temperatures (pH = 7, *C*0 = 400 mg/L).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameters | | Temperature (K) | | |
| 298.15 | 308.15 | 318.15 |
| Part 1 | *k*1d(mg.g-1.min-1/2) | 14.87 | 13.56 | 10.82 |
| *C*1(mg/g) | 88.46 | 124.93 | 195.09 |
| *R*2 | 0.9999 | 0.9847 | 0.9993 |
| Part 2 | *k*2d(mg.g-1.min-1/2) | 13.96 | 12.89 | 8.31 |
| *C*2(mg/g) | 90.08 | 112.90 | 222.53 |
| *R*2 | 0.9901 | 0.9855 | 0.9489 |
| Part 3 | *k*3d(mg.g-1.min-1/2) | 1.34 | 1.40 | 0.47 |
| *C*3(mg/g) | 303.04 | 315.33 | 358.06 |
| *R*2 | 0.9359 | 0.3689 | 0.6348 |

Table S4: The atomic percentage beofore and after adsorption by XPS

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Materials | [Element](javascript:;) [content](javascript:;) (%) | | | | |
| C | O | N | S | Na |
| LFs-PSSS | 60.54 | 35.76 | 0.04 | 1.11 | 1.5 |
| LFs-PSSS-MB | 64.48 | 28.58 | 3.22 | 1.72 | 0 |

**XRD**

Fig.S1 X-ray powder diffraction (XRD) patterns of LFs, LFs-PSSS, and LFs-PSSS-MB.

**IR-LFS-PSSS-MB**

Fig.S2. FT-IR spectra of LFs-PSSS and LFs-PSSS/MB.

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Fig.S3 Adsorption capacity of MB and other dyes. (*T*=298.15K, *C*0=300 mg/L).

**References**

Li, S.Y., Teng, H.J., Guo, J.Z., Wang, Y.X., Li, B., 2021. Enhanced removal of Cr(VI) by nitrogen-doped hydrochar prepared from bamboo and ammonium chloride. Bioresour. Technol. 342, 126028. <https://doi.org/10.1016/j.biortech.2021.126028>