**Supplementary Material**

**Nitrogen-modified nanoporous activated carbon from eucalyptus leaves for ultrasound-assisted removal of basic dyes using derivative spectrophotometric method**

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Fig. S-1. FTIR spectra of (a) nanoporous AC, (b) oxidized AC and (c) nitrogen-modified AC.



Fig. S-2. Final pH versus initial pH plots for pristine, oxidized and nitrogen modified AC samples.



Fig. S-3. Effect of initial dye concentration on the adsorption of BY13 and BR46 dyes onto NOAC (Conditions: 100 mL of 150 mg L-1 dyes solution, pH=9, *m*=30 mg, *t*= 8 min, *T*=25 ºC).





Fig. S-4. Effect of solvent type and concentration on the desorption of (a) BY13 and (b) BR46 dyes from loaded NAC (desorption solvent volume 100 mL, spent NOAC 30 mg, *t*=8 min, *T*=25 ºC).

TABLE S-1. Chemical structure and properties of basic dyes used in this study.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Chemical structure | Commercial name | C. I. number | *λmax* | Molecular weigth, g mol-1 |
| C:\Users\lenovo\Desktop\Basic-Red-46.gif | Basic Red 46 | 110825 | 530 | 401.3 |
| C:\Users\lenovo\Desktop\Basic-Yellow-13.gif | Basic Yellow 13 | 48056 | 411 | 342.86 |

TABLE S-2. Initial dye concentrations in single and binary systems.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Single system |  | Binary System (1) |  | Binary System (2) |
| *C0, BR46* /mg L-1 | *C0, BY13* /mg L-1 |  | *C0, BR46 /*mg L-1 | *C0, BY13* /mg L-1 |  | *C0, BR46* /mg L-1 | *C0, BY13* /mg L-1 |
| 200-400 | 200-400 |  | 1. 150-350
2. 150
 | 1. 150
2. 150-350
 |  | 150-350 | 150-350 |

TABLE S-III. Determination of percentage recovery and error values for BR46 and BY13 in binary mixture by zero and first order derivative spectra methods.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Error, % |  | Recovery, % |  | *Cm*/ mg L-1 |  | *Ct* / mg L-1 |
| CBR | CBY |  | CBR | CBY |  | CBR | CBY |  | CBR | CBY |
| +1.20 | -3.40 |  | 101.20 | 96.60 |  | 5.06 | 4.83 |  | 5 | 5 |
| +2.5 | -2.75 |  | 102.50 | 97.25 |  | 8.20 | 7.78 |  | 8 | 8 |
| -3.50 | +2.00 |  | 96.50 | 102.00 |  | 9.65 | 10.20 |  | 10 | 10 |
| -2.00 | -1.20 |  | 98.00 | 101.20 |  | 14.70 | 15.18 |  | 15 | 15 |
| -3.33 | -4.22 |  | 96.67 | 95.78 |  | 17.40 | 17.24 |  | 18 | 18 |
| +1.90 | +1.25 |  | 101.90 | 101.25 |  | 20.38 | 20.25 |  | 20 | 20 |

TABLE S-IV.RL values for BY13 and BR46 dyes in single and binary solutions.

|  |  |  |
| --- | --- | --- |
| *C0* / mg L-1 | *RL*of BY13 | *RL*of BR46 |
| Single | Binary | Single | Binary |
| 150 | ----- | 0.020 | ----- | 0.020 |
| 200 | 0.026 | 0.015 | 0.026 | 0.014 |
| 250 | 0.021 | 0.012 | 0.020 | 0.011 |
| 300 | 0.018 | 0.010 | 0.017 | 0.009 |
| 350 | 0.015 | 0.008 | 0.015 | 0.008 |
| 400 | 0.013 | ----- | 0.013 | ----- |