**Supplementary Material**

**Adsorption performance and stability of the modified straws and their extracts of cellulose, lignin, and hemicellulose for Pb2+: pH effect**

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Table S1

Fitted parameters of Pb2+ adsorption on unmodified and modified rape straw and the extracted cellulose, lignin, and hemi[cellulose](javascript:void(0);).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Langmuir model | |  | |  | Freundlich model | | | | | |  | | |  | Temkin model | |  | | |
| Absorbent | *1/KL* | | *qm* | *R2* | | | | *KF* | | *1/n* | | *R2* | | | *AT* | | *bT* | *R2* | |
| (L mg-1) | | (mg g-1) | |  | | | (mg1-1/nL1/n g-1) | | |  |  | | (L mg-1) | | | (g mg-1) |  | |
| Rape straw | 28.32 | | 54.37 | | 0.9391 | | | 1.46 | 7.24 | | | 0.7459 | | | | 0.46 | 192.62 | 0.8734 | | |
| Modified rape straw | 2.81 | | 182.15 | | 0.8092 | | | 1.16 | 93.67 | | | 0.8101 | | | | 33.76 | 109.01 | 0.8636 | | |
| Rape hemicellulose | 5.62 | | 104.25 | | 0.9908 | | | 1.23 | 39.87 | | | 0.8443 | | | | 4.44 | 146.68 | 0.9173 | | |
| Modified rape hemicellulose | 0.78 | | 320.46 | | 0.9673 | | | 1.19 | 167.46 | | | 0.8722 | | | | 60.86 | 60.92 | 0.9547 | | |
| Rape lignin | 23.69 | | 82.08 | | 0.9716 | | | 1.42 | 12.74 | | | 0.8160 | | | | 0.37 | 134.36 | 0.9172 | | |
| Modified rape lignin | 3.71 | | 172.31 | | 0.9506 | | | 1.19 | 79.21 | | | 0.8094 | | | | 1.44 | 105.49 | 0.8599 | | |
| Rape cellulose | 5.02 | | 29.43 | | 0.9951 | | | 1.14 | 15.48 | | | 0.7493 | | | | 44.57 | 739.99 | 0.8012 | | |
| Modified rape cellulose | 3.49 | | 122.79 | | 0.9747 | | | 1.16 | 60.82 | | | 0.9310 | | | | 1.36 | 158.20 | 0.9583 | | |

Table S2

Fitted parameters of Pb2+ adsorption on unmodified and modified maize and the extracted cellulose, lignin, and hemi[cellulose](javascript:void(0);).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Langmuir model | |  | |  | Freundlich model | | | | | |  | | |  | Temkin model | |  | | |
| Absorbent | *1/KL* | | *qm* | *R2* | | | | *KF* | | *1/n* | | *R2* | | | *AT* | | *bT* | *R2* | |
| (L mg-1) | | (mg g-1) | |  | | | (mg1-1/nL1/n g-1) | | |  |  | | (L mg-1) | | | (g mg-1) |  | |
| Maize straw | 2.49 | | 47.58 | | 0.9982 | | | | 1.11 | 29.26 | | 0.7721 | | | | 373.30 | 549.66 | 0.8186 | | |
| Modified maize straw | 1.76 | | 174.53 | | 0.9913 | | | | 1.16 | 89.89 | | 0.8062 | | | | 34.86 | 110.03 | 0.8872 | | |
| Maize hemicellulose | 4.48 | | 69.68 | | 0.9894 | | | | 1.19 | 30.51 | | 0.7823 | | | | 9.47 | 247.16 | 0.8573 | | |
| Modified maize hemicellulose | 3.15 | | 292.68 | | 0.9845 | | | | 1.25 | 108.59 | | 0.7995 | | | | 6.77 | 53.51 | 0.9021 | | |
| Maize lignin | 7.86 | | 66.61 | | 0.9633 | | | | 1.21 | 25.86 | | 0.6843 | | | | 2.03 | 239.28 | 0.7540 | | |
| Modified maize lignin | 5.41 | | 211.88 | | 0.9922 | | | | 1.23 | 78.93 | | 0.8671 | | | | 1.93 | 72.87 | 0.9367 | | |
| Maize cellulose | 13.59 | | 32.68 | | 0.9737 | | | | 1.27 | 9.28 | | 0.7799 | | | | 243.57 | 413.85 | 0.8516 | | |
| Modified maize cellulose | 1.33 | | 143.85 | | 0.9873 | | | | 1.09 | 94.10 | | 0.9190 | | | | 1.15 | 195.50 | 0.9461 | | |

Table S3

Fitted parameters of Pb2+ adsorption on unmodified and modifiedcotton and the extracted cellulose, lignin, and hemi[cellulose](javascript:void(0);).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Langmuir model | |  | |  | Freundlich model | | | | | |  | | |  | Temkin model | |  | | |
| Absorbent | *1/KL* | | *qm* | *R2* | | | | *KF* | | *1/n* | | *R2* | | | *AT* | | *bT* | *R2* | |
| (L mg-1) | | (mg g-1) | |  | | | (mg1-1/nL1/n g-1) | | |  |  | | (L mg-1) | | | (g mg-1) |  | |
| Cotton straw | 16.24 | | 58.41 | | 0.9804 | | | 1.36 | 11.83 | | | 0.8676 | | | | 0.69 | 208.14 | 0.9333 | | |
| Modified cotton straw | 1.51 | | 156.99 | | 0.8871 | | | 1.15 | 87.64 | | | 0.8257 | | | | 124.47 | 142.06 | 0.8652 | | |
| Cotton hemicellulose | 11.57 | | 76.07 | | 0.9723 | | | 1.32 | 18.59 | | | 0.7782 | | | | 0.96 | 162.45 | 0.8864 | | |
| Modified cotton hemicellulose | 2.33 | | 257.18 | | 0.9812 | | | 1.21 | 107.27 | | | 0.7343 | | | | 9.74 | 63.34 | 0.8436 | | |
| Cotton lignin | 19.71 | | 73.59 | | 0.9696 | | | 1.39 | 13.62 | | | 0.9417 | | | | 0.13 | 167.38 | 0.9532 | | |
| Modified cotton lignin | 1.88 | | 199.31 | | 0.9750 | | | 1.16 | 104.63 | | | 0.8799 | | | | 1.30 | 100.04 | 0.9311 | | |
| Cotton cellulose | 11.31 | | 38.26 | | 0.9616 | | | 1.27 | 11.35 | | | 0.9587 | | | | 6.13 | 369.44 | 0.9555 | | |
| Modified cotton cellulose | 1.79 | | 160.00 | | 0.9899 | | | 1.13 | 92.69 | | | 0.8589 | | | | 1.23 | 142.47 | 0.9090 | | |

**Figure S1**

C:\Users\HP\Desktop\Fig.1a.tif C:\Users\HP\Desktop\Fig. 2.tifC:\Users\HP\Desktop\Fig. 3.tif

(a) (b) (c)

Fig. 1 Adsorption kinetic curves of Pb2+ on the modified straw and extracts (a) rape, (b) maize, and (c) cotton.