**Supplementary material**

**Preparation of biochar from pyrolysis of soybean straw at different pyrolysis temperature for cadmium removal from wastewater and pyrolysis gas investigation**

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**Fig.S1** The adsorption data of Cd2+ fitting the intraparticle diffusion model



**Fig.S2** Cd2+ adsorption capability of regeneration biochar.



**Fig.S3.** The Cd2+ breakthrough curve of B600℃.



**Fig.S4** The rate performance of B600℃for the lithium ion batteries at different current densities.

**Table S1** Adsorption isotherm models and corresponding parameters.

|  |  |  |
| --- | --- | --- |
| Isotherm | Equation | Parameters |
| Langmuir  |  | Ce is the equilibrium concentration(mg/L) Q0 (mg/g) is adsorption constant related to adsorption capacity KL (L/g) is adsorption constant related to energy of adsorption |
| Freundlich |  | KF is adsorption constant related to adsorption capacity (mg/g).(L/mg)1/nn is adsorption constant measuring the adsorption intensity |

**Table S2** Adsorption kinetic models and corresponding parameters.

|  |  |  |
| --- | --- | --- |
| Kinetic models | Equation | Parameters |
| Pseudo-first order | $$q\_{t}=q\_{t}(1-e^{-tK\_{1}})$$ | Qt is uptake at time (mg/g).K1 means adsorption rate constant(1/min). |
| Pseudo-second order |   | K2 means rate constant (g/mg min). |
| Intraparticle diffusion | $$q\_{t}=K\_{3}t^{1/2}+C$$ | K3 (mg/g min1/2) is rate constantC is a constant. |

**Table S3** Comparison of Cd2+ adsorption amount on various biochars

|  |  |  |
| --- | --- | --- |
| Biochar | Cd2+ adsorption amount | Reference |
| MPCS | 53.17 | This study |
| CPCS | 47.30 | This study |
| Rice straw | 33.7 | ([Han et al., 2013](#_ENREF_5)) |
| Sugarcane straw | 15.7 | ([Melo et al., 2013](#_ENREF_11)) |
| Sugarcane straw | 8.99 | (Melo et al. 2013) |
| Sugarcane straw | 4.5 | (Melo et al. 2013) |
| Miscanthus | 11.99 | ([Kim et al., 2013](#_ENREF_8)) |
| Miscanthus | 13.24 | (Kim et al., 2013) |
| Miscanthus | 12.96 | (Kim et al., 2013) |
| Peanut shell | 400 | ([Wang et al., 2015](#_ENREF_15)) |
| Peanut shell | 500 | (Wang et al., 2015) |
| Peanut shell | 600 | (Wang et al., 2015) |
| Magnetic oak bark | 8.33 | (Mohan et al., 2014) |

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