**Supporting Information file for:**

**Microwave –assisted pyrolysis aspen wood for production of valuable products under different temperatures**

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**Ag+ adsorption experiment**

50 mL Ag+ solution is mixed with 0.05 g biochar. The mixture solution is put in the thermostatic oscillator with the temperature of 25℃. The stirring speed is 300r/min. The residue Ag+ in the solution is analyzed by the atomic absorption spectrum until adsorption equilibrium. The adsorption amount (*qe*) is calculated as follows:

$ q\_{e}=\frac{\left(C\_{o}-C\_{e}\right)M}{V} $ (1)

The qe is the adsorption amount. Co and Ce are the initial and equilibrium concentration, respectively. M is weight of biochar (g), and V is volume of solution (L).

**Catalytic** **degradation experiment**

The rhodamine B with NaBH4 solution is adopted as a main model reaction to investigate the catalytic activities of Ag@biochar. In a typical reaction procedure, Ag@biochar is placed into a conical flask containing 50 mL rhodamine B solution (20-40 mg/L). Then, 0.05 mmol NaBH4 is added into the solution with stirring at room temperature. Aqueous samples are collected at different time intervals and the residual concentrations of rhodamine B are measured using UV-vis spectroscopy. The amount of rhodamine B adsorbed over time, qt (mg/g), is calculated by the following equation:

 (2)

Where Ct (mg/L) is the liquid-phase concentration of rhodamine B solution at time t (min). *qt* is adsorption amount at t time. Co and Ce are initial and equilibrium concentration, respectively. M is weight of Ag@biochar (g), and V is volume of solution (L). The degradation removal of the rhodamine B is named as η.

 $η=\frac{\left(C\_{o}-C\_{t}\right)}{C\_{o}} 100\% $ (3)

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**Fig.S2** Yield of pyrolysis product at different pyrolysis temperatures.



**Fig.S3** The main component of bio-oil at different pyrolysis temperatures.

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**Fig.S4** The component (a) and heating value (b) of bio-gas at different pyrolysis temperatures.

  

c

b

a

e



d

**Fig.S5** SEM of biochar produced at 400-800℃(a:poplar sawdust-400℃, b:poplar sawdust-500℃, c:poplar sawdust-600℃, d:poplar sawdust-700℃ and e:poplar sawdust-800℃).



**Fig.S6** Raman analysis of biochar produced at different pyrolysis temperatures.

**Table S1** The application of the biochar in wastewater treatment and energy storage

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| --- | --- | --- | --- |
| Biochar | Application | Performance | Reference |
| Corn straw-biochar | Cr(VI) removal | 116.28mg/g | [1] |
| Pinewood-biochar | Pb(II) removal | 91.98 mg/g | [2] |
| Cornstalk-biochar | Cd(II) removal | 36.4 mg/g | [3] |
| Coconut shell-biohcar | Methylene blue removal | 916.26 mg/g | [4] |
| Durian rind-biochar | Congo red removal | 87.32 mg/g | [5] |
| Switchgrass-biochar | Orange G removal | 38.2 mg/g | [6] |
| Chestnut shells | Microbial fuel cell | 850 mW/m3 | [7] |
| Bamboo charcoal | Microbial fuel cell | 1652 mW/m3 | [8] |
| Barbed chestnut shell | Microbial fuel cell | 759 mW/m3 | [9] |
| Crayfish shell | Lithium-ion-batteries | 100 mAh g-1 | [10] |
| Banana peel waste | Lithium-ion-batteries | 225 mAh g-1 | [11] |
| Wheat stalk | Lithium-ion-batteries | 215 mAh g-1 | [12] |
| Hazelnut shells | Lithium-ion-batteries | 307 mAh g-1 | [13] |
| Tea leaves waste | Supercapacitor | 167 F/g | [14] |
| Corncob cellulose | Supercapacitor | 208 F/g | [15] |
| Rice brain | Supercapacitor | 265 F/g | [16] |
| Moringa oleifera stem | Supercapacitor | 283 F/g | [17] |

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