CLAIMS

1. A process for making activated carbon, comprising:

providing a biomass;

mixing the biomass with an oxidizing agent to form a biomass-oxidizing agent mixture;

subjecting the biomass-oxidizing agent mixture to a hydrothermal carbonization process to form a hydrochar having an increased oxygenated functional group content compared to that of the biomass;

mixing the hydrochar with an activating agent to form a hydrochar-activating agent mixture; and

subjecting the hydrochar-activating agent mixture to a chemical activation process to form an activated carbon.

2. The process for making activated carbon of claim 1, wherein the biomass comprises one or more of coconut shell, palm kernel shell, sawdust, wood, nut shell, husk, fruit pit, seed, peel, bagasse, peat, lignite and sub-bituminous coal.

3. The process for making activated carbon of claim 1, wherein the biomass is provided in the form of coarse granules having a particle diameter of between 0.5 millimetres (mm) and 5 mm.

4. The process for making activated carbon of claim 1, wherein the oxidizing agent comprises one or more of hydrogen peroxide, a carboxylic acid, a peroxy acid, a dibasic acid and a humic acid.

5. The process for making activated carbon of claim 1, wherein the biomass-oxidizing agent mixture comprises between 60 percent by mass (wt%) and 80 wt% of the biomass.

6. The process for making activated carbon of claim 1, wherein the hydrothermal carbonization process is performed at a temperature of between 200 degrees Celsius (°C) and 300 °C for a period of between 20 minutes (min) and 200 min.

7. The process for making activated carbon of claim 1, wherein the hydrochar has between 30 percent (%) and 70 % more oxygenated functional group content than the biomass.

8. The process for making activated carbon of claim 7, wherein the hydrochar has between 40 % and 60 % more oxygenated functional group content than the biomass.

9. The process for making activated carbon of claim 1, wherein the hydrochar has an oxygenated functional group content of between 1.2 milliequivalent per gram (meq/g) and 1.6 meq/g.

10. The process for making activated carbon of claim 9, wherein the oxygenated functional group content is 1.29 meq/g, 1.42 meq/g or 1.58 meq/g.

11. The process for making activated carbon of claim 9, wherein the oxygenated functional group content comprises one or more of a carboxylic group, a lactonic group and a phenolic group.

12. The process for making activated carbon of claim 1, wherein the activating agent is one or more of zinc chloride, phosphoric acid, a metal chloride, an inorganic acid, sodium phosphate and a base.

13. The process for making activated carbon of claim 1, wherein a ratio of the activating agent to the hydrochar in the hydrochar-activating agent mixture is between 2:1 and 10:1.

14. The process for making activated carbon of claim 1, wherein the chemical activation process is performed at a processing temperature of between 350 °C and 650 °C for a period of between 0.5 hours (h) and 3 h.

15. The process for making activated carbon of claim 13, wherein the chemical activation process is ramped to the processing temperature at a rate of between 5 degrees Celsius per minute (°C/min) and 15 °C/min.

16. The process for making activated carbon of claim 1, wherein the chemical activation process is performed in a presence of nitrogen gas at a flow rate of between 20 millilitres per minute (ml/min) and 100 ml/min.

17. A process for making hydrochar, comprising:

providing a biomass;

mixing the biomass with an oxidizing agent to form a biomass-oxidizing agent mixture; and

subjecting the biomass-oxidizing agent mixture to a hydrothermal carbonization process to form a hydrochar having an increased oxygenated functional group content compared to that of the biomass.

18. The process for making hydrochar of claim 17, wherein the biomass comprises one or more of coconut shell, palm kernel shell, sawdust, wood, nut shell, husk, fruit pit, seed, peel, bagasse, peat, lignite and sub-bituminous coal.

19. The process for making hydrochar of claim 17, wherein the biomass is provided in the form of coarse granules having a particle diameter of between 0.5 millimetres (mm) and 5 mm.

20. The process for making hydrochar of claim 17, wherein the oxidizing agent comprises one or more of hydrogen peroxide, a carboxylic acid, a peroxy acid, a dibasic acid and a humic acid.

21. The process for making hydrochar of claim 17, wherein the biomass-oxidizing agent mixture comprises between 60 percent by mass (wt%) and 80 wt% of the biomass.

22. The process for making hydrochar of claim 17, wherein the hydrothermal carbonization process is performed at a temperature of between 200 degrees Celsius (°C) and 300 °C for a period of between 20 minutes (min) and 200 min.

23. The process for making hydrochar of claim 17, wherein the hydrochar has between 30 percent (%) and 70 % more oxygenated functional group content than the biomass.

24. The process for making hydrochar of claim 23, wherein the hydrochar has between 40 % and 60 % more oxygenated functional group content than the biomass.

25. The process for making hydrochar of claim 17, wherein the hydrochar has an oxygenated functional group content of between 1.2 milliequivalent per gram (meq/g) and 1.6 meq/g.

26. The process for making hydrochar of claim 25, wherein the oxygenated functional group content is 1.29 meq/g, 1.42 meq/g or 1.58 meq/g.

27. The process for making hydrochar of claim 25, wherein the oxygenated functional group content comprises one or more of a carboxylic group, a lactonic group and a phenolic group.