Claims

1. A method of pre-treating biowaste, the method comprising mixing biowaste with an alkaline solution, an oxidising agent and a synthetic catalyst to form pre-treated biowaste, wherein the synthetic catalyst comprises a metal complex with a metal ion and surrounded by a synthetic ligand, the synthetic catalyst having a concentration of 0.5-100 ppm and wherein the mixing is carried out at a pH of 10.

2. The method according to claim 1, wherein the synthetic catalyst has a concentration of 0.5-10 ppm.

3. The method according to claim 1 or 2, wherein the biowaste comprises lignocellulosic biomass.

4. The method according to any preceding claim, wherein the synthetic ligand comprises at least one nitrogen.

5. The method according to any preceding claim, wherein the metal ion is a transition metal ion.

6. The method according to any preceding claim, wherein the mixing is carried out at a temperature of 20-100°C.

7. The method according to any preceding claim, wherein the mixing comprises adding the biowaste to a solution comprising the alkaline solution, the oxidising agent and the synthetic catalyst.

8. The method according to claim 7, wherein the adding comprises adding 1-50 wt % biowaste based on the total weight of the solution.

9. The method according to claim 7 or 8, wherein the mixing is carried out for ≤ 24 hours.

10. The method according to any of claims 1 to 6, wherein the mixing comprises:

- mixing biowaste with an alkaline solution for a pre-determined period of time and at a pre-determined temperature to form a biowaste solid; and
- adding the biowaste solid to a solution comprising the oxidising agent and the synthetic catalyst.

11. The method according to claim 10, wherein the pre-determined period of time is 1-72 hours.

12. The method according to claim 10 or 11, wherein the pre-determined temperature is ≤ 100°C.

13. The method according to claim 12, wherein the pre-determined temperature is 20-100°C.

14. The method according to claim 12 or 13, wherein the pre-determined temperature is room temperature.

15. The method according to any of claims 7 to 14, wherein the solution comprises 0.1-10 vol % oxidising agent based on total volume of the solution.

16. The method according to any preceding claim, wherein the method further comprises treating the pre-treated biowaste.

17. The method according to claim 16, wherein the treating comprises fermenting, enzymatic saccharification, or a combination thereof of the pre-treated biowaste.

18. The method according to claim 17, wherein the fermenting comprises fermenting the pre-treated biowaste in the presence of a bacteria.

19. The method according to claim 17 or 18, wherein the fermenting is carried out for a period of 24-120 hours.