## Summary

In the disclosure, there is provided a method for synthesizing an optionally substituted furoic acid, comprising:

converting a biomass to an optionally substituted furan via a dehydration reaction in the presence of an organic solvent;

purifying the optionally substituted furan by first partially or fully separating the organic solvent from the optionally substituted furan produced from said dehydration reaction, followed by extraction of the optionally substituted furan with water; and

oxidizing the extracted optionally substituted furan to form the optionally substituted furoic acid.

In one aspect, there is provided a method for synthesizing an optionally substituted furoic acid, comprising:

converting a biomass to a substituted furan, wherein said furan is substituted by at least one -$C_1$-$C_{10}$-alkyl-OH group, via a dehydration reaction in the presence of an organic solvent;

purifying the substituted furan by first evaporating the organic solvent from the optionally substituted furan produced from said dehydration reaction to obtain a solid residue or an aqueous slurry, followed by adding water to the residue or aqueous slurry for extraction of the osubstituted furan with water, collecting the supernatant separately from the residue; and

oxidizing the extracted substituted furan to form the optionally substituted furoic acid. The biomass may comprise a carbohydrate selected from cellulose, fructose, glucose or any other sugar. An

(Au/HT), gold-palladium/hydrotalcite ($Au_8Pd_2$/HT) or platinum/carbon (Pt/C).

For optimum oxidation, catalytic oxidation may be first carried out for about 1 to 3 hours at about 30 to 70°C. The oxidation may then continue at a higher temperature of 80 to 110°C for an additional 4 to 10 hours. This may help to aid complete oxidation. For instance, when HMF is the optionally substituted furan that is oxidized, some of it may be converted to HFCA. By increasing oxidation temperature and reaction time, this HFCA may be eventually converted to the desired FDCA so as to improve overall conversion yield.

In the disclosure, there is provided an aqueous solution of 5-(hydroxymethyl)furfural obtainable by:

converting a biomass to an optionally substituted furan via a dehydration reaction in the presence of an organic solvent;

purifying the optionally substituted furan by first partially or fully separating the organic solvent from the optionally substituted furan produced from said dehydration reaction, followed by extraction of the optionally substituted furan with water.

In another aspect, there is provided a process for making an aqueous solution of 5-(hydroxymethyl)furfural comprising the steps of:

converting a biomass to a substituted furan, wherein said furan is substituted by at least one -$C_1$-$C_{10}$-alkyl-OH group, via a dehydration reaction in the presence of an organic solvent;

purifying the substituted furan by evaporating the organic solvent from the substituted furan produced from said dehydration reaction to obtain a solid residue or an aqueous slurry, followed by adding water to the residue or aqueous slurry for

extraction of the substituted furan with water and collecting the supernatant separately from the residue.

As mentioned above, the organic solvent may be partially or fully separated by evaporation so as to obtain a solid residue or an aqueous slurry comprising the optionally substituted furan and/or the impurities found in the biomass.

Water may then be added to extract the optionally substituted furan, particularly the HMF. This water extraction may be repeated several times and the extracts containing the optionally substituted furan may be combined.

In another aspect, there is provided the use of the aqueous solution as defined above to convert 5-

## Claims

1. A method for synthesizing an optionally substituted furoic acid, comprising:

converting a biomass to a substituted furan, wherein said furan is substituted by at least one -$C_1$-$C_{10}$-alkyl-OH group, via a dehydration reaction in the presence of an organic solvent;

purifying the substituted furan by first evaporating the organic solvent from the optionally substituted furan produced from said dehydration reaction to obtain a solid residue or an aqueous slurry, followed by adding water to the residue or aqueous slurry for extraction of the substituted furan with water, collecting the supernatant separately from the residue; and

oxidizing the extracted substituted furan to form the optionally substituted furoic acid.

2. The method according to claim 1, wherein the water extraction is repeated several times and the extracts containing the optionally substituted furan are combined.

3. The method according to claim 2, wherein the water extraction is repeated for 2 to 3 times.

4. The method according to claim 1, wherein said dehydration reaction is an acid catalyzed dehydration reaction.

5. The method according to claim 4, wherein said acid catalyzed dehydration reaction occurs in the presence of a mono-phase solvent system or a biphasic solvent system.

6. The method according to claim 1, wherein said optionally substituted furan is 5-(hydroxymethyl)furfural.

7. The method according to claim 1, wherein said organic solvent is selected from the group consisting of alcohols, ketones, tetrahydrofuran, γ-valerolactone or mixtures thereof.

8. The method according to claim 7, wherein the organic solvent is selected from isopropanol, 1-butanol or methyl isobutyl ketone.

9. The method according to claim 7, wherein the organic solvent is isopropanol.

10. The method according to any one of claims 7 to 9 which comprises an ionic liquid as the co-solvent used in the dehydration reaction.

11. The method according to claim 10, wherein said ionic liquid is water.

12. The method according to claim 1, wherein the oxidization of the optionally substituted furan is carried out in the presence of oxygen, a catalytic system and optionally a base.

13. The method according to claim 12, wherein said catalytic system is a supported catalytic system comprising gold/hydrotalcite, gold-palladium/hydrotalcite or platinum/carbon.

14. The method according to claim 12, wherein said catalytic oxidation is carried out for about 1 to 3 hours at about 30 to 70 °C.

15. The method according to claim 12, wherein said catalytic oxidation is further carried out for 4 to 10 hours at 80 to 110°C.

16. The method according to claim 1, wherein said biomass is Jerusalem artichoke.

17. The method according to claim 1, wherein said biomass comprises a carbohydrate.

18. The method according to claim 17, wherein said carbohydrate is selected from cellulose, fructose, glucose or any other sugar.

19. The method according to claim 1, wherein said optionally substituted furoic acid is 2,5-furandicarboxylic acid.

20. The method according to claim 1, wherein said optionally substituted furoic acid is 5-hydroxymethyl-2-furancarboxylic acid.

21. A process for making an aqueous solution of 5-(hydroxymethyl)furfural comprising the steps of:

converting a biomass to an substituted furan, wherein said furan is substituted by at least one -$C_1$-$C_{10}$-alkyl-OH group, via a dehydration reaction in the presence of an organic solvent;

purifying the substituted furan by evaporating the organic solvent from the optionally substituted furan produced from said dehydration reaction to obtain a solid residue or an aqueous slurry, followed by adding water to the residue or aqueous slurry for extraction of the substituted furan with water and collecting the supernatant separately from the residue.

22. The process of claim 21, wherein the water extraction is repeated several times and the extracts containing the optionally substituted furan are combined.

23. The process according to claim 21, wherein said optionally substituted furan is 5-(hydroxymethyl)furfural.

24. The process according to claim 21, wherein the organic solvent is selected from isopropanol, 1-butanol or methyl isobutyl ketone.

25. The process according to claim 21, which comprises an ionic liquid as the co-solvent used in the dehydration reaction.

26. The process according to claim 25, wherein said ionic liquid is water.