Claims

1. Method for recovery of phosphate from a process for treating biomass material comprising the steps of:

i) adding a magnesium ion source to a biomass material;

ii) subjecting the biomass material to a pre-treatment, comprising at least a step of:

- thermal hydrolysis at a temperature of 140-220°C, at saturation pressure;

iii) transferring the pre-treated biomass material to a digestion tank and subjecting the pre-treated biomass material to an anaerobic digestion at a pH in a range of 7.5 to 8.5 thereby providing a digestate;

iv) controlling the pH of the digestion tank by continuously removing biogas, including carbon dioxide and methane gas, and partially or fully separating the carbon dioxide from the biogas, and partially re-introducing the thereby obtained carbon dioxide reduced biogas to the digestion tank;

v) optionally reducing the magnesium ammonium phosphate (MAP) concentration in the digestion tank by subjecting a sub quantity of the digestate to a MAP separation treatment and re-introducing any remaining solids or semi-solids into the digestion tank;

wherein steps i) and ii) are performed prior to step iii), and wherein the phosphate is recovered as magnesium ammonium phosphate (MAP), or hydrates thereof, as an integral part of the solid or semi-solid digestate product from the digestion tank.

2. The method according to claim 1, wherein the pre-treatment of step ii) further comprises a wet-explosion, wherein the pressure is reduced from at least 5 bar to 1 bar or less, after said thermal hydrolysis.

3. The method according to any of claims 1 or 2, wherein step i) of adding the magnesium ion source is performed prior to, or during the thermal hydrolysis of step ii).

4. The method according to any of the preceding claims, wherein step i) of adding the magnesium ion source is performed after the thermal hydrolysis, or during the wet explosion of step ii).

5. The method according to any of the preceding claims, wherein the magnesium ion source is MgO and/or $Mg(OH)_2$.

6. The method according to any of the preceding claims, wherein step v) is present.

7. The method according to any of the preceding claims, wherein pH in the digestion tank is in a range of 7.5 to 8.3, more preferably in a range of 7.9 to 8.3.

8. The method according to any of the preceding claims, wherein step v) further comprises a purification of the separated MAP.

9. The method according to any of the preceding claims, wherein the pH during the pre-treatment in step ii) is kept below 7.0.

10. The method according to claim 6, wherein the extent of the MAP reduction performed in step v) is controlled by measuring the phosphate or phosphorous content in the digestate obtained in step iii).

11. The method according to any of the preceding claims, wherein the digestate from step iii) is subjected to a dewatering to obtain the solid or semi-solid digestate product.

12. A biomass treatment plant for production of biogas, said biomass treatment plant including:
- at least one biomass pre-treatment reactor (2) having an biomass material inlet for feeding untreated biomass material (1) and having a pre-treated biomass material outlet;
- at least one digestion tank (3) having a pre-treated biomass material inlet connected to said pre-treated biomass material outlet and having a biogas outlet (9) and at least one digestate product outlet (5) for the digestate product including as an integral part recovered magnesium ammonium phosphate (MAP);
- a carbon dioxide separation device (10) having a biogas inlet connected to said biogas outlet (9) and having a carbon dioxide outlet (13) and a carbon dioxide reduced biogas outlet (11);
- the at least one biomass pre-treatment reactor (2) being provided with a steam inlet connected to a steam source, and the at least one biomass pre-treatment reactor (2) being adapted to perform thermal hydrolysis at a temperature of 140-220°C, at saturation pressure; and

- the at least one digestion tank (3) being adapted to subject the pre-treated biomass material to an anaerobic digestion at a pH in a range of 7.5 to 8.5 thereby providing a digestate; characterised in that:
- a magnesium ion source inlet is arranged to add a magnesium ion source (4) to the biomass before introduction of the pre-treated biomass into the biomass digestion tank (3); and
- in that the carbon dioxide reduced biogas outlet (11) of the carbon dioxide separation device (10) is connected to a produced biogas outlet (14) of the biomass treatment plant and is connected to a carbon dioxide reduced biogas inlet (12) of the digestion tank (3) for partial re-introduction of obtained carbon dioxide reduced biogas to the digestion tank.

13. The biomass treatment plant according to claim 12, wherein the digestate product outlet (5) from the digestion tank (3) is connected to a dewatering device (6) having a liquid phase discharge outlet (7) and a dewatered digestate product outlet (8) for the solid or semi-solid digestate product incorporating as an integral part recovered MAP.

14. The biomass treatment plant according to any of claims 12-13, further comprising a MAP separation device (17) having a digestate inlet connected via a circulation pump (16) to a digestate outlet (15) arranged at the bottom of said digestion tank (3), said MAP separation device having a MAP rich outlet and a MAP reduced digestate outlet (18) connected to a MAP reduced digestate inlet of the digestion tank (3), wherein the MAP rich outlet is a MAP discharge outlet.

15. The biomass treatment plant according to claim 14, further comprising a MAP purification unit (20) connected to the MAP rich outlet from said MAP separation device (17), said MAP purification unit (20) having a purified MAP discharge outlet (22) and an excess water outlet (21) connected to a second digestion tank inlet or connected to waste.