CLAIMS

1. Method for recovering phosphate from a biomass material, said method comprising the steps of:

(a) contacting in a contact tank said biomass material together with a liquid concentrate stream (g2) from step (g), for producing a mixed sludge,

(b) separating in a thickener unit the mixed sludge of step (a) into: a concentrated thickened sludge product (b1) with reduced P and Mg levels, and a liquid concentrate stream (b2) rich in P and Mg,

(c) subjecting said concentrated thickened sludge product (b1) to an anaerobic digestion stage in an Anaerobic Digester for producing a biogas stream and a digested sludge product, and retrieving said biogas,

(d) separating in a first-dewatering stage said digested sludge product into a first digested sludge product (d1) containing solid particles, and a liquid concentrate (d2) rich in PO_4-P and NH_4-N

(e) transferring said liquid concentrate (b2) rich in P and Mg from step (b) and said liquid concentrate (d2) rich in PO_4-P and NH_4-N from step (d) into a phosphate recovery process for producing a phosphate salt,

(f) subjecting said first digested sludge product (d1) from step (d) to a thermal hydrolysis stage in a thermal hydrolysis unit for converting the solid particles of said first digested sludge product (d1) at least partially into soluble organic material, thereby forming a thermally hydrolized sludge product (f1),

(g) separating in a second dewatering stage said digested and thermally hydrolysed sludge product (f1) into a second digested and thermally hydrolysed sludge product (g1), and a liquid concentrate stream (g2) rich in volatile fatty acids (VFA's), solubilised P and optionally colloidal organic material; separating at least a portion of said liquid concentrate (g2) into a cake product and a liquid concentrate stream with reduced content of solids; and recycling said cake product to the anaerobic digestion stage of step (c).

(h) recycling at least a portion of the liquid concentrate stream (g2) resulting from step (g) to step (a).

2. The method according to claim 1, wherein said biomass material is wet activated sludge (WAS) produced from an EBPR-process, and the WAS preferably contains 0.5-3.0% DS (dry solids), more preferably 0.8-2.0% DS.

3. The method according to claim 1 or 2, further comprising recycling at least a portion of said liquid concentrate stream (g2) resulting from said second dewatering stage of step (g) to the anaerobic digestion stage of step (c).

4. The method according to any of the preceding claims, further comprising using at least part of said liquid concentrate (g2) from said second dewatering stage, or at least part of said liquid concentrated stream with reduced content of solids in assisting the biological P and/or biological N removal in a upstream wastewater treatment process including an anaerobic stage, for producing said biomass material.

5. The method according to any preceding claim, further comprising providing a residence time in the contact tank of the contacting step (a) of 1-3 hours.

6. The method according to any preceding claim, further comprising adding to the contact tank of step (a) an overflow from the thickener unit of step (b), and/or primary sludge.

7. The method according to any of the preceding claims, wherein said phosphate recovery process for producing a phosphate salt in step (e) comprises at least the following process steps:
- subjecting said liquid concentrates to a crystallization process in a struvite formation reactor
- isolating any struvite crystals formed in said struvite formation reactor by sedimentation or cyclone technology.

8. The method of claim 7 further comprising a degassing step for removing CO2 from the liquid concentrates thereby increasing the pH.

9. The method of any of claims 7-8, further comprising the steps of:
- adding additional Mg to said struvite formation reactor,
and/or
- adding a base or an acid to said struvite formation reactor
for enhancing the crystallization of said struvite.

10. Plant for recovering phosphate from a biomass material, preferably waste activated sludge (WAS), the plant comprising:

- a contact tank (3) for receiving said biomass material and a recycle stream from a second dewatering unit (10), thereby producing a mixed sludge,
- a thickener unit (5) for thickening said mixed sludge and thereby producing a concentrated thickened sludge product and a liquid concentrate stream rich in P (PO_4) and Mg,
- an anaerobic digester (8) for digesting said concentrated thickened sludge product, thereby producing a biogas stream and a digested sludge product,
- a first dewatering unit (10) for dewatering said digested sludge product, thereby producing a first digested sludge product and a liquid concentrate stream rich in PO_4-P and NH_4-N,
- a struvite formation reactor (22) for receiving said liquid concentrate rich in P and Mg, and said liquid concentrate rich in PO_4-P and NH_4-N, thereby producing struvite,
- a thermal hydrolysis unit (14) for hydrolysing said first digested sludge product, thereby producing a digested and thermally hydrolysed sludge product,
- a second dewatering unit (16) for dewatering said digested and thermally hydrolysed sludge product, thereby producing a second digested and thermally hydrolysed sludge product and a liquid concentrate stream rich in volatile fatty acids (VFA), solubilised P and optionally colloidal organic material,
- a conduit for leading at least a portion of said liquid concentrate rich in volatile fatty acids (VFA), solubilised P and optionally colloidal organic material, to said contact tank (3) for contacting with said biomass material,
- a separating unit (19), preferably a disc centrifuge, for separating said liquid concentrate stream rich in volatile fatty acids (VFA), solubilised P as well as colloidal organic material into a cake product and a liquid concentrate stream with reduced content of solids, and
- a conduit or transporting means for leading said cake product to said anaerobic digester.

11. Plant according to claim 10 further comprising a conduit for leading at least a portion of said liquid concentrate rich in volatile fatty acids (VFA), solubilised P and colloidal organic material, to said anaerobic digester (8).

12. A method of retrofitting an existing wastewater treatment plant (WWTP) comprising biological P removal, preferably EPRP, said wastewater treatment plant comprising an anaerobic unit, anoxic unit and aerobic unit and a clarifier arranged in series for producing an activated sludge, an internal recycle means for recycling a mixed liquor from the aerobic unit to the anoxic unit, recycle means for returning a portion of said

activated sludge as return activated sludge (RAS) to the anaerobic unit, and means for withdrawing a portion of said activated sludge as said waste activate sludge (WAS) said method of retrofitting comprising:

- installing a contact tank which is adapted for receiving: a biomass material inlet conduit, said biomass material being produced in said waste water treatment plant, and a recycle stream conduit from a second dewatering unit located downstream, said recycle stream conduit carrying a liquid concentrate stream rich in VFA's and solubilised P and optionally colloidal organic material,
- installing a thickener unit for thickening a mixed sludge produced in said contact tank,
- installing an anaerobic digester for digesting a concentrated thickened sludge product produced in said thickener unit,
- installing a first dewatering unit for dewatering a digested sludge product produced in said anaerobic digester,
- installing a first conduit for transporting a liquid concentrate rich in P and Mg from said thickener unit,
- installing a second conduit for transporting a liquid concentrate rich in P and NH_4-N from said first dewatering unit,
- installing a struvite reactor for producing struvite, said reactor being adapted to receive as inlet said first and second conduit containing said liquid concentrate rich in P and rich in NH_4-N,
- installing a thermal hydrolysis unit for hydrolysing a first sludge product produced in said first dewatering unit,
- installing said second dewatering unit for dewatering digested and thermally hydrolysed sludge product produced in said thermal hydrolysis unit,
- installing a recycle stream conduit for recycling said liquid concentrate stream rich in VFA's and solubilised P and optionally colloidal organic material to said contact tank,
- installing a separating unit, preferably a disc centrifuge, for separating said liquid concentrate stream rich in volatile fatty acids (VFA), solubilised P and optionally colloidal organic material into a cake product and a liquid concentrate stream with reduced content of solids, and
- installing a conduit or transporting means for leading said cake product to said anaerobic digester

13. Method of retrofitting an existing wastewater treatment plant (WWTP) according to claim 12, wherein said existing wastewater treatment plant further comprises upstream said anaerobic unit, a primary clarifier for receiving a wastewater influent, thereby capturing suspended solids and organic material and thereby forming a primary sludge.