CLAIMS

1. System (2) for reducing algae bloom and microbial growth in aqueous systems comprising:

- at least one influent filtration unit (6) comprising an ingress (5) and an egress (7);
- at least one adsorption vessel (4) which is operatively coupled with the at least one influent filtration unit (6), the adsorption vessel comprising an ingress (8), an egress (10) and a phosphate adsorption element (12), wherein the phosphate adsorption element (12) is configured for adsorption of phosphates and removing the adsorbed phosphates from a phosphate containing influent water flow; ~~and~~
- a regeneration system (14) which is operatively coupled with the at least one adsorption vessel (4) and comprises an ingress (13) and an egress (15), wherein the regeneration system (14) is configured for holding a regeneration solution, and is configured to regenerate the at least one adsorption vessel (4), and wherein the regeneration system (14) comprises at least four regeneration subsystems (21 A-D) which are provided in a cascade configuration, wherein the regeneration subsystems (21 A-D) are configured to regenerate the adsorption vessel (4) by:
  - firstly flowing regeneration solution 17B, held by regeneration subsystem 21B, through the adsorption vessel (4), wherein the regeneration solution 17B flows into regeneration subsystem 21C and becomes regeneration solution 17C;
  - secondly, regeneration solution 17A, held by regeneration subsystem 21A, flows through the adsorption vessel (4), wherein regeneration solution 17A flows into regeneration subsystem 21B and becomes regeneration solution 17B;
  - thirdly, regeneration solution 17D, held by regeneration subsystem 21D, flows through the adsorption vessel (4), wherein regeneration solution 17D flows into regeneration subsystem 21A and becomes regeneration solution 17A; and
- at least two pumps (18, 20), wherein the first pump (18) is configured to pump the influent and the second pump (20) is configured to pump the regeneration solution,

wherein the regeneration system (14) further comprises:

- a regeneration filtration unit (16), which is configured to separate the phosphate and regeneration solution, wherein the regeneration filtration unit (16) is operatively coupled to the egress of the regeneration subsystem comprising the highest phosphate concentration; and
- a recycling loop (19) configured to recycle the regeneration solution, wherein the recycling loop comprises the at least four regeneration subsystems (21 A-D), and

wherein the separated regeneration solution in use flows back to the regeneration system (14),

wherein the cascade configuration of the regeneration subsystems (21 A-D) is configured to direct the regeneration solution in use from a regeneration subsystem (21 A-D) with a low phosphate concentration to a regeneration subsystem (21 A-D) with a high phosphate concentration.

~~2. System according to claim 1, wherein the regeneration system comprises at least two regeneration subsystems, preferably at least three regeneration subsystems, more preferably at least four regeneration subsystems.~~

~~3. System according to claim 2, wherein the regeneration subsystems are provided in a cascade-configuration, wherein the separated regeneration solution flows back to the regeneration system.~~

~~4. System according to claim 3, wherein the cascade configuration of the regeneration subsystems is configured to direct the regeneration solution from a regeneration subsystem with a low phosphate concentration to a regeneration subsystem with a high phosphate concentration.~~

~~5. System according to claim 4, wherein the regeneration filter is operatively coupled to the egress of the regeneration subsystem comprising the highest phosphate concentration.~~

2~~6~~. System (2) according to any one of the preceding claims, further comprising a phosphate sensor (24) configured for sensing the phosphate concentration at the egress (10) of the adsorption vessel (4).

3~~7~~. System (2) according to any one of the preceding claims, further comprising a control unit (26), for controlling the system (2).

~~8. System according to any one of the preceding claims, further comprising at least two pumps, wherein the first pump is configured to pump the influent and the second pump is configured to pump the regeneration solution.~~

4~~9~~. System (2) according to any one of the preceding claims, wherein the regeneration filtration unit (16) is a nano-filtration unit.

5~~10~~. System (2) according to any one of the preceding claims, wherein the at least one influent filtration unit (6) is an at least one ultra filtration unit.

6~~11~~. System (2) according to any one of the preceding claims, wherein the regeneration solution is chosen from the group of aqueous sodium hydroxide, aqueous potassium hydroxide, or a mixture thereof.

7~~12~~. System (2) according to any one of the preceding claims, wherein the at least one influent filtration unit (6) and/or the regeneration system (14) comprises a sensor (28, 30), wherein the sensor is configured to measure the phosphate level in the effluent.

8~~13~~. Method (100, 200) for reducing algae bloom and microbial growth in aqueous systems comprising the steps of:

- providing a system (2) according to any one of the preceding claims;
- providing a phosphate rich influent water flow (102, 202) to the system;
- filtering the phosphate rich influent water flow (104, 204);
- adsorbing the phosphate from the phosphate rich influent water flow on a phosphate adsorption element (106, 206); and
- regenerating the phosphate adsorption element using a regeneration solution (108, 208).

9~~14~~. Method according to claim 8~~13~~, further comprising the step of separating the phosphate and regeneration solution (210).

10~~15~~. Method according to claim 8~~13~~ or 9~~14~~, wherein the adsorbing is performed at a pH of 7 – 9.

11~~16~~. Method according to claim 8~~13~~, 9~~14~~ or 10~~15~~, wherein the regeneration is performed at a pH of 10 – 11.

~~17. Composition comprising phosphate obtainable by the method according to claim 14 after the separating step.~~

~~18. Composition according to claim 17, wherein the composition is derived from the system according to any one of the claims 1 – 12 at the regeneration filtration unit.~~

~~19. Effluent obtainable by the method according to claim 13 after the adsorbing the phosphate step.~~

~~20. Effluent according to claim 19, wherein the effluent is derived from the system according to any one of the claims 1 – 12 at the egress of the adsorption vessel.~~