Claims

1. A material for use in sorbent-based dialysis, the material comprising:
acidic and/or neutral cation exchange particles;
alkaline anion exchange particles; and
one or more of a water insoluble alkaline earth metal carbonate, and a water insoluble polymeric ammonium carbonate.

2. The material according to Claim 1, wherein the material further comprises one or both of $Ca(OH)_2$, and $Mg(OH)_2$.

3. The material according to Claim 1 or Claim 2, wherein the acidic and/or neutral cation exchange particles are acidic and/or a neutral water-insoluble metal phosphate, optionally wherein the metal is selected from one or more of the group consisting of titanium, zirconium, and hafnium.

4. The material according to Claim 3, wherein the metal is zirconium.

5. The material according to any one of the preceding claims, wherein the alkaline anion exchange particles comprise an amorphous and partly hydrated, water-insoluble metal oxide in its: hydroxide-; and/or carbonate-; and/or acetate-; and/or lactate- counter-ion form, wherein the metal is selected from one or more of the group consisting of titanium, zirconium, and hafnium, optionally wherein the anion exchange particles are alkaline hydrous zirconium oxide.

6. The material according to any one of the preceding claims, wherein:
(a) the water insoluble alkaline earth metal carbonate is selected from one or more of the group consisting of $CaCO_3$ and $MgCO_3$; and/or
(b) the water insoluble polymeric ammonium carbonate is selected from one or more of the group consisting of sevelamer carbonate, polymer-bound tetra-alkyl ammonium carbonate, and 3-(trialkyl ammonium) alkyl functionalised silica gel carbonate.

7. The material according to any one of the preceding claims, wherein the material comprises:
from 30 to 79 wt% of acidic and/or neutral cation exchange particles;
from 20 to 65 wt% of alkaline anion exchange particles;

one or more of a water insoluble alkaline earth metal carbonate, and a water insoluble polymeric ammonium carbonate in a total amount from 0.1 to 10 wt%; and

one or both of $Ca(OH)_2$, and $Mg(OH)_2$ in a total amount of from 0 to 5 wt%.

8. The material according to Claim 7, wherein the material comprises:

from 31 to 75 wt% of acidic and/or neutral cation exchange particles;

from 23 to 63 wt% of alkaline anion exchange particles;

one or more of a water insoluble alkaline earth metal carbonate, and a water insoluble polymeric ammonium carbonate in a total amount of from 0.1 to 5 wt%; and

one or both of $Ca(OH)_2$, and $Mg(OH)_2$ in a total amount of from 0 to 4 wt%.

9. The material according to Claim 7 or Claim 8, wherein the material comprises:

from 50 to 64 wt% of acidic and/or neutral cation exchange particles;

from 35 to 45 wt% of alkaline anion exchange particles; and

one or more of a water insoluble alkaline earth metal carbonate, and a water insoluble polymeric ammonium carbonate a total amount of from 0.3 to 5 wt%.

10. The material according to Claim 9, wherein the material comprises:

from 53 to 60 wt% of acidic and/or neutral cation exchange particles;

from 39 to 44 wt% of alkaline anion exchange particles; and

one or more of a water insoluble alkaline earth metal carbonate, and a water insoluble polymeric ammonium carbonate a total amount of from 0.5 to 3 wt%.

11. The material according to Claim 7 or Claim 8, wherein the material comprises:

from 45 to 59 wt% of acidic and/or neutral cation exchange particles;

from 40 to 54 wt% of alkaline anion exchange particles; and

one or more of a water insoluble alkaline earth metal carbonate, and a water insoluble polymeric ammonium carbonate a total amount of from 0.5 to 5 wt%.

12. The material according to Claim 11, wherein the material comprises:

from 48 to 56 wt% of acidic and/or neutral cation exchange particles;

from 42 to 50 wt% of alkaline anion exchange particles; and

one or more of a water insoluble alkaline earth metal carbonate, and a water insoluble polymeric ammonium carbonate a total amount of from 1 to 2 wt%.

13. The material according to Claim 7 or Claim 8, wherein the material comprises:

from 50 to 70 wt% of acidic and/or neutral cation exchange particles;

from 30 to 49 wt% of alkaline anion exchange particles;

from 0.2 to 3 wt% one or more of a water insoluble alkaline earth metal carbonate, and a water insoluble polymeric ammonium carbonate; and

one or both of $Ca(OH)_2$, and $Mg(OH)_2$ in a total amount of from 0.2 to 2 wt%.

14. The material according to Claim 13, wherein the material comprises:

from 53 to 67 wt% of acidic and/or neutral cation exchange particles;

from 33 to 46 wt% of alkaline anion exchange particles;

one or more of a water insoluble alkaline earth metal carbonate, and a water insoluble polymeric ammonium carbonate a total amount of from 0.2 to 2 wt%; and

one or both of $Ca(OH)_2$ and $Mg(OH)_2$ in a total amount of from 0.2 to 1.5 wt%.

15. The material according to any one of the preceding claims, wherein the material is one in which:

the cation exchange particles are an acidic and/or a neutral water-insoluble metal phosphate;

anion exchange particles are an alkaline hydrous zirconium oxide; and

the one or more of a water insoluble alkaline earth metal carbonate, and a water insoluble polymeric ammonium carbonate is $CaCO_3$ and/or $MgCO_3$, optionally wherein the material further comprises $Ca(OH)_2$.

16. The material according to any one of the preceding claims, wherein the material further comprises an organic compounds absorber, wherein the organic compounds absorber is present in an amount of from 10 to 40 wt% relative to the total weight of the components listed in Claim 1, optionally wherein the organic compounds absorber is present in an amount of from 15 to 25 wt%, such as from 18 to 23 wt%, such as from 19 to 21 wt% relative to the total weight of the components listed in Claim 1.

17. The material according to Claim 16, wherein the organic compounds absorber is activated carbon.

18. The material according to any one of the preceding claims, wherein:

(a) the material further comprises neutral hydrous zirconium oxide, wherein the neutral hydrous zirconium oxide is present in an amount of from 0.1 to 10 wt% relative to the total weight of the components listed in Claim 1, optionally wherein the neutral hydrous zirconium oxide is present in an amount of from 0.5 to 5 wt% relative to the total weight of the components listed in Claim 1; and/or

(b) (i) all of the components are intermixed together to provide a single layer of material; or

(ii) the one or more of a water insoluble alkaline earth metal carbonate, and a water insoluble polymeric ammonium carbonate, and, when present, one or both of $Ca(OH)_2$ and $Mg(OH)_2$ are intermixed with the cation exchange particles to form a first layer, with the anion exchange particles provided as a second layer.

19. The material according to any one of Claims 4 and 5 to 18, as dependent upon Claim 4, wherein both an acidic zirconium phosphate and a neutral zirconium phosphate are present and the acidic zirconium phosphate is present in an amount of from 55 to 80 wt% of the total amount of zirconium phosphate in the material, with the neutral zirconium phosphate supplying the balance to 100 wt%, optionally wherein:

(a) the acidic zirconium phosphate is present in an amount of from 59 to 70 wt% of the total amount of zirconium phosphate in the material, with the neutral zirconium phosphate supplying the balance to 100 wt%; or

(b) the acidic zirconium phosphate is present in an amount of from 75 to 78 wt% of the total amount of zirconium phosphate in the material, with the neutral zirconium phosphate supplying the balance to 100 wt%.

20. A cartridge for use in sorbent dialysis, the cartridge comprising a material as described in any one of Claims 1 to 19.