CLAIMS

1. A chromatography medium, comprising

a matrix of cellulose-based nanofibers, the nanofibers optionally being crosslinked to one another, and

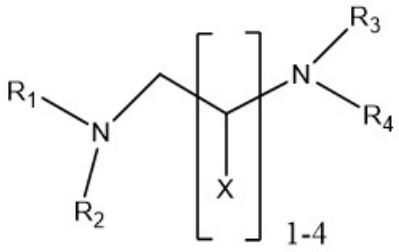
a ligand, coupled to the matrix without any intermediate extender group.

2. The chromatography medium of claim 1, wherein the matrix comprises crosslinks between said nanofibers, provided by a crosslinking agent selected from the group consisting of divinyl sulfone, bis acrylamide, butanediol diglycidyl ether, epichlorohydrin, allyl glycidyl ether, allyl bromide, 1,4-dibromo butane and bismaleimide.

3. The chromatography medium of claim 1 or 2, wherein the ligand is coupled to the nanofibers of the matrix via a linking group comprising less than 10 repeating moieties, or via a linking group that contains no more than 20 atoms.

4. The chromatography medium of any one of the preceding claims, wherein the ligand is selected from anionic ligands, cationic ligands, affinity ligands and multimodal ligands.

5. The chromatography medium of claim 4, wherein the ligand or a portion of the ligand described by the formula:



wherein

X independently for each occurrence is selected from H, OH or a C_{1-3} group, and

R1, R2, R3 and R4 are independently selected from H, and a C_{1-3} group,

wherein a C_3 group is straight or branched,

wherein a C_{1-3} group comprises groups independently selected from OH, O-C_{1-2}, S-C_{1-2}, NH, NHR, NR_2,

wherein R is selected from H and a C_{1-3} group, and wherein

the diamine functionality of the ligand or portion of the ligand is coupled to the derivatised cellulose nanofibers such that it generates at least one weak anion exchange group to an ionic capacity of 10-500 µmol/mL.

6. The chromatography medium of claim 5, wherein the ligand is selected from N,N,N'-triethylethylenediamine, diethylenetriamine, N,N'-dimethylethylenediamine, N-methylethylenediamine, 1,3-diaminopropane, 1,3-diamino-2-hydroxypropane, 2-methyl-1,3-propanediamine, N,N-diethylethylenediamine and diethylethylaminoethyl.

7. The chromatography medium of any of claims 4 to 6, wherein the functionalised chromatography medium is provided with said anionic ligand, cationic ligand, or multimodal ligand to an ionic capacity of 10-500 µmol/mL.

8. The chromatography medium of claim 4, wherein the ligand is an affinity ligand, and optionally wherein the chromatography medium has a ligand density of at least 150 nmol/mL.

9. The chromatography medium of any one of the preceding claims, wherein the matrix allows convective flow of a fluid through the matrix, and/or, wherein the matrix has a mean flow pore size in the range of from 0.1-2.0 µm.

10. The chromatography medium of any one of the preceding claims, wherein the ligand is coupled to the nanofibers of the matrix via a linking group selected from a vinyl sulfone moiety and an alkyne or allyl derivative.

11. A method of preparing a functionalised chromatography medium, which method comprises:

(i) providing a substrate comprising cellulose acetate,

(ii) forming a fibrous matrix/membrane spun of nanofibers from the substrate,

(iii) saponification of the nanofibers to form regenerated cellulose nanofibers,

(iv) derivatisation of the regenerated cellulose nanofibers with a cross-linker,

(v) coupling of a ligand to the derivatised cellulose nanofibers,

wherein the preparation of the functionalised chromatography medium does not comprise any surface extender.

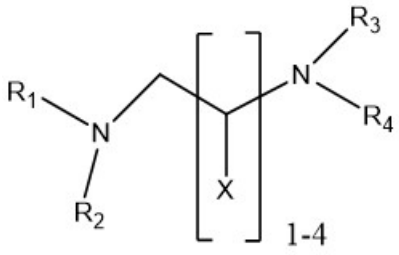
12. The method of claim 11, wherein the cross-linker comprises at least two functional groups arranged to react with hydroxyl groups of the regenerated cellulose nanofibers.

13. The method of claim 12, wherein the functional groups are selected from, halide, acrylamide, epoxide, tosylate, a functional group comprising a double or triple bond that is or can be activated, or any combination thereof, and optionally wherein the functional groups are selected from divinyl sulfone, bis acrylamide, butanediol diglycidyl ether, epichlorohydrin, allyl glycidyl ether, allyl bromide, 1, 4 di bromo butane, bismaleimide or any combination thereof.

14. The method of claim 12, wherein the crosslinker is divinylsulfone, and optionally wherein the divinylsulfone derivatised regenerated cellulose nanofiber matrix/membrane has a vinylsulfone content in the range of 200-1600 µmol/g, such as 200-1000 µmol/g.

15. The method of any of the claims 12 to 14, wherein the ligand is selected from anionic ligands, cationic ligands, affinity ligands and multimodal ligands.

16. The method of claim 15, wherein the ligand or a portion of the ligand coupled to the derivatised cellulose nanofibers is described by the formula:



wherein X is selected from H, OH or a C_{1-3} group, and

R1, R2, R3 and R4 are independently selected from H, and a C_{1-3} group,

wherein a C_3 group is straight or branched,

wherein a C_{1-3} group comprises groups independently selected from OH, O-C_{1-2}, S-C_{1-2}, NH, NHR, NR_2,

wherein R is selected from H and a C_{1-3} group, and wherein

the diamine functionality of the ligand or portion of the ligand is coupled to the derivatised cellulose nanofibers such that it generates at least one weak anion exchange group to an ionic capacity of 10-500 µmol/mL.

17. The method of claim 16, wherein the ligand is selected from N,N,N'-triethylethylenediamine, diethylenetriamine, N,N'-dimethylethylenediamine, N-methylethylenediamine, 1,3-diaminopropane, 1,3-diamino-2-hydroxypropane, 2-methyl-1,3-propanediamine, N,N-diethylethylenediamine and diethylethylaminoethyl.

18. The method of any of claims 15 to 17, wherein the functionalised chromatography medium is provided with an anionic ligand, cationic ligand, or multimodal ligand to an ionic capacity of 10-500 µmol/mL.

19. The method of claim 15, wherein the ligand is an affinity ligand, and optionally wherein the affinity ligand is coupled to the

derivatised cellulose nanofibers in a ligand density of at least 150 nmol/mL.

20. A process of separating an analyte in a solution, the process comprising:

obtaining a solution comprising an analyte,

adding the solution to a chromatography medium provided with an anionic ligand, cationic ligand, or multimodal ligand according to any one of the claims 4-12, or produced according to any of claims 19 to 22, in a binding buffer having a conductivity of 1.5-35.0 mS/cm,

eluting the analyte from the chromatography medium by contacting the chromatography medium with an elution buffer having a conductivity of 20-105 mS/cm, and collecting the thus formed eluate containing the analyte.

21. A process of separating an analyte in a solution, the process comprising:

obtaining a solution comprising an analyte,

adding the solution to the functionalised chromatography medium provided with an affinity ligand according to any one of claims 4 and 8-12, or produced according to any of claims 19 and 23-24, in a binding buffer having a conductivity of 1.5-35.0 mS/cm,

eluting the analyte from the chromatography medium by contacting the chromatography medium with an elution buffer having a conductivity of 20-105 mS/cm, and collecting the thus formed eluate containing the analyte.

22. The process of any of claims 20 or 21, wherein the analyte is selected from the group consisting of mRNA, viruses or virus-like particles, plasmids, exosomes, and protein complexes, and optionally

wherein analyte is selected from the group consisting of mRNA, viruses, virus-like particles, plasmids, and exosomes, or

wherein analyte is an enveloped virus, such as a lentivirus.

23. Use of a chromatography medium according to any one of the claims 1 to 10 for separation of an analyte selected from the group consisting of mRNA, viruses, virus-like particles, plasmids, and extracellular vesicles, and preferably viruses, such as viral vectors.