Claims

What is claimed is:

1. A continuous process for the purification of a target molecule comprising the steps of:

a) providing a sample comprising the target molecule and one or more impurities;

b) adding at least one precipitant to the sample and removing one or more impurities, thereby to recover a clarified sample;

c) subjecting the clarified sample from step (b) to a bind and elute chromatography step comprising at least two separation units, thereby to obtain an eluate comprising the target molecule; and

d) subjecting the eluate to flow-through purification comprising use of two or more media, one of which is activated carbon and the other(s) are selected from anion-exchange chromatography media and cation-exchange chromatography media;

wherein at least two steps are performed concurrently for at least a portion of their duration, wherein the process comprises only one bind and elute chromatography step, and wherein the process is a continuous process,

wherein the process comprises use of one or more surge tanks and/or one or more static mixers, wherein the flow-through purification is carried out as: activated carbon followed by anion-exchange chromatography media followed by cation-exchange chromatography media, and

wherein the in-line static mixer and/or surge tank is used between anion-exchange chromatography media and cation-exchange chromatography media to change pH.

2. The process of claim 1, comprising a virus inactivation step between steps (c) and (d).

3. The process of claim 2, wherein the virus inactivation step comprises use of a virus inactivating agent selected from acid, detergent, solvent and temperature change.

4. The process of claim 2, wherein virus inactivation step comprises use of one or more in-line static mixers.

5. The process of claim 2, wherein virus inactivation comprises use of one or more surge tanks.

6. The process of claim 1, wherein the target molecule is an antibody.

7. The process of claim 6, wherein the antibody is selected from a monoclonal antibody or a polyclonal antibody.

8. The process of claim 1, wherein the precipitant in step (b) is a stimulus responsive polymer.

9. The process of claim 8, wherein the stimulus responsive polymer is a modified polyallylamine polymer.

10. The process of claim 1, wherein the precipitant in step (b) is selected from the group consisting of an acid, caprylic acid, a flocculant and a salt.

11. The process of claim 1, wherein removing impurities in step (b) comprises use of one or more depth filters.

12. The process of claim 1, wherein removing impurities in step (b) comprises use of centrifugation.

13. The process of claim 1, wherein the bind and elute chromatography step in (c) employs continuous multi-column chromatography.

14. The process of claim 1, wherein the bind and elute chromatography step in (c) is selected from the group consisting of affinity chromatography, cation exchange chromatography and mixed-mode chromatography.

15. The process of claim 1, wherein the bind and elute chromatography step in (c) employs Protein A affinity chromatography.

16. The process of claim 15, wherein Protein A affinity chromatography employs a Protein A ligand coupled to a matrix selected from the group consisting of rigid hydrophilic polyvinylether polymer, controlled pore glass and agarose.

17. The process of claim 1, wherein the sample in step (a) is a cell culture.

18. The process of claim 17, wherein the cell culture is provided in a bioreactor.

19. The process of claim 18, wherein the bioreactor is a single use bioreactor.

20. The process of claim 17, wherein the cell culture is provided in a vessel other than a bioreactor.

21. The process of claim 1, wherein the precipitant in step (b) is added to a bioreactor comprising a cell culture.

22. The process of claim 21, wherein the precipitant is added using a static mixer.

23. The process of claim 1, wherein the precipitant in step (b) is added to a vessel other than a bioreactor which comprises the sample comprising the target molecule.

24. The process of claim 1, wherein the flow-through purification in step (d) further comprises use of a virus filtration membrane.

25. The process of claim 1, wherein the cation exchange chromatography media is in the form of a membrane, a bead or a fiber.

26. The process of claim 1, wherein the process comprises use of one or more surge tanks and does not employ any pool tanks between process steps.

27. The process of claim 1, further comprising a formulation step.

28. The process of claim 27, wherein formulation comprises diafiltration, concentration and sterile filtration.

29. The process of claim 28, further concentration comprises tangential flow filtration.