Claims

1. A cross-flow apparatus for producing an emulsion or dispersion by dispersing a first phase in a second phase; said cross-flow apparatus comprising:

an outer tubular sleeve provided with a first inlet at a first end; an emulsion outlet; and a second inlet, distal from and inclined relative to the first inlet;

a tubular membrane provided with a plurality of pores and adapted to be positioned inside the tubular sleeve; and

an insert adapted to be located inside the tubular membrane, said insert comprising an inlet end and an outlet end, each of the inlet end and an outlet end being provided with chamfered region; the chamfered region is provided with a plurality of orifices and a furcation plate.

2. A cross-flow apparatus according to claim 1 wherein the apparatus does not include an insert.

3. A cross-flow apparatus according to claim 1 wherein the tubular membrane is located centrally within the outer sleeve, such that the spacing between the membrane and the sleeve comprises an annulus, of equal or substantially equal dimensions at any point around the tubular membrane.

4. A cross-flow apparatus according to claim 3 wherein the spacing is from about 0.05 to about 10mm.

5. A cross-flow apparatus according to claim 1 wherein the insert is tapered.

6. A cross-flow apparatus according to claim 1 wherein the tubular membrane is located centrally within the outer sleeve, such that the spacing between the membrane and the insert comprises an annulus, of equal or substantially equal dimensions at any point around the insert.

7. A cross-flow apparatus according to any one of the preceding claims wherein the internal diameter of the tubular membrane is from about 1mm to about 10mm.

8. A cross-flow apparatus according to claim 1 wherein the cross-flow apparatus comprises a plurality of tubular membranes.

9. A cross-flow apparatus according to claim 8 wherein each membrane has an insert located inside it.

10. A cross-flow apparatus according to claims 8 or 9 wherein a plurality of membranes is grouped as a cluster of membranes positioned alongside each other.

11. A cross-flow apparatus according to any one of the preceding claims wherein the inlet and outlet ends of the outer sleeve are generally be provided with a seal assembly.

12. A cross-flow apparatus according to claim 11 wherein the seal assembly comprises a tubular ferrule provided with a flange at each end.

13. A cross-flow apparatus according to any one of the preceding claims wherein the membrane pores are laser drilled.

14. A cross-flow apparatus according to claim 13 wherein the membrane pores are substantially uniform in pore diameter, pore shape and pore depth.

15. A cross-flow apparatus according to claim 14 wherein the membrane pores are generally uniformly spaced.

16. A cross-flow apparatus according to any one of claims 13 to 15 wherein the pores have a diameter of from about 1 μm to about 100 μm.

17. A cross-flow apparatus according to any one of claims 13 to 16 wherein the shape of the pores is substantially tubular.

18. A cross-flow apparatus according to any one of claims 13 to 17 wherein the interpore distance is from about 1 μm to about 1,000 μm.

19. A cross-flow apparatus according to any one of claims 13 to 17 wherein the surface porosity of the membrane may be from about 0.001% to about 20% of the surface area of the membrane.

20. A cross-flow apparatus according to any one of claims 13 to 19 wherein the pores are in a patterned arrangement.

21. A cross-flow apparatus according to claim 20 wherein the patterned arrangement is a square, triangular, linear, circular or rectangular arrangement.

22. A cross-flow apparatus according to any one of the preceding claims wherein the membrane comprises a material selected from glass; ceramic; metal; polymer/plastic or silicon.

23. A cross-flow apparatus according to claim 22 wherein the membrane comprises a metal, such as stainless steel.

24. A cross-flow apparatus according to claim 1 wherein the furcation plate is a bi-furcation plate or a tri-furcation plate.

25. A cross-flow apparatus according to claim 24 wherein the number of orifices provided in the insert is from 2 to 6.

26. A cross-flow apparatus according to claim 24 wherein the chamfered region on the insert comprises a shallow chamfer.

27. A cross-flow apparatus according to any one of the preceding claims wherein the apparatus is suitable for preparing droplets with a CV of from about 5% to about 50%.

28. A cross-flow apparatus according to any one of the preceding claims wherein the apparatus is capable of a throughput of from 1 to 10^6 LMH

29. A method of preparing an emulsion using an apparatus according to claim 1.

30. A method according to claim 29 wherein the apparatus includes an insert.

31. A method according to claim 29 wherein the cross-flow apparatus comprises a plurality of tubular membranes.

32. A cross-flow apparatus according to claim 12 wherein a first flange located at the end adjacent to the outer sleeve (when coupled) is provided with a circumferential internal recess which acts as a seat for an O-ring seal wherein the O-ring seal allows a loose fit as the membrane slides through the O-ring.