WHAT IS CLAIMED IS:

1. A method of purifying polysaccharides from a cell lysate, the method comprising
   a. partially purifying the cell lysate comprising a polysaccharide and an impurity to obtain a clarified crude lysate;
   b. mixing the clarified crude lysate with a neutralization solution comprising 100 mM to 2 M salt to form a neutralized lysate;
   c. mixing the neutralized lysate with a precipitation solution comprising 0.1% v/v to 6% v/v cetyltrimethylammonium bromide (CTAB) to form a first supernatant and a first precipitate; and
   d. separating the first precipitate from the first supernatant,

   wherein the polysaccharide is substantially located in the first supernatant.

2. The method of claim 1, wherein the partially purifying the cell lysate comprises precipitation, centrifugation, filtration, or combination thereof.

3. The method of claim 2, wherein the filtration comprises depth filtration, tangential flow filtration (TFF), sterile filtration, or combination thereof.

4. The method of any one of claims 1 to 3, wherein the neutralization solution comprises 200 mM to 1 M salt.

5. The method of claim 4, wherein the neutralization solution comprises 250 mM to 650 mM salt.

6. The method of claim 5, wherein the neutralization solution comprises 300 mM to 500 mM salt.

7. The method of claim 6, wherein the salt is NaCl, KCl, CH_4Cl, NH_4Cl, $MgCl_2$, $CaCl_2$, Na_3PO_4, or combination thereof.

8. The method of any one of claims 1 to 7, wherein the neutralization solution comprises about 440 mM NaCl.

9. The method of any one of claims 1 to 8, wherein the mixing of the clarified crude lysate with the neutralization solution in (b) is performed simultaneously with or prior to a filtration step, wherein the filtration step is prior to (c).

10. The method of claim 9, wherein the mixing in (b) is performed simultaneously with the filtration step.

11. The method of claim 9 or 10, wherein the filtration comprises tangential flow filtration (TFF).

12. The method of any one of claims 1 to 11, wherein the precipitation solution comprises 0.2% v/v to 5% v/v CTAB.

13. The method of claim 12, wherein the precipitation solution comprises 0.5% v/v to 4% v/v CTAB.

14. The method of claim 13, wherein the precipitation solution comprises 1% v/v to 3% v/v CTAB.

15. The method of any one of claims 1 to 14, wherein the cell lysate comprises a positively charged polysaccharide, a neutral polysaccharide, a negatively charged polysaccharide, or combination thereof.

16. The method of claim 1 to 15, wherein the positively charged polysaccharide, the neutral polysaccharide, the negatively charged polysaccharide, or combination thereof are substantially in the first supernatant.

17. The method of any one of claims 1 to 16, wherein the impurity is substantially in the first precipitate.

18. The method of any one of claims 1 to 17, wherein the impurity comprises a polynucleotide.

19. The method of claim 18, wherein the polynucleotide is DNA, RNA, or combination thereof.

20. The method of any one of claims 1 to 19, wherein the mixing in (b), (c), or both, is performed by shaking, stirring, or pumping.

21. The method of any one of claims 1 to 20, wherein the separating is performed by centrifugation, filtration, or combination thereof.

22. The method of any one of claims 1 to 21, further comprising subjecting the first supernatant to ultrafiltration, diafiltration, or combination thereof to produce a retentate and a permeate, wherein the polysaccharide is substantially in the retentate, and the CTAB is substantially in the permeate.

23. The method of claim 22, wherein the ultrafiltration, diafiltration, or combination thereof is tangential flow filtration (TFF).

24. The method of claim 22, further comprising subjecting the retentate to carbon filtration.

25. The method of claim 24, further comprising subjecting the retentate to chromatography.

26. The method of any one of claims 1 to 21, further comprising adding potassium iodide (KI) to the first supernatant to form a second precipitate and a second supernatant, wherein the polysaccharide is substantially in the second supernatant and the CTAB is substantially in the second precipitate.

27. The method of any one of claims 1 to 26, wherein the method does not comprise a chromatography step prior to the addition of KI.

28. The method of claim 27, further comprising separating the second supernatant from the second precipitate by centrifugation, filtration, or combination thereof.

29. The method of claim 28, further comprising subjecting the second supernatant to carbon filtration.

30. The method of claim 29, further comprising subjecting the second supernatant to chromatography.

31. The method of claim 25 or 30, wherein the chromatography comprises ceramic hydroxyapatite type (CHT) chromatography, hydrophobic interaction chromatography (HIC), or combination thereof.

32. The method of claim 31, wherein the chromatography comprises CHT chromatography and HIC.

33. The method of claim 32, wherein the HIC is performed using a chromatography column or membrane comprising phenyl groups.

34. The method of claim 33, ultrafiltration, diafiltration, or combination thereof following the chromatography, to concentrate the polysaccharide.

35. The method of claim 34, wherein the ultrafiltration, diafiltration, or combination thereof is tangential flow filtration.

36. The method of any one of claims 1 to 35, wherein the method does not comprise a first precipitate containing greater than 10% of the polysaccharides in the cell lysate during the purification.

37. The method of any one of claims 1 to 36, wherein the positively charged polysaccharide, the neutral polysaccharide, the negatively charged polysaccharide, or the combination thereof are not substantially precipitated during the purification.

38. The method of any one of claims 1 to 37, wherein the positively charged polysaccharide, the neutral polysaccharide, the negatively charged polysaccharide, or the combination thereof are not isolated from each other.

39. The method of any one of claims 1 to 38, wherein greater than 90% (v/v) of negatively charged polysaccharides are in the first supernatant and less than 10% (v/v) of negatively charged polysaccharides are in the first precipitate.

40. The method of claim 39, wherein greater than 98% (v/v) of negatively charged polysaccharides are on the first supernatant and less than 2% (v/v) of negatively charged polysaccharides are in the first precipitate.

41. The method of any one of claims 1 to 40, wherein the percent yield of polysaccharides is greater than 30% relative to the polysaccharides in the cell lysate.

42. The method of claim 41, wherein the percent yield of polysaccharides is greater than 40% relative to the polysaccharides in the cell lysate.

43. The method of claim 42, wherein the percent yield of polysaccharides is greater than 50% relative to the polysaccharides in the cell lysate.

44. The method of claim 43, wherein the percent yield of polysaccharides is greater than 60% relative to the polysaccharides in the cell lysate.

45. The method of claim 44, wherein the percent yield of polysaccharides is 35% to 80 relative to the polysaccharides in the cell lysate.

46. The method of any one of claims 1 to 45, wherein the cell lysate is derived from a bacterial cell or a fungal cell.

47. The method of claim 46, wherein the cell is a *Staphylococcus* cell, *Streptococcus* cell, *Salmonella* cell, *Neisseria* cell, *Mycobacterium* cell, or *Aureobasidium* cell.

48. The method of claim 47, wherein the cell is an *Aureobasidium pullulans* cell.

49. The method of claim 47, wherein the cell is a *Streptococcus* cell.

50. The method of claim 49, wherein the *Streptococcus* cell is serotype 1, 2, 3, 4, 5, 6A, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15A, 15B, 17F, 18C, 19A, 19F, 20A, 22F, 23F, or 33F.

51. The method of claim 50, wherein the *Streptococcus* cell is serotype 3 or 4.

52. A method of purifying polysaccharides from a cell lysate, the method comprising
    a. partially purifying the cell lysate comprising an impurity and a polysaccharide to obtain a clarified crude lysate;
    b. mixing the clarified crude lysate with a neutralization solution comprising about 400 mM sodium chloride (NaCl) to form a neutralized lysate;

c. mixing the neutralized lysate with about 1.0% v/v cetyltrimethylammonium bromide (CTAB) to form a first supernatant and a first precipitate;

d. separating the first precipitate from the first supernatant;

e. mixing the first supernatant with potassium iodide (KI) to form a second precipitate and a second supernatant; and

f. separating the second precipitate from the second supernatant,

wherein the polysaccharide is substantially located in the second supernatant.

53. A method of making a polysaccharide vaccine, the method comprising purifying a polysaccharide according to the method of any one of claims 1 to 52 to obtain the polysaccharide vaccine.

54. The method of claim 53, wherein the polysaccharide comprises chitosan, glucan, mannose, inulin, galactose, galacturonic acid, 2-acetamido-4-amino-2,4,6-trideoxygalactose (AATGal*p*), glucuronic acid, glucose, rhamnose, N-acetylmannosamine (ManNAc), N-acetyl-L-fucosamine (FucNAc), beta-galactofuranose (beta-Galf), or combination thereof.

55. The method of claim 53 or 54, wherein the polysaccharide is further conjugated with a protein or polypeptide.