CLAIMS

We claim:

1. A method for producing a sophorolipid (SLP) composition with a hydrophile-lipophile balance (HLB) of 9 or greater, the method comprising:

obtaining a yeast fermentation product comprising a mixture of hydrophilic sophorolipid (SLP) molecules comprising non-acetylated acidic sophorolipid (ASL) molecules, and hydrophobic SLP molecules comprising lactonic sophorolipid (LSL) molecules and mono- and di-acetylated ASL molecules, said mixture being produced by cultivating Starmerella bombicola;

functionalizing the hydrophobic SLP molecules by converting them into hydrophilic SLP molecules by mixing the hydrophobic SLP molecules with a base to produce a hydrophilic SLP fraction comprising only hydrophilic SLP molecules;

producing a purified hydrophobic SLP fraction; and

mixing the hydrophilic SLP fraction with the purified hydrophobic SLP fraction at a ratio of hydrophilic SLP molecules to purified hydrophobic SLP molecules between 60:40 to 75:25.

2. The method or claim 1, wherein the yeast fermentation product is allowed to sit undisturbed for 12 to 24 hours, wherein a layer substantially comprising hydrophobic SLP molecules settles to the bottom of the product,

wherein the settled layer is harvested to obtain a crude hydrophobic SLP fraction comprising residual yeast cells, glucose, fatty acids, and/or fermentation broth, in addition to hydrophobic SLP molecules, and

the crude hydrophobic SLP fraction is treated to remove the residual yeast cells, glucose, fatty acids, and/or fermentation broth, thereby producing a purified hydrophobic SLP fraction.

3. The method of claim 2, wherein the crude hydrophobic SLP fraction is treated via water washing and/or oil-washing.

4. The method of claim 2, wherein converting the hydrophobic SLP molecules of the purified hydrophobic SLP fraction comprises altering the molecular structure of the SIN molecules, and wherein said structural alteration modifies a functional property selected from HLB, solubility, foaming, detergency, emulsification, demulsification, and wettability alteration.

5. The method of claim 4, wherein the functional property is HLB.

6. The method of claim 5, wherein the HLB is increased to 9 or greater.

7. The method of claim 4, wherein the functional property is water solubility, and wherein the water solubility is increased.

8. The method of claim 4, wherein the hydrophobic SLP fraction is converted to a hydrophilic SLP fraction by mixing the hydrophobic SLP fraction with a base.

9. The method of claim 8, wherein the base is selected from sodium hydroxide, potassium hydroxide and ammonium hydroxide.

10. The method of claim 8, wherein the base facilitates alkali-mediated lactone bond breakage of lactonic sophorolipid (LSL) molecules and/or alkali-mediated deacetylation of LSL and/or acidic sophorolipid (ASL) molecules.

11. The method of claim 4, wherein the water solubility of the hydrophobic SLP fraction is increased by mixing the fraction with an organic amine selected from ethanolamine, triethanolamine, propylamine, and isopropylamine.

12. The method of claim 11, wherein the organic amine deprotonates the carboxyl group of the fatty acid chain of an ASL molecule within the hydrophobic SLP fraction, and wherein the deprotonation produces an ammonium carboxylate salt.

13. An oil and gas service fluid composition having an HLB of 9 or greater, the composition comprising one or more functionalized sophorolipid (SLP) molecules that have been functionalized by mixing hydrophobic SLP molecules with a base to convert the hydrophobic SLP molecules into hydrophilic SLP molecules; a liquid, and one or more optional components specific to a desired use.

14. The composition of claim 13, wherein the functionalized SLP molecule has been functionalized to increase its solubility.

15. The composition of claim 14, wherein the functionalized SLP molecule is a non-acetylated ASL obtained via alkaline hydrolysis of the acetyl group(s) of a di-acetylated ASL and/or a mono- acetylated ASL.

16. The composition of claim 14, wherein the functionalized SLP molecule is a mono-acetylated ASL molecule obtained via alkaline hydrolysis of the acetyl groups of a di-acetylated ASL molecule.

17. The composition of claim 14, wherein the functionalized SLP molecule is a non-, mono-, or di-acetylated ASL molecule obtained via alkaline hydrolysis of the lactone bond of a non-, mono-, or di-acetylated LSL molecule.

18. The composition of claim 14, wherein the functionalized SLP molecule is a non-acetylated LSL molecule obtained via alkaline hydrolysis of the acetyl group(s) of a di-acetylated LSL and/or a mono-acetylated LSL molecule.

19. The composition of claim 14, wherein the functionalized SLP molecule is a mono-acetylated LSL molecule obtained via alkaline hydrolysis of the acetyl groups of a di-acetylated LSL molecule.

20. The composition of claim 14, wherein the functionalized SLP molecule is a non-, mono-, or di-acetylated ASL molecule that has been deprotonated via reaction with an organic amine.

21. The composition of claim 20, further comprising an LSL molecule.

22. The composition of claim 13, wherein the functionalized SLP molecule has been functionalized to increase its HLB value.

23. The composition of claim 13, wherein the liquid is fresh water, salt water, brine, produced water, methanol or ethylene glycol.

24. The composition of claim 13, wherein the one or more additional components are selected from a polymer. viscosifying agent, deflocculant, lubricant, fluid loss additive, friction reducer, solvent, pH adjuster, biocide, sulfide scavenger, microorganism, chelating agent. and surfactant.

25. The composition of claim 13, formulated as a water-based drilling fluid, water-in-oil demulsifier, sludge removal treatment, crude oil viscosity reducer, corrosion inhibitor, reservoir wettability modifier, water flooding injection fluid, polymer flooding fluid, fracturing fluid, matrix stimulation fluid, hydrocarbon-based treatment fluid, paraffin and/or asphaltene remover and/or dispersant, workover fluid, packer fluid, completion fluid, diverter fluid and/or oil displacement fluid.