

WHAT IS CLAIMED IS:

1. A sake replica comprising:
ethanol;
water; and
one or more additional VOCs, wherein the one or more additional VOCs do not comprise at least one compound selected from the group consisting of 2,3-pentadione, 1-octanol, 2-heptanone, 2-nonanone, 5-methyl furfural, benzaldehyde, benzyl alcohol, butyl acetate, butyraldehyde, citronellol, diethyl succinate, ethyl isobutyrate, ethyl lactate, ethyl propionate, ethyl trans-2-butenate, ethyl(methylthio) acetate, gamma-heptalactone, gamma-hexalactone, gamma-octalactone, hexanol, isoamyl hexanoate, isobutyl acetate, isobutyraldehyde, isobutyric acid, isovaleric acid, methionyl acetate, methyl acetate, nonanoic acid, phenylacetaldehyde, propionaldehyde, propionic acid, propyl acetate, and propyl butyrate.
2. The sake replica of claim 1, wherein the one or more additional VOCs comprise:
an ester;
an alcohol;
an aldehyde, a ketone, or an aldehyde and a ketone;
optionally, an acid;
optionally, a terpene, an isoprenoid, or a terpene and an isoprenoid;
optionally, a phenol;
optionally, a lactone;
optionally, an amine, a pyrazine, or an amine and a pyrazine;
optionally, a thiol, a thiazole, a sulfide, or any combination thereof;
optionally, an ether;
optionally, an acetal; and
optionally, a furan.
3. The sake replica of claim 2, wherein the one or more esters are selected from the group consisting of butyl acetate, diethyl malate, diethyl succinate, ethyl 2-

methylbutyrate, ethyl 3-hydroxyhexanoate, ethyl acetate, ethyl benzoate, ethyl butanoate, ethyl decanoate, ethyl heptanoate, ethyl hexanoate, ethyl isobutyrate, ethyl isovalerate, ethyl lactate, ethyl laurate, ethyl levulinate, ethyl nonanoate, ethyl octanoate, ethyl phenylacetate, ethyl propionate, ethyl salicylate, ethyl trans-2-butenate, ethyl valerate, ethyl(methylthio) acetate, ethyl-trans-3-hexenoate, heptyl acetate, hexyl acetate, isoamyl acetate, isoamyl hexanoate, isoamyl octanoate, isobutyl acetate, isobutyl propionate, methionyl acetate, methyl acetate, methyl hexanoate, methyl laurate, phenethyl acetate, phenethyl formate, phenethyl propionate, propyl acetate, propyl butyrate, propyl isovalerate, and mixtures thereof.

4. The sake replica of claim 2 or claim 3, wherein the one or more esters are selected from the group consisting of ethyl acetate, ethyl butanoate, ethyl hexanoate, ethyl octanoate, isoamyl acetate, phenethyl acetate, and mixtures thereof.

5. The sake replica of any one of claims 2-4, wherein the one or more esters are present in an amount of at least about 41 mg/L.

6. The sake replica of any one of claims 2-5, wherein the one or more alcohols are selected from the group consisting of 1-octanol, 1-octen-3-ol, 2-heptanol, 2-methyl-1-butanol, 2-phenylethanol, benzyl alcohol, butyl alcohol, DL-3-methyl-2-butanol, hexanol, isoamyl alcohol, isobutyl alcohol, propanol, and mixtures thereof.

7. The sake replica of any one of claims 2-6, wherein the one or more alcohols are selected from the group consisting of 2-methyl-1-butanol, 2-phenylethanol, butyl alcohol, isoamyl alcohol, isobutyl alcohol, propanol, and mixtures thereof.

8. The sake replica of any one of claims 2-7, wherein the one or more aldehydes or ketones are selected from the group consisting of 2,3-pentadione, 2-heptanone, 2-methylbutyraldehyde, 2-nonanone, 2-undecanone, 5-ethyl-3-hydroxy-4-methyl-2(5H)-furanone, 5-methyl furfural, 6-methyl-5-hepten-2-one, acetaldehyde, acetophenone, benzaldehyde, butyraldehyde, furfural, isobutyraldehyde, isovaleraldehyde, methyl β -

naphthyl ketone, methyl-2-pyrrolyl ketone, nonanal, octanal, p-anisaldehyde, phenylacetaldehyde, propionaldehyde, and mixtures thereof.

9. The sake replica of any one of claims 2-8, wherein the one or more aldehydes or ketones are selected from the group consisting of acetaldehyde, furfural, and mixtures thereof.

10. The sake replica of any one of claims 2-9, wherein the one or more aldehydes or ketones are present in a total amount of at least about 1.2 mg/L.

11. The sake replica of any one of claims 1-10, wherein the one or more additional VOCs comprise at least 3 compounds selected from the group consisting of 1-octanol, 2,3-pentadione, 2-heptanone, 2-methyl-1-butanol, 2-nonanone, 2-phenylethanol, 5-methyl furfural, acetaldehyde, benzaldehyde, benzyl alcohol, butyl acetate, butyl alcohol, butyraldehyde, citronellol, diethyl succinate, ethyl acetate, ethyl butanoate, ethyl hexanoate, ethyl isobutyrate, ethyl lactate, ethyl octanoate, ethyl propionate, ethyl trans-2-butenate, ethyl(methylthio) acetate, furfural, gamma-heptalactone, gamma-hexalactone, gamma-octalactone, hexanol, isoamyl acetate, isoamyl alcohol, isoamyl hexanoate, isobutyl acetate, isobutyl alcohol, isobutyraldehyde, isobutyric acid, isovaleric acid, methionyl acetate, methyl acetate, nonanoic acid, phenethyl acetate, phenylacetaldehyde, propanol, propionaldehyde, propionic acid, propyl acetate, propyl butyrate.

12. The sake replica of any one of claims 1-11, wherein the one or more additional VOCs comprise at least 3 compounds selected from the group consisting of 2-methyl-1-butanol, 2-phenylethanol, acetaldehyde, butyl alcohol, ethyl acetate, ethyl butanoate, ethyl hexanoate, ethyl octanoate, furfural, isoamyl acetate, isoamyl alcohol, isobutyl alcohol, phenethyl acetate, and propanol.

13. The sake replica of any one of claims 1-12, wherein the sake replica comprises 2-phenylethanol in an amount of less than about 28 mg/L.

14. The sake replica of any one of claims 1-13, wherein the sake replica comprises propanol in an amount of less than about 39 mg/L.
15. The sake replica of any one of claims 1-14, wherein the sake replica comprises ethyl butanoate in an amount of at least about 0.17 mg/L.
16. The sake replica of any one of claims 1-15, wherein the sake replica comprises ethyl octanoate in an amount of at least about 3.4 mg/L.
17. The sake replica of any one of claims 1-16, wherein the sake replica comprises furfural in an amount of at least about 0.45 mg/L.
18. The sake replica of any one of claims 1-17, wherein less than about 15.5% by mass of the one or more additional VOCs comprise 2-phenylethanol.
19. The sake replica of any one of claims 1-18, wherein less than about 22.5% by mass of the one or more additional VOCs comprise propanol.
20. The sake replica of any one of claims 1-19, wherein at least about 0.12% by mass of the one or more additional VOCs comprise ethyl butanoate.
21. The sake replica of any one of claims 1-20, wherein at least about 0.31% by mass of the one or more additional VOCs comprise furfural.
22. The sake replica of any one of claims 1-21, wherein the additional VOCs have less than 90% identity to the VOCs in a single reference sake.
23. The sake replica of any one of claims 1-22, wherein the sake replica comprises at least 7 additional VOCs and wherein no more than 6 of the additional VOCs are found in a single reference sake.
24. The sake replica of any one of claims 1-23, further comprising one or more non-volatile compounds.

25. The sake replica of claim 24, wherein the one or more non-volatile compounds comprise one or more non-volatile compounds that are not present in a corresponding traditional sake.
26. The sake replica of claim 25, wherein the one or more non-volatile compounds that are not present in a traditional sake are selected from the group consisting of 2,3,5-trimethylpyrazine, 2,3-dimethylpyrazine, aspartic acid, caffeic acid, camphoric acid, catechin, cinnamic acid, cysteine, cystine, ellagic acid, epicatechin, epicatechin gallate, gallic acid, hesperetin, methyl gallate, methyl-2-pyrrolyl ketone, inositol, propyl gallate, pyridine, quercetin, resveratrol, sinapinic acid, sorbic acid, syringaldehyde, and tryptamine.
27. The sake replica of any one of claims 24-26, wherein the one or more non-volatile compounds comprise:
- a sugar, a sugar alcohol, or a combination thereof;
 - an amino acid, an amino acid derivative, or a combination thereof;
 - a pH-modifying salt;
 - an organic acid;
 - optionally, a nucleobase, a nucleotide, or a combination thereof;
 - optionally, a nitrogen-containing heterocycle; and
 - optionally, a phenolic compound.
28. The sake replica of claim 27, wherein the sugar, sugar alcohol, or combination thereof is selected from the group consisting of fructose, glucose, sorbitol, fucose, galactose, glucosamine, mannitol, mannose, rhamnose, xylose, arabitol, ribose, and mixtures thereof.

29. The sake replica of claim 27 or claim 28, wherein the sugar, sugar alcohol, or combination thereof is selected from the group consisting of fructose, glucose, sorbitol, and mixtures thereof.
30. The sake replica of any one of claims 27-29, wherein the amino acid, amino acid derivative, or combination thereof is selected from the group consisting of arginine, glutamic acid, isoleucine, lysine, phenylalanine, threonine, alanine, asparagine, beta-alanine, carnitine, GABA, glutamine, glycine, histidine, leucine, methionine, ornithine, proline, serine, tryptophan, tyrosine, valine, betaine, carnosine, citrulline, homoserine, trans-4-hydroxyproline, tyramine, kynurenic acid, and mixtures thereof.
31. The sake replica of any one of claims 27-30, wherein the amino acid, amino acid derivative, or combination thereof is selected from the group consisting of alanine, arginine, glutamic acid, isoleucine, lysine, phenylalanine, threonine, and mixtures thereof.
32. The sake replica of any one of claims 27-31, wherein the organic acid is selected from the group consisting of citric acid, D-glucuronic acid, fumaric acid, malic acid, succinic acid, tartaric acid, cinnamic acid, pantothenic acid, 2-furoic acid, 2-isopropylmalic acid, 4-guanidinobutyric acid, lactic acid, pyruvic acid, quinic acid, adipic acid, and mixtures thereof.
33. The sake replica of any one of claims 27-32, wherein the organic acid is selected from the group consisting of cinnamic acid, citric acid, D-glucuronic acid, fumaric acid, lactic acid, malic acid, succinic acid, tartaric acid, and mixtures thereof.
34. The sake replica of any one of claims 27-33, wherein the one or more non-volatile compounds comprise at least 5 compounds selected from the group consisting of 2,3,5,6-tetramethylpyrazine, 4-guanidinobutyric acid, alanine, arginine, choline bitartrate, cinnamic acid, citric acid, D-glucuronic acid, fructose, fumaric acid, glucose, glutamic acid, guanine, isoleucine, KOH, lysine, lactic acid, malic acid, phenylalanine, pyridoxine, salicylic acid, sorbitol, succinic acid, tartaric acid, and threonine.

35. The sake replica of any one of claims 27-34, wherein the one or more non-volatile compounds comprise at least 5 compounds selected from the group consisting of alanine, arginine, choline bitartrate, cinnamic acid, citric acid, D-glucuronic acid, fructose, fumaric acid, glucose, glutamic acid, isoleucine, KOH, lysine, lactic acid, malic acid, phenylalanine, sorbitol, succinic acid, tartaric acid, threonine.

36. The sake replica of any one of claims 27-35, wherein the sake replica comprises less than about 1.4 mg/L of fumaric acid.

37. The sake replica of any one of claims 27-36, wherein the sake replica comprises at least about 38 mg/L of phenylalanine.

38. The sake replica of any one of claims 27-37, wherein the sake replica comprises at least about 25 mg/L of fructose.

39. A sake replica comprising:

ethanol;

water; and

one or more non-volatile compounds, wherein the one or more non-volatile compounds comprise at least one compound selected from the group consisting of cinnamic acid, 2,3,5-trimethylpyrazine, 2,3-dimethylpyrazine, aspartic acid, caffeic acid, camphoric acid, catechin, cysteine, cystine, ellagic acid, epicatechin, epicatechin gallate, gallic acid, hesperetin, methyl gallate, methyl-2-pyrrolyl ketone, inositol, propyl gallate, pyridine, quercetin, resveratrol, sinapinic acid, sorbic acid, syringaldehyde, and tryptamine.

40. A sake replica comprising:

ethanol;

water; and

one or more additional VOCs, wherein the additional VOCs comprise 2-methyl-1-butanol, 2-phenylethanol, acetaldehyde, butyl alcohol, ethyl acetate, ethyl butanoate, ethyl hexanoate, ethyl octanoate, furfural, isoamyl acetate, isoamyl alcohol, isobutyl alcohol, phenethyl acetate, and propanol.

41. The sake replica of claim 40, further comprising one or more non-volatile compounds, wherein the non-volatile compounds comprise alanine, arginine, choline bitartrate, cinnamic acid, citric acid, D-glucuronic acid, fructose, fumaric acid, glucose, glutamic acid, isoleucine, KOH, lactic acid, lysine, malic acid, phenylalanine, sorbitol, succinic acid, tartaric acid, and threonine.

42. A method of making a sake replica, the method comprising:
combining ingredients comprising:

water;

ethanol;

five or more additional VOCs, wherein at least five of the five or more additional VOCs are provided as separate ingredients; and

five or more non-volatile compounds, wherein at least five of the five or more non-volatile compounds are provided as separate ingredients.

43. A sake replica produced by the method of claim 42.

44. The sake replica of claim 43, wherein the sake replica is the sake replica of any one of claims 1-41.

45. A sake replica comprising:

ethanol;

water;

additional volatile organic compounds (VOCs); and

non-volatile compounds,

wherein the additional VOCs comprise:

Compound (mg/L, unless otherwise specified)	
acetaldehyde	17 - 32
butyl alcohol	3 - 7
propyl alcohol	5 - 11
ethyl acetate	45 - 85
ethyl butanoate	0.4 - 0.8
ethyl hexanoate	2 - 4
ethyl octanoate	2.5 - 5.5
furfural	4 - 10
isoamyl acetate	0.5 - 1
isoamyl alcohol	70 - 130
isobutyl alcohol	14 - 26
phenethyl acetate	0.1 - 0.2
phenethyl alcohol	4 - 9
2-methyl-1-butanol	10 - 19

and wherein the non-volatile compounds comprise:

Compound (mg/L, unless otherwise specified)	
arginine	225 - 420
alanine	60 - 120
choline bitartrate	400 - 750
fructose	300 - 600
glucose	25000 - 50000
D-glucuronic acid	20 - 45
malic acid	330 - 620
sorbitol	25 - 50
fumaric acid	0.25 - 0.6
glutamic acid	100 - 200

citric acid	35 - 70
isoleucine	35 - 65
tartaric acid	0.1 - 0.25
lactic acid (mL/L)	280 - 530
lysine HCl	20 - 45
phenylalanine	40 - 90
threonine	9 - 16
cinnamic acid	16 - 32
succinic acid	200 - 400
KOH	250 - 500