[0009c] In another aspect, the present disclosure refers to a method for producing RebD: (a) culturing a population of the genetically modified host cells of any the preceding claims in a medium with a carbon source under conditions suitable for making RebD; and (b) recovering said RebD compound from the medium.

[0009d] In another aspect, the present disclosure refers to a method for producing RebM: (a) culturing a population of the genetically modified host cells of any of the preceding claims in a medium with a carbon source under conditions suitable for making RebM; and (b) recovering said RebM compound from the medium.

~~**[0009e]** In another aspect, the present disclosure refers to an *in vitro* method for producing kaurenoic acid: (a) contacting kaurene with a non-naturally occurring kaurene oxidase of any of the preceding claims, capable of converting kaurene to kaurenoic acid, under conditions suitable for forming kaurenoic acid; and (b) recovering said kaurenoic acid compound from the medium.~~

[~~0009f~~0009e] In another aspect, the present disclosure refers to a fermentation composition comprising: (a) a genetically modified *Saccharomyces cerevisiae* host cell comprising: i. a heterologous nucleic acid encoding a non-natural kaurene oxidase of any of the preceding claims, capable of converting kaurene to kaurenoic acid; and (b) steviol glycosides produced from the genetically modified host cell.

~~**[0009g]** In another aspect, the present disclosure refers to a non-naturally occurring kaurene oxidase having at least 80%, 85%, 90%, 95% sequence identity to SEQ ID NO:1.~~

~~**[0009h]** In another aspect, the present disclosure refers to a non-naturally occurring nucleic acid encoding the non-naturally occurring kaurene oxidase as disclosed herein.~~

[~~0009i~~0009f] In another aspect, the present disclosure refers to a method for producing a steviol glycoside: (a) culturing a population of the genetically modified host cells of any of the preceding claims in a medium with a carbon source under conditions suitable for making a steviol glycoside.

[0010] In one example, provided herein are genetically modified host cells and methods of their use for the production of industrially useful compounds. In one example, provided herein is a genetically modified host cell comprising: a heterologous nucleic acid encoding a *Pisum sativum* kaurene oxidase. In some examples, the genetically modified host cell further comprises one or more enzymatic pathways capable of producing steviol and/or steviol glycosides.

[0011] In certain examples, provided herein are genetically modified host cells comprising a heterologous nucleic acid encoding a kaurene oxidase comprising an amino acid sequence having at least 80%, 85%, 90%, or 95% sequence identity to the sequence of *Pisum sativum* kaurene oxidase (*e.g.*, SEQ ID NO:1). In certain examples, the genetically

WHAT IS CLAIMED:

1. A genetically modified *Saccharomyces cerevisiae* host cell capable of producing one or more steviol glycosides comprising a heterologous nucleic acid encoding a kaurene oxidase comprising an amino acid sequence having at least 80%, 85%, 90%, or 95% sequence identity to SEQ ID NO: 1.

2. The genetically modified *Saccharomyces cerevisiae* host cell of claim 1 that is capable of converting kaurene to kaurenoic acid at an efficiency of greater than 30%, 35%, 40%, 45%, 50%, or 55%.

3. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the kaurene oxidase comprises an amino acid sequence having the sequence of SEQ ID NO:1.

4. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the kaurene oxidase is capable of oxidation of the C19 position of kaurene, kaurenol, and/or kaurenal.

5. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the kaurene oxidase is encoded by a heterologous nucleic acid, wherein the heterologous nucleic acid comprises a nucleotide sequence having at least 80%, 85%, 90%, or 95% sequence identity to SEQ ID NO:15.

6. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the kaurene oxidase is encoded by a heterologous nucleic acid having the sequence of SEQ ID NO:15.

7. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, that is capable of converting kaurene to kaurenoic acid at an efficiency of greater than 30%, 35%, 40%, 45%, 50%, or 55%, and wherein the kaurene oxidase comprises an amino acid sequence having at least 95% sequence identity to SEQ ID NO:1.

8. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the kaurene oxidase is a polypeptide having a functional domain with at least 80%, 85%, 90%, or 95% sequence identity to a functional domain of SEQ ID NO:1.

9. The genetically modified *Saccharomyces cerevisiae* host cell of claim 7 that is capable of converting kaurene to kaurenoic acid at an efficiency of greater than 55%.

10. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims that is capable of producing kaurenoic acid.

11. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims that is capable of producing steviol.

12. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims that is capable of producing RebD.

13. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims that is capable of producing RebM.

14. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims that is capable of producing at RebM and RebM2 at a ratio of at least 10:1, 100:1, or 1000:1.

15. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the genetically modified host cell produces an undetectable level of RebM2.

16. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the genetically modified host cell further comprises one or more heterologous nucleic acids encoding one or more enzymes of a pathway for making steviol.

17. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the genetically modified host cell further comprises one or more

heterologous nucleic acids encoding one or more enzymes of a pathway for making a steviol glycoside.

18. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the genetically modified host cell further comprises one or more heterologous nucleic acids encoding one or more enzymes of a pathway for making a RebA.

19. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the genetically modified host cell further comprises one or more heterologous nucleic acids encoding one or more enzymes of a pathway for making RebM.

20. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the genetically modified host cell further comprises one or more heterologous nucleic acids encoding one or more enzymes of a pathway for making RebE.

21. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the one or more enzymes of the pathway comprise a geranylgeranyl diphosphate synthase.

22. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the one or more enzymes of the pathway comprise a copalyl diphosphate synthase.

23. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the one or more enzymes of the pathway comprise an *ent*-kaurene synthase.

24. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the one or more enzymes of the pathway comprise a kaurenoic acid hydroxylase.

25. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the one or more enzymes of the pathway comprise a cytochrome P450 reductase.

26. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the one or more enzymes of the pathway comprise one or more uridine 5'-diphosphate-dependent glycosyltransferases.

27. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims wherein the one or more enzymes of the pathway comprise Os_UGT_91C1, Sl_UGT_101249881, UGT40087, sr.UGT_9252778, Bd_UGT10840, Hv_UGT_V1, Bd_UGT10850, or Ob_UGT91B1_like.

28. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims wherein the one or more enzymes of the pathway comprise UGT74G1, UGT76G1, UGT85C2, UGT91D, or UGT40087.

29. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the one or more enzymes of the pathway comprise a geranylgeranyl diphosphate synthase, a copalyl diphosphate synthase, a ent-kaurene synthase, a kaurene oxidase, a kaurenoic acid hydroxylase, a cytochrome P450 reductase, a UGT_{AD}, UGT74G1, UGT76G1, UGT85C2, and UGT91D.

30. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the one or more enzymes of the pathway comprise a geranylgeranyl diphosphate synthase, a copalyl diphosphate synthase, a *ent*-kaurene synthase, a kaurene oxidase, a kaurenoic acid hydroxylase, a cytochrome P450 reductase, UGT40087, UGT74G1, UGT76G1, UGT85C2, and UGT91D.

31. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the UGT40087 is according to SEQ ID NO:17, 18, or 33.

32. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the one or more enzymes of the pathway comprises a bifunctional copalyl diphosphate synthase and kaurene synthase.

33. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the one or more heterologous nucleic acids encoding one or more enzymes of the pathway are under control of a single transcriptional regulator.

34. The genetically modified *Saccharomyces cerevisiae* host cell of any of the preceding claims, wherein the one or more heterologous nucleic acids encoding one or more enzymes of the pathway are under control of multiple heterologous transcriptional regulators.

35. A method for producing kaurenoic acid:

(a) culturing a population of the genetically modified *Saccharomyces cerevisiae* host cells of any the preceding claims in a medium with a carbon source under conditions suitable for making RebD; and

(b) recovering said kaurenoic acid compound from the medium.

36. A method for producing RebD:

(a) culturing a population of the genetically modified host cells of any the preceding claims in a medium with a carbon source under conditions suitable for making RebD; and

(b) recovering said RebD compound from the medium.

37. A method for producing RebM:

(a) culturing a population of the genetically modified host cells of any of the preceding claims in a medium with a carbon source under conditions suitable for making RebM; and

(b) recovering said RebM compound from the medium.

~~38. An *in vitro* method for producing kaurenoic acid:~~

~~(a) contacting kaurene with a non-naturally occurring kaurene oxidase of any of the preceding claims, capable of converting kaurene to kaurenoic acid, under conditions suitable for forming kaurenoic acid; and~~

~~(b) recovering said kaurenoic acid compound from the medium.~~

~~39.~~38. A fermentation composition comprising:

(a) a genetically modified *Saccharomyces cerevisiae* host cell comprising:

i. a heterologous nucleic acid encoding a non-natural kaurene oxidase of any of the preceding claims, capable of converting kaurene to kaurenoic acid; and

(b) steviol glycosides produced from the genetically modified host cell.

~~40.~~39. The fermentation composition of claim 3~~9~~8, wherein the steviol glycosides comprise RebA, RebD and ReM at a ratio of RebA:RebD:RebM of at least 1:7:50.

~~41. A non-naturally occurring kaurene oxidase having at least 80%, 85%, 90%, 95% sequence identity to SEQ ID NO:1.~~

~~42. A non-naturally occurring kaurene oxidase of claim 41 that is capable of converting kaurene to kaurenoic acid at an efficiency of greater than 30%, 35%, 40%, 45%, 50%, or 55% *in vivo*.~~

~~43. A non-naturally occurring nucleic acid encoding the non-naturally occurring kaurene oxidase of claim 41 or 42.~~

~~44.~~40. A method for producing a steviol glycoside:

(a) culturing a population of the genetically modified host cells of any of the preceding claims in a medium with a carbon source under conditions suitable for making a steviol glycoside.