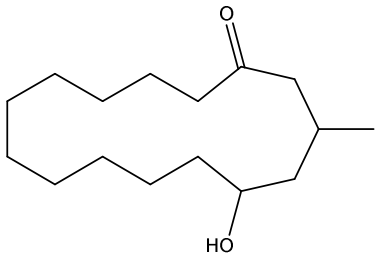
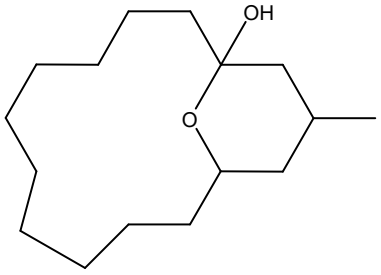
CLAIMS

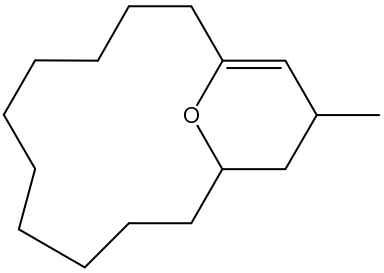
1. A method for making a mixture comprising a compound of formula (II), a compound of formula (III) and a compound of formula (IV),



Formula (II)

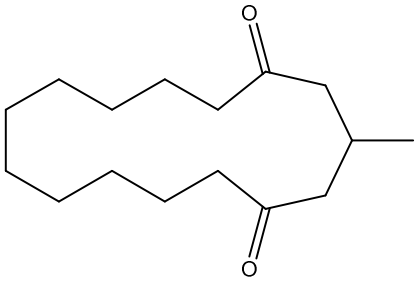


Formula (III)



Formula (IV)

wherein the method comprises contacting a compound of formula (I) with an alcohol dehydrogenase,



Formula (I).

2. The method of any preceding claim, wherein the alcohol dehydrogenase has an amino acid sequence as set out in SEQ ID NO: 1 or is a variant of the amino acid sequence as set out in SEQ ID NO: 1, the variant having an amino acid sequence with at least 70 % identity with the amino acid sequence as set out in SEQ ID NO:1.

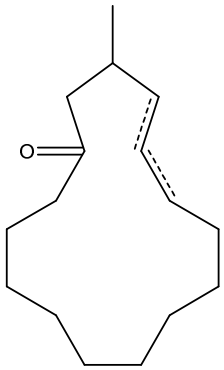
3. The method of claim 2, wherein the alcohol dehydrogenase is the variant of the amino acid sequence as set out in SEQ ID NO: 1, and the variant alcohol dehydrogenase variant includes an amino acid alteration relative to one or more of the following amino acids in amino acid sequence as set out in SEQ ID NO:1: R11, F30, V99, A100, L103, Q105, M106, L133, T145, N154, G161, V192, E194, K196, V198, Y209, M211, A213, E227 and S258.

4. The method according to claim 3, wherein the alcohol dehydrogenase variant has an amino acid sequence with at least 90 % identity with the amino acid sequence as set out in SEQ ID NO: 1.

5. The method according to any one of claims 2 to 4, wherein the alcohol dehydrogenase has an amino acid sequence as set out in any one of SEQ ID NO: 2 to SEQ ID NO: 16.

6. The method of any preceding claim, wherein the reaction takes place in the presence of an enzyme cofactor and a cofactor regeneration system.

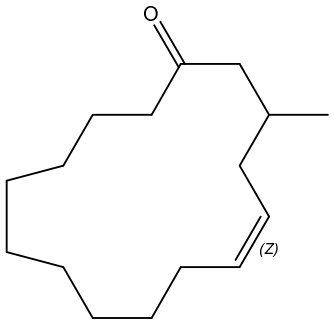
7. The method of any preceding claim, further comprising treating the one or more of a compound of formula (II), a compound of formula (III) and a compound of formula (IV) with acid to provide one or more compound(s) of formula (V),



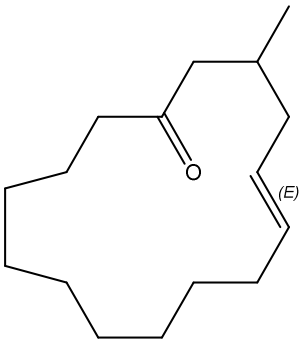
Formula (V),

wherein one of ------ is a single bond and the other is a double bond.

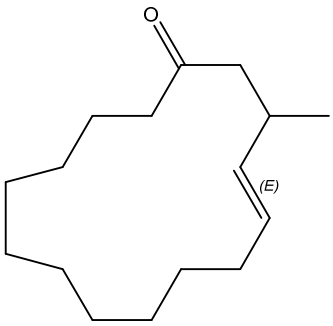
8. The method of any of claims 1 to 7, further comprising treating the mixture comprising a compound of formula (II), a compound of formula (III) and a compound of formula (IV) with acid to provide a mixture comprising a compound of formula (Va), a compound of formula (Vb) and a compound of formula (Vc),



Formula (Va)

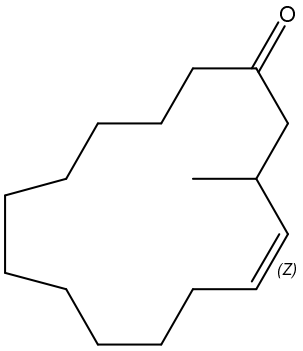


Formula (Vb)



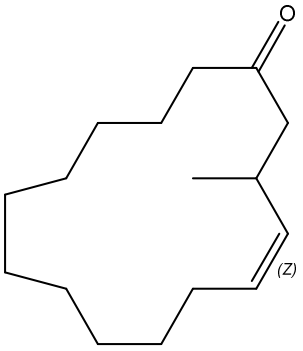
Formula (Vc).

9. The method of claim 8, wherein the product mixture further comprises a compound of Formula (Vd),



Formula (Vd).

10. The method of claim 8, wherein the product mixture does not comprise a compound of Formula (Vd),

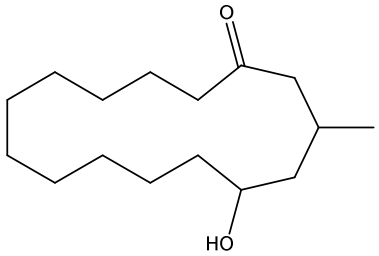


Formula (Vd).

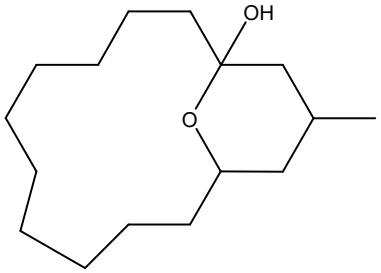
11. The method of any of claims 7 to 10, wherein the acid is para-toluene sulphonic acid (pTSA) or phosphoric acid.

12. The method of any of claims 7 to 11, further comprising an enrichment distillation step after the acid treatment to obtain a desired stereoisomer ratio.

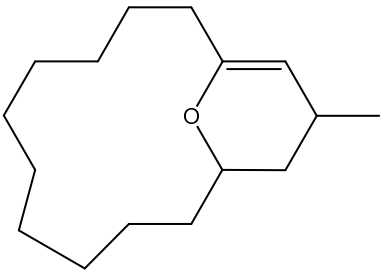
13. A composition comprising a compound of formula (II), a compound of formula (III) and a compound of formula (IV),



Formula (II)

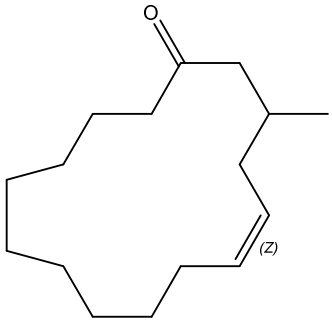


Formula (III)

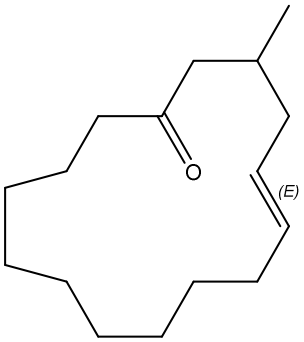


Formula (IV).

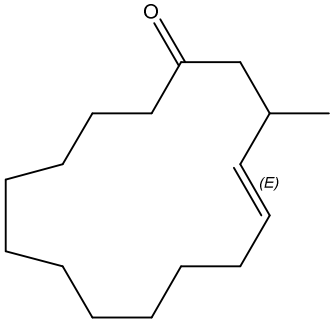
14. A composition comprising a compound of formula (Va), a compound of formula (Vb) and a compound of formula (Vc),



Formula (Va)



Formula (Vb)



Formula (Vc)

wherein:

the compound of formula (Va) is present in the composition in an amount ranging from about 20.0 wt% to less than about 40.0 wt%;

the compound of formula (Vb) is present in the composition in an amount ranging from greater than about 40.0 wt% to about 70.0 wt%; and

the compound of formula (Vc) is present in the composition in an amount ranging from about 5.0 wt% to about 15.0 wt%.

15. The composition of claim 14, wherein:

the compound of formula (Va) has an enantiomeric excess of the (*R*) enantiomer equal to or greater than about 25.0 %; and/or

the compound of formula (Vb) has an enantiomeric excess of the (*R*) enantiomer equal to or greater than about 25.0 %; and/or

the compound of formula (Vc) has an enantiomeric excess of the (*S*) enantiomer equal to or greater than about 25.0 %.

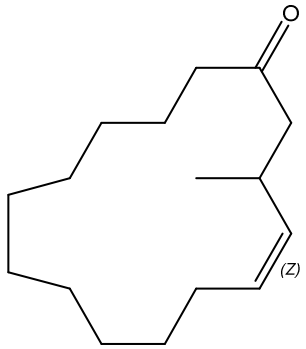
16. The composition of claim 14 or 15, wherein:

the compound of formula (Va) has an enantiomeric excess of the (*R*) enantiomer equal to or greater than about 60.0 %; and/or

the compound of formula (Vb) has an enantiomeric excess of the (*R*) enantiomer equal to or greater than about 60.0 %; and/or

the compound of formula (Vc) has an enantiomeric excess of the (*S*) enantiomer equal to or greater than about 60.0 %.

17. The composition of any of claims 14 to 16, wherein the composition further comprises a compound of formula (Vd) in an amount ranging from about 0.5 wt% to about 5.0 wt%,



Formula (Vd).

18. A composition comprising:

from 35 to 55% w/w of a compound of formula (Va) having an enantiomeric excess of the (*R*) enantiomer of less than 80 %;

from 27 to 40% w/w of a compound of formula (Vb) having an enantiomeric excess of the (*R*) enantiomer of less than 80 %;

from 3 to 20% w/w of a compound of formula (Vc) having an enantiomeric excess of the (*S*) enantiomer of less than 80 %; and

from 0 to 5% w/w of a compound of formula (Vd) having an enantiomeric excess of the (*S*) enantiomer of less than 80 %.

19. A composition obtained by or obtainable by a method of any one of claims 1 to 6 or a composition obtained by or obtainable by a method of any one of claims 7 to 12.

20. Use of a composition of any of claims 13 to 18 as a fragrance ingredient.

21. A consumer product comprising a composition of any of claims 13 to 18.

22. An alcohol dehydrogenase, the alcohol dehydrogenase being a variant of the alcohol dehydrogenase having the amino acid sequence as set out in SEQ ID NO: 1, wherein the variant has at least 70 % sequence identity with SEQ ID NO: 1.