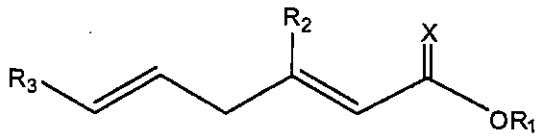
CLAIMS

What is claimed is:

1. A compound of formula (I)



(I)

wherein

X is a carbon or heteroatom;

R^1, R^2 and R^3 are each independently selected from the group consisting of hydrogen, unsubstituted or substituted C_1-C_{10} alkyl, unsubstituted or substituted C_1-C_{10} alkenyl, unsubstituted or substituted C_1-C_{10} alkynyl, unsubstituted or substituted C_3-C_8 cycloalkyl, unsubstituted or substituted C_1-C_{10} alkoxy, unsubstituted or substituted C_3-C_8 cycloalkoxy, unsubstituted or substituted C_6-C_{14} aryl, an unsubstituted or substituted 5- to 10-membered heteroaryl wherein 1 to 4 ring atoms are independently selected from nitrogen, oxygen or sulfur, an unsubstituted or substituted 5- to 10-membered heteroalicyclic ring wherein 1 to 3 ring atoms are independently nitrogen, oxygen or sulfur, -C(O)R , -C(O)OR , -C(O)NRR', -NRR', $-S(O)_2R$, $-S(O)_2OR$, and $-S(O)_2NRR'$,

R and R' are independently selected from the group consisting of hydrogen and unsubstituted or substituted C_1-C_{10} alkyl, unsubstituted or substituted C_1-C_{10} alkenyl, unsubstituted or substituted C_1-C_{10} alkynyl;

or a tautomer, geometrical isomer, enantiomer, diastereomer, racemate form, pharmaceutically acceptable salt or prodrug thereof.

2. The compound of claim 1, wherein the heteroatom is oxygen, sulphur, nitrogen or phosphorus.

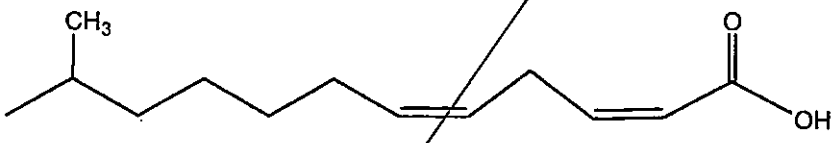
3. The compound of claim 1 or 2, wherein R^2 is hydrogen, methyl or ethyl.

4. The compound of any one of claims 1 to 3, wherein R^2 is hydrogen and R^3 is unsubstituted or substituted C_1-C_{10} alkyl.

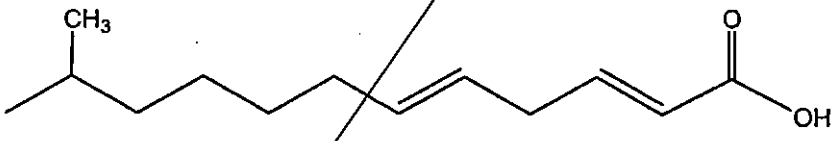
5. The compound of claim 4, wherein R^3 is unsubstituted or substituted methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl or decyl.

6. The compound of claim 5, wherein R^3 is 2-methylhexyl.

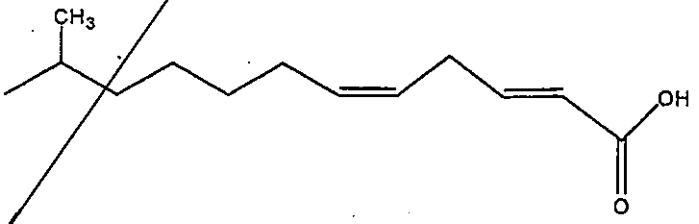
7. The compound of any one of claims 1 to 6, wherein the compound is a compound of formula (II), formula (III), formula (IV) or formula (V)



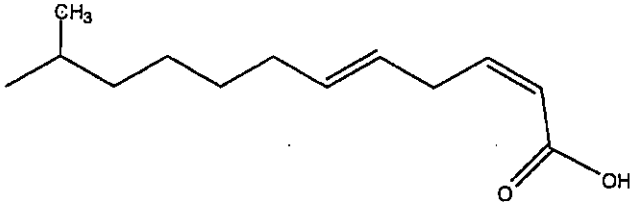
(II)



(III)



(IV)



(V).

8. A composition comprising a compound of any one of claims 1 to 7.

9. The composition of claim 8, wherein the composition is a personal hygiene article, a toiletry or a cosmetic.

10. The composition of claim 9, wherein the toiletry is an oral hygiene product.

11. The composition of claim 10, wherein the oral hygiene product is selected from the group consisting of toothpaste, mouthwash, gel, dentifrice composition, mouthwash composition and chewing gum composition.

12. The composition of any one of claims 8 to 11, wherein the composition is a pharmaceutical composition.

13. The composition of claim 12, further comprising a pharmaceutically acceptable carrier.

14. The compound according to any one of claims 1 to 7, for use as a medicament.

15. A method of treating or preventing a bacterial or fungal infection or both bacterial and fungal infections in a subject comprising administering a therapeutically effective amount of a compound of any one of claims 1-7 or the composition according to claim 8 to a subject in need thereof.

16. The method of claim 15, wherein the fungal infection is caused by yeast or a non-yeast fungus.

17. The method of claim 15 or 16, wherein the fungal infection is a *Candida albicans*, *Candida tropicalis*, *Candida (Clasvispora) lusitaniae*, *Candida (Pichia) guillermondii*, *Lodderomyces elongisporus*, *Debaryomyces hansenii*, *Pichia stipitis*, *Asperigillus fumigatus*, *Blastomyces dermatitidis*, *Cladophialophora bantiana*, *Coccidioides immitis*,

Cryptococcus neoformans, Fusarium spp., Microsporum spp., Penicillium marneffei, or Trichophyton spp infection.

18. The method of claim 17, wherein the bacterial infection is caused by a Gram negative bacterium or a Gram positive bacterium.

19. The method of claim 18, wherein the bacterial infection is a *Acinetobacter, Actinomyces, Aeromonas, Bordetella, Borrelia, Brucella, Burkholderia, Campylobacter, Chlamydia, Clostridium, Corynebacterium, Enterococcus, Erwinia, Escherichia, Francisella, Haemophilus, Helicobacter, Klebsiella, Legionella, Leptospira, Listeria, Mycobacterium, Mycoplasma, Neisseria, Pseudomonas, Rickettsia, Salmonella, Shigella, Staphylococcus, Streptococccus, Treponema, Verllonella, Vibrio* or *Yersinia* infection.

20. The method of claim 19, wherein the bacterial infection is a *Staphylococcus aureus, Mycobacterium smegmatic, Pseudomonas aeruginosa, Burkholderia cepacia, Klebsiella pneumonia, Aeromonas hydrophila, Erwinia carotovora, Erwinia chrysanthemi,* or *Escherichia coli* infection.

21. A compound of any one of claims 1 to 7 for use in treating or preventing a bacterial or fungal infection or both bacterial and fungal infections.

22. The compound of claim 21, wherein the fungal infection is caused by yeast or a non-yeast fungus.

23. The compound of claim 21 or 22, wherein the fungal infection is a *Candida albicans, Candida tropicalis, Candida (Clasvispora) lusitaniae, Candida (Pichia) guillermondii, Loddeyomyces elongisporus, Debaryomyces hansenii, Pichia stipitis, Asperigillus fumigatus, Blastomyces dermatitidis, Cladophialophora bantiana, Coccidioides immitis, Cryptococcus neoformans, Fusarium spp., Microsporum spp., Penicillium marneffei, or Trichophyton spp* infection.

24. The compound of claim 21, wherein the bacterial infection is caused by a Gram negative bacterium or a Gram positive bacterium.

25. The compound of claim 24, wherein the bacterial infection is a *Acinetobacter, Actinomyces, Aeromonas, Bordetella, Borrelia, Brucella, Burkholderia, Campylobacter, Chlamydia, Clostridium, Corynebacterium, Enterococcus, Erwinia, Escherichia, Francisella, Haemophilus, Helicobacter, Klebsiella, Legionella, Leptospira, Listeria, Mycobacterium, Mycoplasma, Neisseria, Pseudomonas, Rickettsia, Salmonella, Shigella, Staphylococcus, Streptococccus, Treponema, Verllonella, Vibrio* or *Yersinia* infection.

26. The compound of claim 25, wherein the bacterial infection is a *Staphylococcus aureus*, *Mycobacterium smegmatic*, *Pseudomonas aeruginosa*, *Burkholderia cepacia*, *Klebsiella pneumonia*, *Aeromonas hydrophila*, *Erwinia carotovora*, *Erwinia chrysanthemi*, or *Escherichia coli* infection.

27. A compound of any one of claims 1 to 7 or a composition of claim 8 for the removal/treatment of a biofilm or for inhibiting biofilm formation.

28. The compound or composition of claim 27 for the removal of a biofilm or for inhibiting biofilm formation on a medical article, instrument or device.

29. The compound or composition of claim 28 for the removal of a biofilm or for inhibiting biofilm formation in a personal hygiene article, a toiletry or a cosmetic.

30. The compound or composition of claim 29, for the removal of a biofilm or for inhibiting biofilm formation in a toiletry.

31. The compound or composition of claim 30, wherein the toiletry is an oral hygiene product.

32. The compound or composition of claim 31, wherein the oral hygiene product is selected from the group consisting of toothpaste, mouthwash, gel, dentifrice composition, mouthwash composition and chewing gum composition.

33. The compound or composition of claim 27 for the removal of a biofilm or for inhibiting biofilm formation in industrial settings.

34. The compound or composition of claim 33, wherein the industrial setting is selected from the group consisting of ship hulls, food processing systems, oil recovery or paper manufacturing plants.

35. The compound or composition of claim 27, for the treatment of biofilms or for inhibiting biofilm formation in environmental settings.

36. The compound or composition of claim 35, wherein the environmental setting is a water distribution system or a cooling water system.

37. A method for producing a compound of any one of claims 1-7 comprising
    (a) cultivating an organism of the genus *Xanthomonas* or *Burkholderia*; and
    (b) isolating said compound from said organism.

38. The method of claim 37, wherein the organism of the genus *Xanthomonas* is *Xanthomonas campestris* pv. *campestris*.

39. The method of claim 38, wherein the *Xanthomonas campestris* pv. *campestris* is *Xanthomonas campestris* pv. *campestris* strain XC1 or a mutant thereof.

40. The method of claim 39, wherein the organism of the genus *Burkholderia* is *Burkholderia multivorans*, *Burkholderia stabilis*, *Burkholderia anthina* or *Burkholderia pyrrocinia*.

41. The method of claim 40, wherein the *Burkholderia multivorans* is the *Burkholderia multivorans* strain having the ATCC accession number 17616 or a mutant thereof.

42. The method of claim 40, wherein *Burkholderia stabilis* is the *Burkholderia stabilis* strain having the LMG accession number 14086 or a mutant thereof.

43. The method of claim 40, wherein the *Burkholderia anthina* is the *Burkholderia anthina* strain having the LMG accession number 16670 or a mutant thereof.

44. The method of claim 40, wherein the *Burkholderia pyrrocinia* is the *Burkholderia pyrrocinia* strain having the LMG accession number 14191 or a mutant thereof.

45. The method of any one of claims 37 to 44, wherein the cultivating step comprises incubation of the organism of the genus *Xanthomonas* or *Burkholderia* in a medium comprising glycerol.

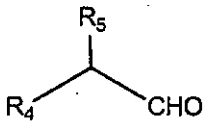
46. The method of any one of claims 37 to 45, wherein the isolating step comprises purification by column chromatography.

47. A mutant of Xanthomonas campestris pv. campestris strain XC1, producing any one of the compounds of claims 1 to 7, wherein a *Bmul5121* coding region of *Burkholderia multivorans* (ATCC 17616) or a homologue thereof has been inserted into the mutant.

48. The mutant of claim 47, wherein the rpfC region of XC1 has been deleted.

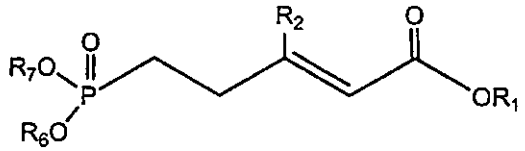
49. The mutant of claim 47 or 48, wherein the *Bmul5121* coding region is homologous to the rpfF region of XC1.

50. A method for producing a compound of formula (I) comprising reacting a compound of formula (VI)



(VI)

with a compound of formula (VII)



(VII)

under conditions to form the compound of formula (I),

wherein

R^1, R^2, R^4, R^5, R^6 and R^7 are independently selected from the group consisting of hydrogen, unsubstituted or substituted C_1-C_{10} alkyl, unsubstituted or substituted C_1-C_{10} alkenyl, unsubstituted or substituted C_1-C_{10} alkynyl, unsubstituted or substituted C_3-C_8 cycloalkyl, unsubstituted or substituted C_1-C_{10} alkoxy, unsubstituted or substituted C_3-C_8 cycloalkoxy, unsubstituted or substituted C_6-C_{14} aryl, an unsubstituted or substituted 5- to 10-membered heteroaryl wherein 1 to 4 ring atoms are independently selected from nitrogen, oxygen or sulfur, an unsubstituted or substituted 5- to 10-membered heteroalicyclic ring wherein 1 to 3 ring atoms are independently nitrogen, oxygen or sulfur, -C(O)R , -C(O)OR , -C(O)NRR', -NRR', -$S(O)_2$R, -$S(O)_2$OR, and -$S(O)_2$NRR',

R and R' are independently selected from the group consisting of hydrogen and unsubstituted or substituted C_1-C_{10} alkyl, unsubstituted or substituted C_1-C_{10} alkenyl, unsubstituted or substituted C_1-C_{10} alkynyl;

or a tautomer, geometrical isomer, enantiomer, diastereomer, racemate form, pharmaceutically acceptable salt or prodrug thereof.

51. The method of claim 50, wherein R^1, R^2, R^4, R^5, R^6 and R^7 are independently selected from the group consisting of unsubstituted or substituted C_1-C_{10} alkyl, unsubstituted or substituted C_1-C_{10} alkenyl, unsubstituted or substituted C_1-C_{10} alkynyl, unsubstituted or substituted C_3-C_8 cycloalkyl, unsubstituted or substituted C_1-C_{10} alkoxy, unsubstituted or substituted C_3-C_8 cycloalkoxy.

52. The method of claim 51, wherein R^1, R^2, R^4, R^5, R^6 and R^7 is unsubstituted or substituted C_1-C_{10} alkyl.

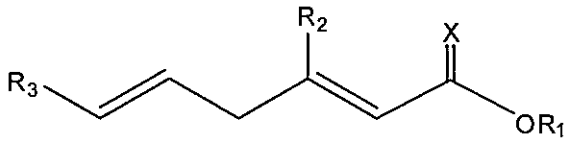
53. The method of any one of claims 50 to 52, wherein the compound of formula (VI) is 2-methylpropanal, 3-methylbutanal, 4-methylpentanal, 3-methylhexanal, 6-methylheptanal, 6-methyloctanal, 7-methylnonanl or 9-methyldecanal.

54. The method of any one of claims 50 to 53, further comprising, subjecting the reaction mixture containing the compound of formula (VI) and (VII) to hydrolysis.

CLAIMS

What is claimed is:

1. A compound of formula (I)



(I)

or a tautomer, geometrical isomer, enantiomer, diastereomer, racemate form, pharmaceutically acceptable salt, or prodrug thereof;

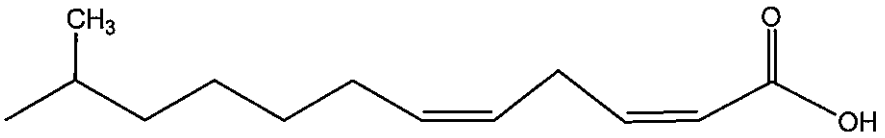
wherein

X is oxygen;

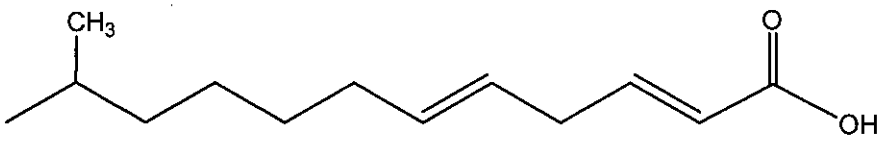
R^1 and R^2 are hydrogen; and

R^3 is 2-methylhexyl.

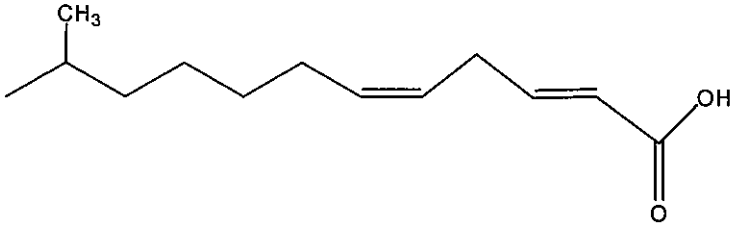
2. The compound of claim 1, wherein the compound is a compound of formula (II), formula (III), formula (IV) or formula (V)



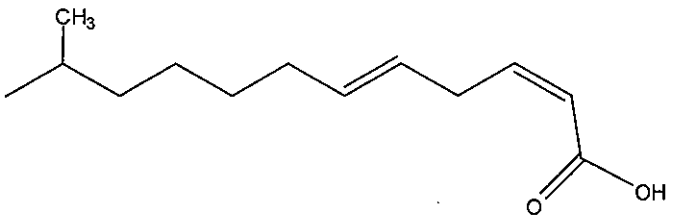
(II)



(III)



(IV)



(V).

3. The compound of claim 1, for use in preventing a fungal infection, treating a bacterial or fungal infection, or treating both bacterial and fungal infections in a subject.

4. The compound of claim 3, wherein the fungal infection is a Candida albicans, Candida tropicalis, Candida (Clasvispora) lusitaniae, Candida (Pichia) guillermondii, Lodderomyces elongisporus, Debaryomyces hansenii, Pichia stipitis, Asperigillus fumigatus, Blastomyces dermatitidis, Cladophialophora bantiana, Coccidioides immitis, Cryptococcus neoformans, Fusarium spp., Microsporum spp., Penicillium marneffei, or Trichophyton spp infection.

5. The compound of claim 3, wherein the bacterial infection is caused by a Gram negative bacterium or a Gram positive bacterium.

6. The compound of claim 3, wherein the bacterial infection is a Staphylococcus aureus, Mycobacterium smegmatic, Pseudomonas aeruginosa, Burkholderia cepacia, Klebsiella pneumonia, Aeromonas hydrophila, Erwinia carotovora, Erwinia chrysanthemi, or Escherichia coli infection.

7. A method for producing a compound of claim 1 comprising (a) cultivating an organism of the genus Xanthomonas or Burkholderia; and (b) isolating said compound from said organism.

8. The method of claim 7, wherein the organism of the genus Xanthomonas is Xanthomonas campestris pv. Campestris.

9. The method of claim 7, wherein the organism of the genus Burkholderia is Burkholderia multivorans, Burkholderia stabilis, Burkholderia anthina or Burkholderia pyrrocinia.

10. The method of claim 9, wherein the Burkholderia multivorans is the Burkholderia multivorans strain having the ATCC accession number 17616 or a mutant thereof.

11. The method of claim 9, wherein Burkholderia stabilis is the Burkholderia stabilis strain having the LMG accession number 14086 or a mutant thereof.

12. The method of claim 9, wherein the Burkholderia anthina is the Burkholderia anthina strain having the LMG accession number 16670 or a mutant thereof.

13. The method of claim 9, wherein the Burkholderia pyrrocinia is the Burkholderia pyrrocinia strain having the LMG accession number 14191 or a mutant thereof.

14. The method of claim 7, wherein the cultivating step comprises incubation of the organism of the genus Xanthomonas or Burkholderia in a medium comprising glycerol.

15. The compound of claim 5, wherein the bacterial infection is an Acinetobacter, Actinomyces, Aeromonas, Bordetella, Borrelia, Brucella, Burkholderia, Campylobacter, Chlamydia, Clostridium, Corynebacterium, Enterococcus, Erwinia, Escherichia, Francisella, Haemophilus, Helicobacter, Klebsiella, Legionella, Leptospira, Listeria, Mycobacterium, Mycoplasma, Neisseria, Pseudomonas, Rickettsia, Salmonella, Shigella, Staphylococcus, Streptococccus, Treponema, Verllonella, Vibrio, or Yersinia infection.

16. The method of claim 8, wherein the Xanthomonas campestris pv. campestris is Xanthomonas campestris pv. campestris strain XC1 or a mutant thereof.