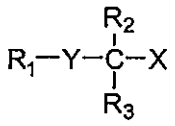
CLAIMS:

1. A lipid compound of formula (I):



(I)

wherein

- R_1 is selected from a C_{10}-C_{22} alkenyl with 3-6 methylene interrupted double bonds in Z configuration and a C_{10}-C_{22} alkynyl having 1-6 triple bonds;
- R_2 and R_3 are the same or different and may be selected from a group of substituents consisting of a hydrogen atom, an alkyl group, an alkoxy group,or an aryl group, provided that R_2 and R_3 cannot both be a hydrogen atom; or
- R_2 and R_3 can be connected in order to form a cycloalkane;
- Y is selected from sulphur, sulfoxide, and sulfone;
- X represents a carboxylic acid or a derivative thereof in the form of an ester, a triglyceride, or a phospholipid, a carboxylic ester or a carboxamide;

or a pharmaceutically acceptable salt thereof.

2. A lipid compound according to claim 1, wherein R_2 and R_3 are independently selected from a hydrogen atom, an alkyl group, an alkoxy group or an aryl group; or R_2 and R_3 can be connected in order to form a cycloalkane.

3. A lipid compound according to claim 2, wherein R_2 and R_3 are independently selected from a hydrogen atom, an alkyl group, or a methoxy group or an ethoxy group.

4. A lipid compound according to claim 2, wherein R_2 and R_3 are independently selected from a hydrogen atom, an ethyl, methoxy or ethoxy group, phenyl; or R_2 and R_3 are connected to form a cyclobutane group.

5. A lipid compound according to claim 1, wherein one of R_2 and R_3 is hydrogen and the other one is selected from a group of substituents consisting of an alkyl group, an alkoxy group, or an aryl group.

6. A lipid compound according to claim 1, wherein R_2 and R_3 are the same or different and may be selected from a group of substituents consisting of an alkyl group, an alkoxy group, or an aryl group.

7. A lipid compound according to claim 6, wherein R_2 and R_3 are alkyl groups.

8. A lipid compound according to claim 7, wherein R_2 and R_3 are the same or different and are selected from methyl, ethyl, n-propyl, or isopropyl.

9. A lipid compound according to claim 7, wherein R_2 and R_3 are ethyl.

10. A lipid compound according to any one of claims 1-9, wherein R_1 is a C_{10}-C_{22} alkenyl with 3-6 methylene interrupted double bonds in Z configuration.

11. A lipid compound according to claim 10, wherein said lipid compound is derived from a polyunsaturated fatty acid.

12. A lipid compound according to claim 1, wherein R_1 is a C_{14}-C_{22} alkenyl group with 3-6 methylene interrupted double bonds in*Z* configuration having the first double bond at the third carbon-carbon bond from the omega (ω) end of the carbon chain.

13. A lipid compound according to claim 12, wherein R_1 is a C_{14}-C_{22} alkenyl with 5-6 double bonds.

14. A lipid compound according to claim 1, wherein R_1 is a C_{10}-C_{22} alkynyl, said lipid

compound being derived from lipids comprising 1-6 triple bonds.

15. A lipid compound according to any one of the preceding claims, wherein Y is sulfur.

16. A lipid compound according to any one of the preceding claims, wherein Y is sulfoxide.

17. A lipid compound according to any one of the preceding claims, wherein Y is sulfone.

18. A lipid compound according to any one of the preceding claims, wherein X is a carboxylic acid or a derivative thereof in the form of an ester, a triglyceride, or a phospholipid.

19. A lipid compound according to claim 18, wherein X is a carboxylic acid or a derivative thereof in the form of an ester.

20. A lipid compound according to claims 18 or 19, wherein X is a carboxylic acid.

21. A lipid compound according to claim 1, wherein

R_2 and R_3 are the same or different and may be selected from a group of substituents consisting of an alkyl group, an alkoxy group, or an aryl group; and

X is a carboxylic acid.

22. A lipid compound according to claim 21, wherein R_2 and R_3 are alkyl groups.

23. A lipid compound according to claim 1, wherein said salt of said lipid compound comprises a monovalent cation, divalent cation, or a polyvalent cation.

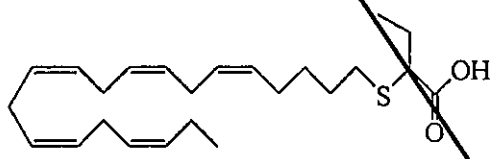
24. A lipid compound according to any one of the preceding claims in a mixture of diastereomerisomers or in racemic form.

25. A lipid compound according to claim 24 in the form of a diastereomer or an enantiomer.

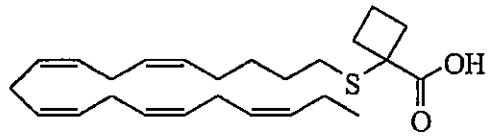
26. A lipid compound according to claim 24 in the form of its R stereoisomer.

27. A lipid compound according to claim 24 in the form of its S stereoisomer.

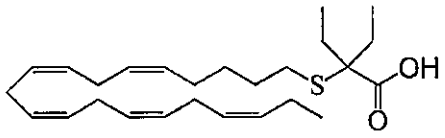
28. A lipid compound according to claim 1, wherein said compound is:



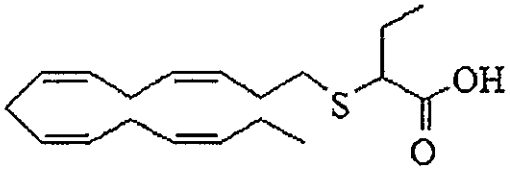
2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylthio)butanoic acid;



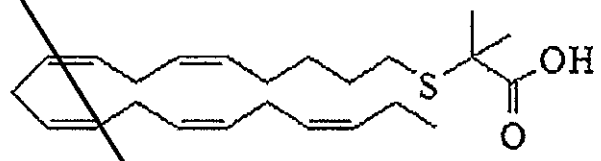
1-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylthio)cyclobutanecarboxylic acid;



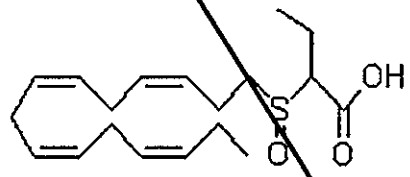
2-ethyl-2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylthio)butanoic acid;



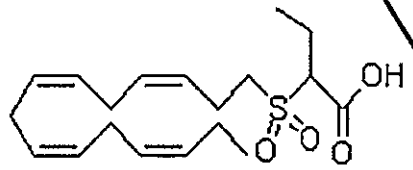
2-((3Z,6Z,9Z,12Z)-pentadeca-3,6,9,12-tetraenylthio)butanoic acid;



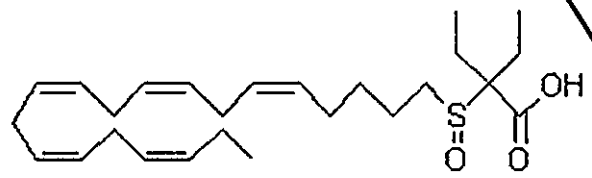
2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylthio)-2-methylpropanoic acid;



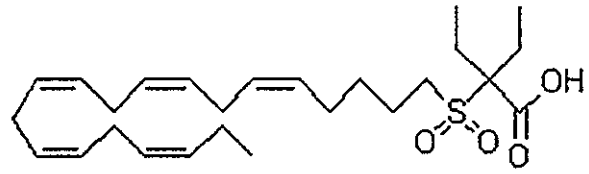
2-((3Z,6Z,9Z,12Z)-pentadeca-3,6,9,12-tetraenylsulfinyl)butanoic acid;



2-((3Z,6Z,9Z,12Z)-pentadeca-3,6,9,12-tetraenylsulfonyl)butanoic acid;



2-ethyl-2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylsulfinyl)butanoic acid; or



2-ethyl-2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylsulfonyl)butanoic acid.

29. A lipid compound according to claim 1, wherein

X represents a carboxylic acid or a derivative thereof, a carboxylic ester or a carboxamide; and
Y is sulphur.

30. A lipid compound according to claim 1, wherein
R_1 is a C_{10}-C_{22} alkenyl with 3-6 methylene interrupted double bonds in Z configuration, said lipid compound being derived from a polyunsaturated fatty acid; and
X represents a carboxylic acid or a derivative thereof, a carboxylic ester or a carboxamide; and
Y is sulphur.

31. A lipid compound according to claim 1, wherein
R_1 is a C_{10}-C_{22} alkynyl, said lipid compound being derived from lipids containing 1-6 triple bonds; and
X represents a carboxylic acid or a derivative thereof, a carboxylic ester or a carboxamide; and
Y is sulphur.

32. A lipid compound according to claim 1, wherein
R_1 is selected from a C_{10}-C_{22} alkenyl with 3-6 methylene interrupted double bonds in Z configuration and C_{10}-C_{22} alkynyl having 1-6 triple bonds;
X represents a carboxylic acid or a derivative thereof, a carboxylic ester or a carboxamide; and
Y is sulfoxide or sulfone.

33. A food supplement composition comprising a lipid compound according to any one of the claims 1-32.

34. A pharmaceutical composition comprising a lipid compound according to any one of the claims 1-32.

35. A pharmaceutical composition according claim 34, further comprising a pharmaceutically acceptable carrier, excipient or diluent, or any combination thereof.

36. A pharmaceutical composition according to claim 34 or 35, further comprising a pharmaceutically acceptable antioxidant.

37. A pharmaceutical composition according to claim 36, wherein said antioxidant is tocopherol.

38. A pharmaceutical composition according to any one of the claims 34 to 37, formulated for oral administration.

39. A pharmaceutical composition according to claim 38, in the form of a capsule or a tablet.

40. A pharmaceutical composition according to any one of the claims 34-39, formulated to provide a daily dosage of 1 mg to 10 g of said lipid compound.

41. A pharmaceutical composition according to claim 40, formulated to provide a daily dosage of 50 mg to 1 g of said lipid compound.

42. A pharmaceutical composition according to claim 41, formulated to provide a daily dosage of 50 mg to 200 mg of said lipid compound.

43. A pharmaceutical composition according to any one of the claims 34-42 for use as a medicament or for diagnostic purposes.

44. A lipid composition comprising a lipid compound according to any one of the claims 1-32.

45. A lipid composition according to claim 44, wherein at least 60% by weight of said lipid composition is comprised of said lipid compound.

46. A lipid composition according to claim 44, wherein at least 80% by weight of said lipid composition is comprised of said lipid compound.

47. A lipid composition according to any one of the claims 44-46, further comprising a pharmaceutically acceptable antioxidant.

48. A lipid composition according to claim 47, wherein said antioxidant is tocopherol.

49. A lipid composition according to any one of the claims 44-48, for use as a medicament.

50. A lipid compound according to any one of the claims 1-32, for use in activation or modulation of at least one of the human peroxisome proliferator-activated receptor (PPAR) isoforms α, γ or δ.

51. A lipid compound according to claim 50, wherein said compound is a pan-agonist or modulator.

52. A lipid compound according to any one of the claims 1-32, for use in prevention and/or treatment of a dyslipidemic condition.

53. A lipid compound according to claim 52, wherein said dyslipidemic condition is hypertriglyceridemia (HTG).

54. A lipid compound according to any one of the claims 1-32, for use inprevention and/or treatment of elevated triglyceride levels, LDL cholesterol levels, and/or VLDL cholesterol levels.

55. A lipid compound according to any one of the claims 1-32 for use in treatment and/or the prevention of obesity or an overweight condition.

56. A lipid compound according to any one of the claims 1-32, for use in reduction of body weight and/or for preventing body weight gain.

57. A lipid compound according to any one of the claims 1-32, for use in treatment and/or the prevention of a fatty liver disease.

58. A lipid compound according to claim 57, wherein said fatty liver diesase is non-alcoholic fatty liver disease (NAFLD).

59. A lipid compound according to any one of the claims 1-32, for use in treatment and/or the prevention of atherosclerosis.

60. A lipid compound according to any one of the claims 1-32, for use in prevention of myocardial infarction.

61. A lipid compound according to any one of the claims 1-32, for use intreatment and/or the prevention of peripheral insulin resistance and/or a diabetic condition.

62. A lipid compound according to any one of the claims 1-32, for use in treatment and/or the prevention of type 2 diabetes.

63. A lipid compound according to any one of the claims 1-32, for use in reduction of plasma insulin, blood glucose and/or serum triglycerides.

64. A lipid compound according to any one of the claims 1-32, for use in treatment and/or the prevention of an inflammatory disease or condition.

65. A pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 for use in the treatment of conditions related to activation or modulation of

at least one of the human peroxisome proliferator-activated receptor (PPAR) isoforms α, γ or δ.

66. A pharmaceutically active amount of a lipid compound according to claim 65, wherein said compound is a PPAR pan-agonist or modulator.

67. A pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 for use in the prevention and/or treatment of a dyslipidemic condition.

68. A pharmaceutically active amount of a lipid compound according to claim 67, wherein said dyslipidemic condition is hypertriglyceridemia (HTG).

69. A pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 for use in the prevention and/or treatment of elevated triglyceride levels, LDL cholesterol levels, and/or VLDL cholesterol levels.

70. A pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 for use in the the treatment and/or prevention of obesity or an overweight condition.

71. A pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 for use in the reduction of body weight and/or for preventing body weight.

72. A pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 for use in the treatment and/or the prevenetion of a fatty liver disease.

73. A pharmaceutically active amount of a lipid compound according to claim 72, wherein said fatty liver disease is non-alcoholic fatty liver disease (NAFLD).

74. A pharmaceutically active amount of a lipid compound according to any one of the

claims 1-32 for use in the treatment and/or prevention of atherosclerosis.

75. A pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 for use in the prevention of myocardial infarction.

76. A pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 for use in the treatment and/or the prevention of peripheral insulin resistance and/or a diabetic condition.

77. A pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 for use in the treatment and/or the prevention of type 2 diabetes.

78. A pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 for use in the reduction of plasma insulin, blood glucose and/or serum triglycerides.

79. A pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 for use in the treatment and/or prevention of an inflammatory disease or condition.

80. Use of a pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 in the manufacture of a medicament for use in the treatment of human conditions related to activation or modulation of at least one of the human peroxisome proliferator-activated receptor (PPAR) isoforms α, γ or δ.

81. Use of claim 80, wherein said compound is a PPAR pan-agonist or modulator.

82. Use of a pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 in the manufacture of a medicament for use in the prevention and/or treatment of a dyslipidemic condition.

83. Use of claim 82, wherein said dyslipidemic condition is hypertriglyceridemia (HTG).

84. Use of a pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 in the manufacture of a medicament for use in the prevention and/or treatment of elevated triglyceride levels, LDL cholesterol levels, and/or VLDL cholesterol levels.

85. Use of a pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 in the manufacture of a medicament for use in the treatment and/or prevention of obesity or an overweight condition.

86. Use of a pharmaceutically active amount of a lipid compound according to any one of the claims 1-32 in the manufacture of a medicament for use in the reduction of body weight and/or for preventing body weight.

87. Use of a pharmaceutically active amount of a lipid compound according to anyone of the claims 1-32 in the manufacture of a medicament for use in the treatment and/or the prevention of a fatty liver disease.

88. Use of claim 87, wherein said fatty liver disease is non-alcoholic fatty liver disease (NAFLD).

89. Use of a pharmaceutically active amount of a lipid compound according to anyone of the claims 1-32 in the manufacture of a medicament for use in the treatment and/or prevention of atherosclerosis.

90. Use of a pharmaceutically active amount of a lipid compound according to anyone of the claims 1-32 in the manufacture of a medicament for use in the prevention of myocardial infarction.

91. Use of a pharmaceutically active amount of a lipid compound according to anyone of the claims 1-32 in the manufacture of a medicament for use in the treatment and/or the prevention of peripheral insulin resistance and/or a diabetic condition.

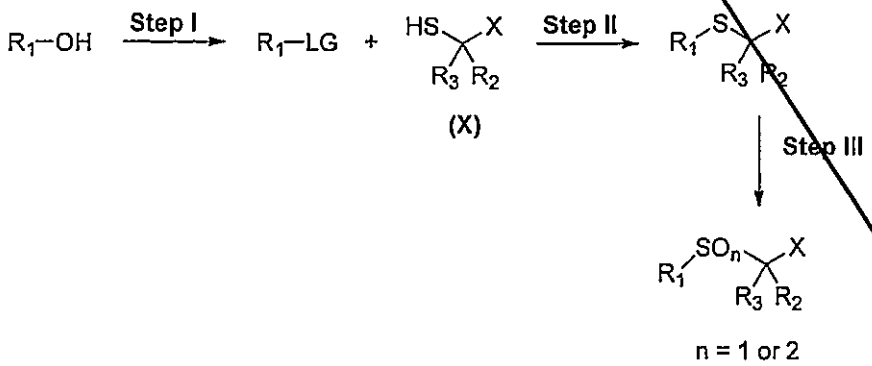
92. Use of a pharmaceutically active amount of a lipid compound according to anyone of the claims 1-32 in the manufacture of a medicament for use in the treatment and/or the prevention of type 2 diabetes.

93. Use of a pharmaceutically active amount of a lipid compound according to anyone of the claims 1-32 in the manufacture of a medicament for use in the reduction of plasma insulin, blood glucose and/or serum triglycerides.

94. Use of a pharmaceutically active amount of a lipid compound according to anyone of the claims 1-32 in the manufacture of a medicament for use in the treatment and/or the prevention of an inflammatory disease or condition.

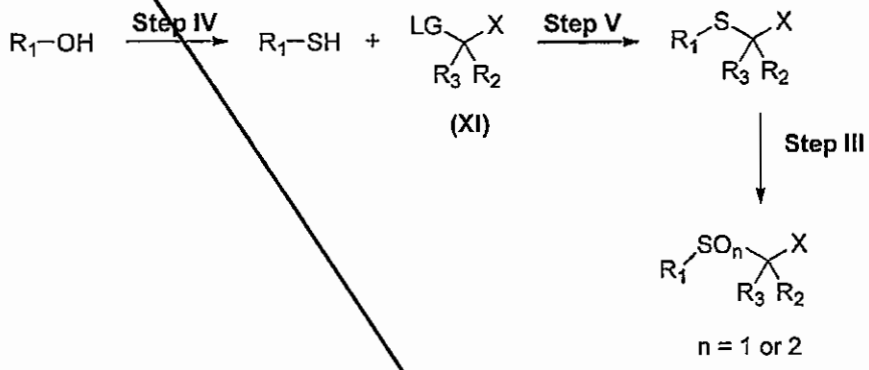
95. A method for the production of a lipid compound according to any one of the claims 1-32 comprising one of the following methods:

Method I



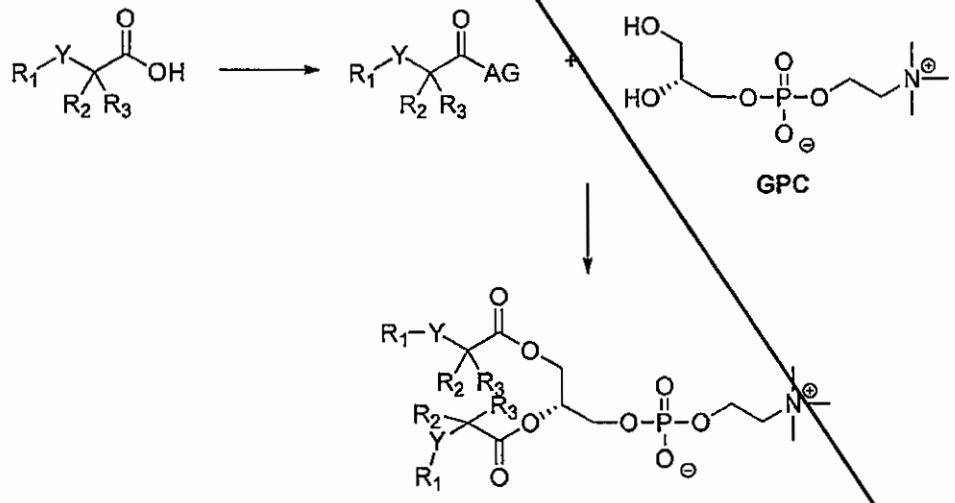
wherein R_1, R_2, R_3, and X are as defined in claims 1-32, and LG represents a leaving group such as mesylate, tosylate, or a suitable halogen;

Method II



wherein R_1, R_2, R_3, and X are as defined in claims 1-32;

Method III



wherein R_1, R_2, R_3, and Y are as defined in claims 1-32, and AG represents an acyl group;

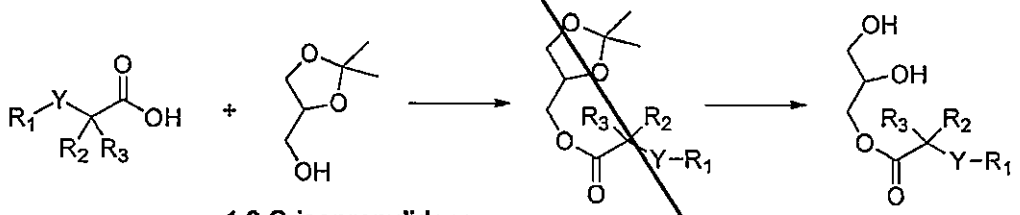
Method IV

Coupling excess of a fatty acid to glycerol by using dimethylaminopyridine (DMAP) and 2-(1H-benzotriazol-1-yl)-N,N,N',N'-tetramethyluroniumhexafluorophosphate (HBTU) to prepare a compound of formula (I) wherein R_1, R_2, R_3 and Y are as defined in claims 1-32, and X is a carboxylic acid in the form of a triglyceride;

Method V

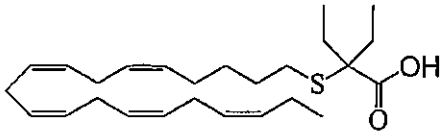
Reacting 2 equivalents of a fatty acid with 1 equivalent of glycerol in the presence of 1,3-dicyclohexylcarbodiimide (DCC) and 4-dimethylaminopyridine (DMAP) to prepare a compound of formula (I) wherein R_1, R_2, R_3 and Y are as defined in claims 1-32, and X is a carboxylic acid in the form of a diglyceride; or

Method VI



wherein R_1, R_2, R_3 and Y are as defined in claims 1-32.

96. The lipid compound according to claim 28, wherein said compound is



2-ethyl-2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylthio)butanoic acid.

97. A composition comprising the lipid compound according to claim 96.

98. The composition according to claim 96, wherein the composition is a pharmaceutical composition.

99. The lipid compound of claim 1, wherein the cycloalkane is selected from cyclopropane, cyclobutane, cyclopentane, or cyclohexane.

100. The lipid compound according to claim 23, wherein said monovalent cation is selected from Li^+, Na^+, K^+, NH_4^+, meglumine, tris(hydroxymethyl)aminomethane, diethylamine, or arginine.

101. The lipid compound according to claim 23, wherein said divalent cation is selected from Mg^{2+}, Ca^{2+}, ethylenediamine, or piperazine.

102. The lipid compound according to claim 23, wherein said polyvalent cation is chitosan.

103. The lipid compound according to claim 1, wherein X is a carboxamide selected from the group consisting of N-methyl carboxamide, N,N-dimethyl carboxamide, N-ethyl carboxamide, and N,N-diethyl carboxamide.

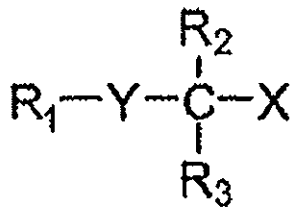
104. The method according to claim 95, wherein the raw material may originate from a vegetable, a microbial, and/or an animal source.

105. The method according to claim 95, wherein the animal source is a marine oil or krill oil.

CLAIMS

1. A lipid compound or its pharmaceutically acceptable salt represented by formula (1)

[First chemical formula]



(I)

[In the formula, R1 is selected from among C10-C22 alkenyl groups in Z configuration with 3 to 6 methylene-interrupted double bonds as well as C16-C22 alkenyl groups with 1 to 6 triple bonds;

R2 and R3, which are identical or different, can be selected from among groups of substituents comprising a hydrogen atom, a hydroxy group, an alkyl group, a halogen atom, an alkoxy group, an acyloxy group, an acyl group, an alkenyl group, an alkynyl group, an aryl group, an alkylthio group, an alkoxycarbonyl group, a carboxy group, an alkylsulfinyl group, an alkylsulfonyl group, an amino group, or an alkylamino group, but R2 and R3 may not both be a hydrogen atom; or

R2 and R3 can be bound to form a cycloalkane;

Y is selected from among sulfur, sulfoxide and sulfone;

X is a carboxylic acid or derivative thereof, said derivative may be a carboxylic acid ester, carboxamide, monoglyceride, diglyceride, triglyceride, or phospholipid. However, the compound of formula (I) is not 2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylthio) butanoic acid.]

2. The lipid compound of Claim 1 in which the aforementioned cycloalkane is cyclopropane, cyclobutane, cyclopentane or cyclohexane.

3. The lipid compound of Claim 1 or 2 in which R2 and R3 each are independently selected from among a hydrogen atom, an alkyl group, an alkoxy group or an aryl group; or R2 and R3 are connected to form a cycloalkane.

4. The lipid compound of Claim 3 in which R2 and R3 each are independently chosen from a hydrogen atom, an alkyl group, a methoxy group, or an ethoxy group.

5. The lipid compound of Claim 3 in which R2 and R3 each are independently chosen from a hydrogen atom, an ethyl group, a methoxy group, an ethoxy group, or a phenyl group; or R2 and R3 are connected to form a cyclobutane group.

6. The lipid compound of Claim 1 or 2 in which one of R2 and R3 is a hydrogen atom and the other one is chosen from a group of substituents comprising a hydroxy group, an alkyl group, a halogen atom, an alkoxy group, an acyloxy group, an acyl group, an alkenyl group, an alkynyl group, an aryl group, an alkylthio group, an alkoxycarbonyl group, a carboxy group, an alkylsulfinyl group, an alkylsulfonyl group, an amino group, or an alkylamino group.

7. The lipid compound of Claim 1 or 2 in which R2 and R3 are the same or different and each is selected from a group of substituents comprising a hydroxy group, an alkyl group, a halogen atom, an alkoxy group, an acyloxy group, an acyl group, an alkenyl group, an alkynyl group, an aryl group, an alkylthio group, an alkoxycarbonyl group, a carboxy group, an alkylsulfinyl group, an alkylsulfonyl group, or an amino group.

8. The lipid compound of Claim 7 in which R2 and R3 are alkyl groups.

9. The lipid compound of Claim 8 in which R2 and R3 are the same or different and each is independently chosen from a methyl group, an ethyl group, an n-propyl group or an isopropyl group.

10. The lipid compound of Claim 8 in which R2 and R3 are ethyl groups.

11. The compound of Claim 1 or 2 in which R1 is a C14-C22 alkenyl group having 3 to 6 methylene-interrupted double bonds in Z configuration, wherein at least one of the aforementioned double bonds is located at the third carbon-carbon bond from the omega (ω) end of the carbon chain.

12. The compound of Claim 11 in which R1 is a C14-C22 alkenyl group having 5 or 6 double bonds.

13. The lipid compound of Claims 1 or 2 in which R1 is a C16-C22 alkynyl group wherein the aforementioned lipid compound is derived from lipids having 1 to 6 triple bonds.

14. The lipid compound of any of Claims 1 to 13 in which Y is sulfur.

15. The lipid compound of any of Claims 1 to 13 in which Y is sulfoxide.

16. The lipid compound of any of Claims 1 to 13 in which Y is sulfone.

17. The lipid compound of Claims 1 or 2 in which X is a carboxylic acid or its derivative in ester form.

18. The lipid compound of Claim 17 in which X is a carboxylic acid.

19. The lipid compound of Claims 1 or 2 in which the aforementioned salts of the aforementioned lipid compounds contain a monovalent cation, a bivalent cation, or a polyvalent cation.

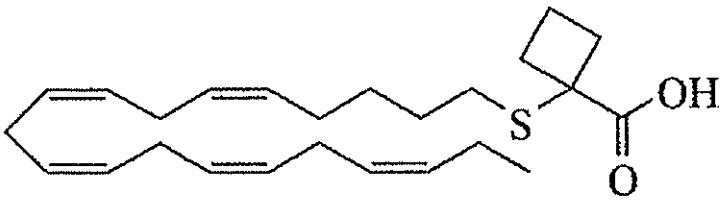
20. The lipid compound of any of Claims 1 to 19 in which said compound is in a mixture of diastereomeric isomers or is in racemic form.

21. The lipid compound of Claim 20 in which said compound is in the form of a diastereomer or an enantiomer.

22. The lipid compound of Claim 20 in the form of its R stereoisomer.

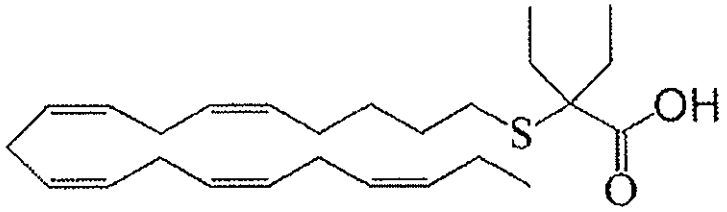
23. The lipid compound of Claim 20 in the form of its S stereoisomer.

24. The lipid compound of Claims 1 or 2 in which the aforementioned compound is: [Second chemical formula]



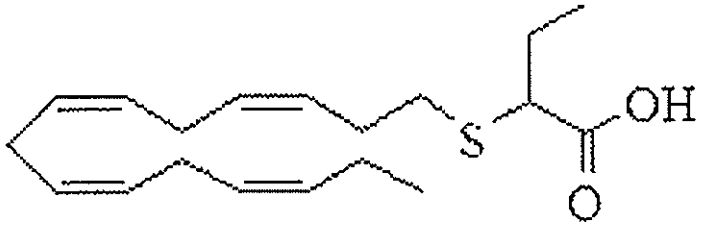
1-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylthio) cyclobutane carboxylic acid; or

[Third chemical formula]



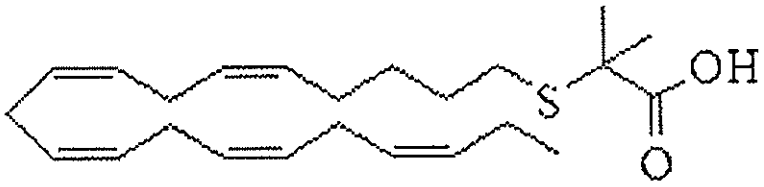
2-ethyl-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylthio) butanoic acid,

[Fourth chemical formula]



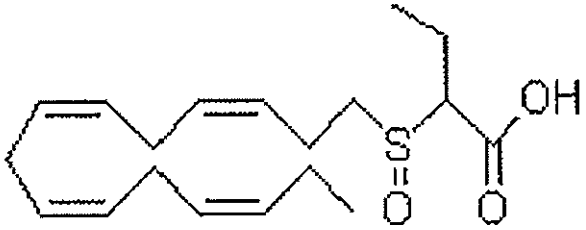
2-((3Z,6Z,9Z,12Z)-pentadeca-3,6,9,12-tetraenylthio) butanoic acid,

[Fifth chemical formula]



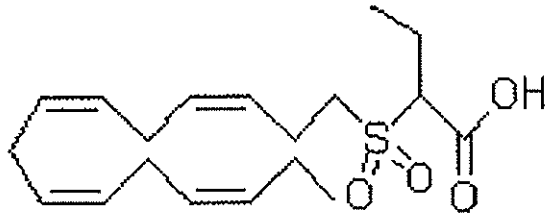
2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylthio)-2-methyl propanoic acid,

[Sixth chemical formula]



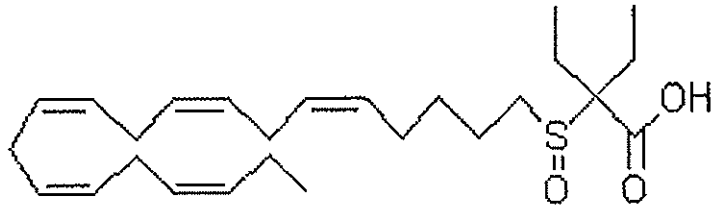
2-((3Z,6Z,9Z,12Z)-pentadeca-3,6,9,12-tetraenylsulfinyl) butanoic acid,

[Seventh chemical formula]



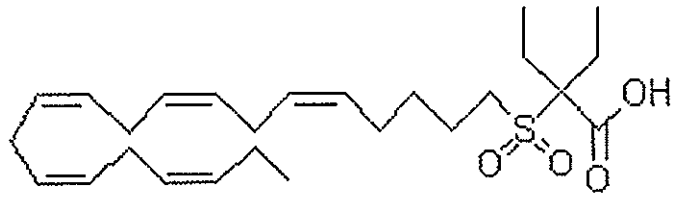
2-((3Z,6Z,9Z,12Z)-pentadeca-3,6,9,12-tetraenylsulfonyl) butanoic acid,

[Eighth chemical formula]



2-ethyl-2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylsulfinyl) butanoic acid or

[Ninth chemical formula]



2-ethyl-2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylsulfonyl) butanoic acid.

25. The lipid compound of Claims 1 or 2 in which R1 is a C16-C22 alkynyl, the aforementioned lipid compound is derived from lipids having 1-6 triple bonds; X is a carboxylic acid or its derivative, said derivative is represented by a carboxylic ester, a carboxamide, a monoglyceride, a diglyeride, a triglyceride or a phospholipid; and Y is sulfur.

26. The lipid compound of Claim 1 or 2 in which R1 is selected from among C10-C22 alkenyl groups having 3 to 6 methylene-interrupted double bonds in Z configuration and C16-C22 alkynyl groups having 1 to 6 triple bonds; X is a carboxylic acid or its derivative, said derivative is represented by a monoglyceride, a diglyeride, a triglyceride, a carboxylic acid ester or carboxamide; and Y is a sulfoxide or sulfone.

27. A food supplement containing at least one lipid compound from any of Claims 1 to 26.

28. A pharmaceutical composition containing at least one lipid compound from any of Claims 1 to 26.

29. The pharmaceutical composition of Claim 28 that contains at least one pharmaceutically acceptable carrier, excipient or diluent, or any arbitrary combination thereof.

30. The pharmaceutical composition of Claims 28 or 29 that contains at least one pharmaceutically acceptable antioxidant.

31. The pharmaceutical composition of Claim 30 in which the aforementioned at least one pharmaceutically acceptable antioxidant is tocopherol.

32. The pharmaceutical composition of any of Claims 28 to 31 that is formulated for oral administration.

33. The pharmaceutical composition of Claim 32 that is in the form of a capsule or a tablet.

34. The pharmaceutical composition of any of Claims 28 to 33 that is formulated to provide a daily dosage ranging from 1 mg to 10 g of the aforementioned lipid compound.

35. The pharmaceutical composition of Claim 34 that is formulated to provide a daily dosage ranging from 50 mg to 1 g of the aforementioned lipid compound.

36. The pharmaceutical composition of Claim 35 that is formulated to provide a daily dosage ranging from 50 mg to 200 mg of the aforementioned lipid compound.

37. The pharmaceutical composition of any of Claims 28 to 36 for use as a medicament or for medical examination purposes.

38. A lipid composition containing at least one of the lipid compounds of any of Claims 1 to 26.

39. The lipid composition Claim 38 that is structured so that at least 60 wt% of the aforementioned lipid composition is at least one of the aforementioned lipid compounds.

40. The lipid composition of Claim 38 that is structured so that at least 80 wt% of the aforementioned lipid composition is at least one of the aforementioned lipid compounds.

41. The lipid composition of any of Claims 38 to 40 that further contains at least one pharmaceutically acceptable antioxidant.

42. The lipid composition of Claim 41 in which the aforementioned at least one pharmaceutically acceptable antioxidant is tocopherol.

43. The lipid composition of any of Claims 38 to 42 that is used as a medicament.

44. The lipid compound of any of Claims 1 to 26 for use in activation or modulation of at least one of the human peroxisome proliferator-activated receptor (PPAR) isoforms α, γ or δ.

45. The lipid compound of Claim 44 in which the aforementioned compound is a pan-agonist or a modulator.

46. The lipid compound of any of Claims 1 to 26 for use in the prevention and/or treatment of symptoms of a dyslipidemic condition.

47. The lipid compound of Claim 46 in which the symptom of the aforementioned dyslipidemic condition is hyptertriglyceridemia.

48. The lipid compound of any of Claims 1 to 26 for use in the prevention and/or treatment of elevated triglyceride levels, LDL cholesterol levels, and/or VLDL cholesterol levels.

49. The lipid compound of any of Claims 1 to 26 for use in the treatment and/or the prevention of obesity or an overweight condition.

50. The lipid compound of any of Claims 1 to 26 for use in the reduction of body weight and/or for preventing body weight gain.

51. The lipid compound of any of Claims 1 to 26 for use in the treatment and/or the prevention of fatty liver disease.

52. The lipid compound of Claim 51 in which the aforementioned fatty liver disease is non-alcoholic fatty liver disease (NAFLD).

53. The lipid compound of any of Claims 1 to 26 for use in the treatment and/or the prevention of atherosclerosis.

54. The lipid compound of any of Claims 1 to 26 for use in the prevention of myocardial infarction.

55. The lipid compound of any of Claims 1 to 26 for use in the treatment and/or the prevention of peripheral insulin resistance and/or a diabetic condition.

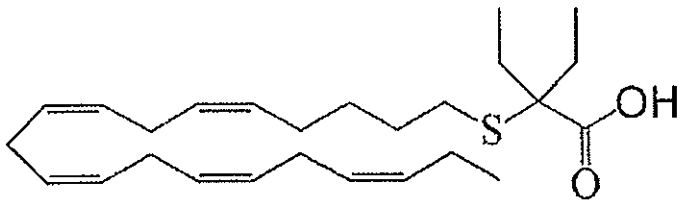
56. The lipid compound of any of Claims 1 to 26 for use in the treatment and/or prevention of type 2 diabetes.

57. The lipid compound of any of Claims 1 to 26 for use in the reduction of plasma insulin, blood glucose and/or serum triglycerides.

58. The lipid compound of any of Claims 1 to 26 for use in the treatment and/or the prevention of an inflammatory disease or condition.

59. The method of producing the lipid compound of any of Claims 1 to 26.

60. The lipid compound of Claim 24 in which the aforementioned compound is
[Tenth chemical formula]



2-ethyl-2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylthio) butanoic acid.

61. A lipid composition containing the lipid compound stated in Claim 60.

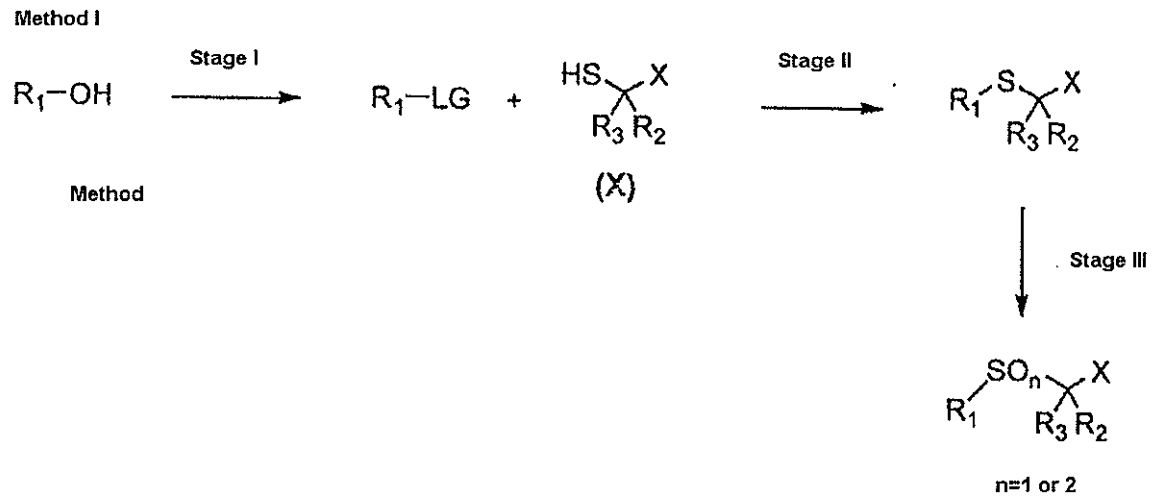
62. The lipid composition of Claim 61 in which the aforementioned lipid composition is a pharmaceutical composition.

63. The lipid compound of Claim 19 in which the aforementioned salts of the aforementioned lipid compound contain a bivalent cation.

64. The lipid compound of Claim 19 in which the aforementioned bivalent cation is chosen from Mg2+, Ca2+, ethylene diamine, or piperazine.

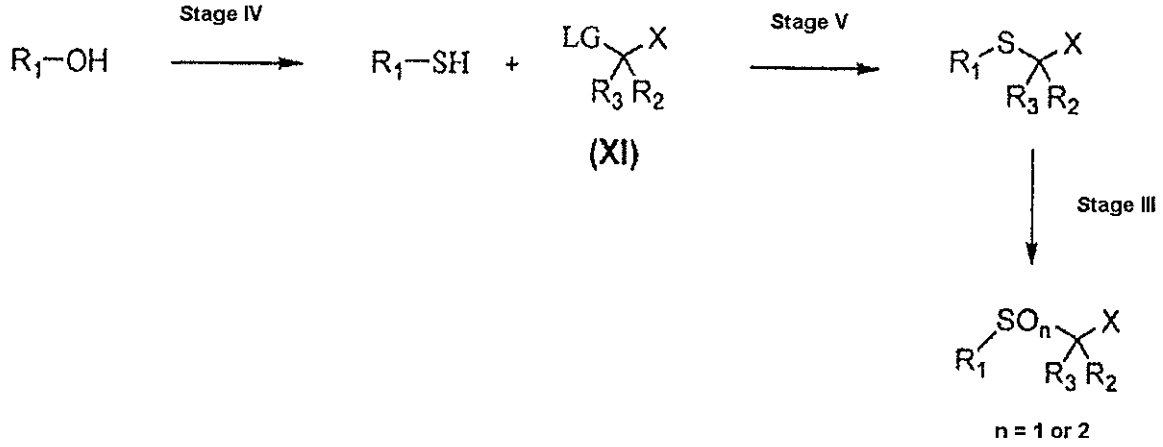
65. The lipid compound of Claims 1 or 2 in which X is chosen from among N-methyl carboxamide, N,N-dimethyl carboxamide, N-ethyl carboxamide, and N,N-diethyl carboxamide.

66. A method of producing the lipid compound stated in any of Claims 1, 2 or 25 that comprises any of the following methods:
method I:
[Eleventh chemical formula]



{In the formula, R1, R2, R3 and X are as defined in Claims 1 or 26, while LG represents a leaving group such as mesylate, tosylate or a suitable halogen}
method II:
[Twelfth chemical formula]

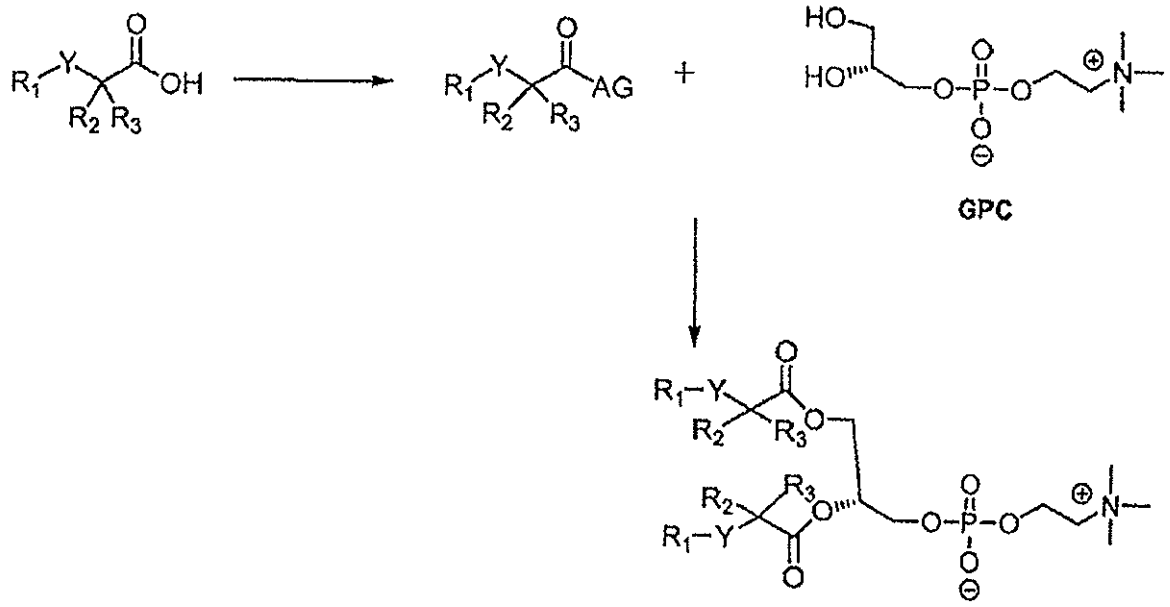
Method II



{In the formula, R1, R2, R3 and X are as defined in Claims 1 or 26};

method III:

[Thirteenth chemical formula]



{In the formula, R1, R2, R3 and Y are as defined in Claims 1 or 26, AG represents an acyl group}

method IV:

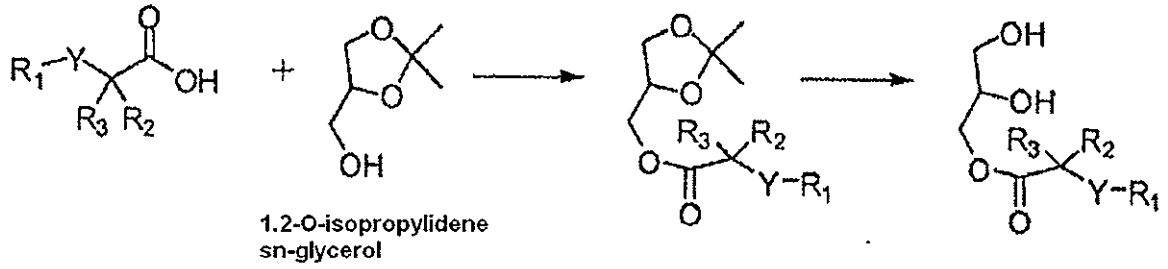
the compounds of formula (I) {wherein R1, R2, R3 and Y are as defined in Claims 1 or 26 and X is a carboxylic acid derivative in the form of a triglyceride} are prepared by coupling excess fatty acid to glycerol using dimethylaminopyridine (DMAP) and 2-(1H-benzotriazol-1-yl)-N,N,N',N'-tetramethyl uronium hexafluorophosphate (HBTU),

method V:

The compounds of formula (I) {wherein R1, R2, R3 and Y are as defined in Claims 1 or 26 and X is a carboxylic acid derivative in the form of a diglyceride} by reacting a fatty acid (2 equivalents) with glycerol (1 equivalent) in the presence of 1,3-dicyclohexyl carbon diimide (DCC) and 4-dimethylamino pyridine (DMAP),

method VI:

[Fourteenth chemical formula]



{In the formula, R1, R2, R3 and Y are as defined in Claims 1 or 26}.

67. The method of Claim 66 in which the starting material originates from a vegetable, a microbial and/or an animal source.

68. The method of Claim 67 in which the animal oil starting material is a marine oil or a krill oil.

69. The method of Claim 19 in which the aforementioned salts of the aforementioned lipid compound contain a monovalent cation.

70. The lipid compound of Claim 69 in which the aforementioned monovalent cation is chosen from Li+, Na+, K+, NH4 +, meglumine, tris (hydroxymethyl) aminomethane, diethylamine, or arginine.

71. The lipid compound of Claim 19 in which the aforementioned salts of the aforementioned lipid compound contain a polyvalent cation.

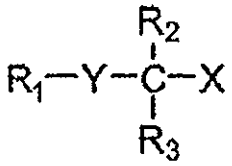
72. The lipid compound of Claim 71 in which the aforementioned polyvalent cation is chitosan.

73. The lipid compound of any of Claims 1 or 2 in which R1 is a C10-C22 alkenyl group in Z configuration with 3 to 6 methylene-interrupted double bonds.

74. The lipid compound of Claim 73 in which the aforementioned lipid compound is derived from unsaturated fatty acids.

75. The lipid compound of Claim 73 in which R1 is a C10-C22 alkenyl group with 3 to 6 double bonds.

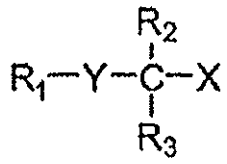
76. The lipid compound of formula (I) or its pharmaceutically acceptable salt
[Fifteenth chemical formula]



(I)

{In the formula, R1 is selected from among C10-C22 alkenyl groups in Z configuration with 3 to 6 methylene-interrupted double bonds;
R2 and R3, which are identical or different, can be selected from among groups of substituents comprising a hydrogen atom, a hydroxy group, an alkyl group, a halogen atom, an alkoxy group, an acyloxy group, an acyl group, an alkenyl group, an alkynyl group, an aryl group, an alkylthio group, an alkoxycarbonyl group, a carboxy group, an alkylsulfinyl group, an alkylsulfonyl group, an amino group, or an alkylamino group, but R2 and R3 may not both be a hydrogen atom; or
R2 and R3 can be bound to form a cycloalkane;
Y is selected from among sulfur, sulfoxide and sulfone;
X is a carboxylic acid or derivative thereof, said derivative may be a carboxylic acid ester or carboxamide. However, the compound of formula (I) is not 2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylthio) butanoic acid.}

77. A lipid compound or its pharmaceutically acceptable salt represented by formula (1)
[Sixteenth chemical formula]



(I)

{In the formula, R1 is selected from among C10-C22 alkenyl groups in Z configuration with 3 to 6 methylene-interrupted double bonds as well as C18-C22 alkenyl groups with 1 to 6 triple bonds;
R2 and R3, which are identical or different, can be selected from among groups of substituents comprising a hydrogen atom, a hydroxy group, an alkyl group, a halogen atom, an alkoxy group, an acyloxy group, an acyl group, an alkenyl group, an alkynyl group, an aryl group, an alkylthio group, an alkoxycarbonyl group, a carboxy group, an alkylsulfinyl group, an alkylsulfonyl group, an amino group, or an alkylamino group, but R2 and R3 may not both be a hydrogen atom; or
R2 and R3 can be bound to form a cycloalkane;
Y is selected from among sulfur, sulfoxide and sulfone;
X is a carboxylic acid or derivative thereof, said derivative may be a carboxylic acid ester or carboxamide. However, the compound of formula (I) is not 2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenylthio) butanoic acid.}

78. The lipid compound of Claim 76 in which X is a carboxamide chosen from among N-methyl carboxamide, N,N-dimethyl carboxamide, N-ethyl carboxamide, and N,N-diethyl carboxamide.

79. The lipid compound of Claim 77 in which X is a carboxamide chosen from among N-methyl carboxamide, N,N-dimethyl carboxamide, N-ethyl carboxamide, and N,N-diethyl carboxamide.