# Claims

1. Method for the ozonolysis of unsaturated fatty acids and derivatives thereof, comprising the steps:

   a) ozonolysis of an unsaturated fatty acid or a derivative thereof in an organic phase comprising an organic solvent, and

   b) contacting the organic phase with an aqueous phase comprising catalase and preferably a buffer,

   where the unsaturated fatty acid or the derivative thereof has a linear chain with at least eight carbon atoms.

2. Method according to Claim 1, where the organic solvent is an organic solvent which, in the presence of an aqueous phase at room temperature forms an organic phase separate from the aqueous phase.

3. Method according to Claim 2, where step a) takes place in the presence of an aqueous phase.

4. Method according to Claim 3, where, before step b), the aqueous phase is removed from step a).

5. Method according to one of Claims 1 to 4, where the unsaturated fatty acid or the derivative thereof is a compound of the formula (I)

$$R^1 - (CH_2)_x - CH = CH - (CH_2)_y - COR^2 \quad (I),$$

where $R^1$ is selected from the group which comprises hydrogen, HO-, HS-, CHO-, $R^2OC$-, unsubstituted or substituted, preferably halogenated, alkyl, cycloalkyl, heterocycloalkyl, aryl and heteroaryl,

where $R^2$ is selected from the group which comprises HO-, substituted or unsubstituted alkoxy, alkenoxy, alkynoxy and cycloalkoxy having one to seven carbon atoms, $-NR^3R^4$, aryloxy and benzyloxy,

where $R^3$ and $R^4$ in each case, and independently of one another, are selected from the group which comprises hydrogen, alkyl, preferably methyl or ethyl, alkenyl, alkynyl, aryl and benzyl,

and where x and y, in each case and independently of one another are 0 or a larger integer.

6. Method according to Claim 5, where $R^1$ is hydrogen, $R^2$ is HO- or methoxy or ethoxy and the sum of x and y is nine or more.

7. Method according to one of Claims 1 to 6, where the fatty acid or the derivative is selected from the group which comprises oleic acid and erucic acid and esters thereof, preferably methyl ester.

8. Method according to one of Claims 1 to 7, where the organic solvent is selected from the group which comprises $R^5R^6R^7C-O-R^8$ or intramolecular ethers thereof,

where $R^5$, $R^6$ and $R^7$ in each case, and independently of one another, are selected from the group which comprises hydrogen, an alkyl or cycloalkyl having one to seven carbon atoms, and also unsubstituted and substituted aryl, where $R^8$ is selected from the group which comprises hydrogen, an alkyl, cycloalkyl, hydroxyalkyl and alkoxyalkyl having one to seven carbon atoms, and unsubstituted or substituted aryl and benzyl, and where preferably at least one of the radicals $R^5$, $R^6$ and $R^7$ is methyl.

9. Method according to Claim 8, where the organic solvent is a compound of the formula $R^5R^6R^7C$–OH, and $R^5$, $R^6$ and $R^7$ in each case, and independently of one another, are selected from the group which comprises hydrogen, methyl, ethyl, propyl, butyl and pentyl.

10. Method according to Claim 9, where the organic solvent is 2-methyl-2-butanol.

11. Method according to one of Claims 1 to 10, where the volume fraction of the aqueous phase upon contacting the organic phase, relative to the total volume of both phases, is more than 0 to 50, more preferably 5 to 30, even more preferably 15 to 25 percent.

12. Method according to one of Claims 1 to 11, where the catalase is present in step a).

13. Method according to one of Claims 1 to 12, where the catalase is beef liver catalase or a variant thereof.

14. Method according to one of Claims 1 to 13, where the pH of the aqueous phase in step b), before contacting with the organic phase, is 3 to 11, preferably 5 to 8, yet more preferably 6.5 to 7.5.

15. Use of catalase for removing reactive oxygen species, preferably organic reactive oxygen species, from a reaction mixture comprising ozonolysis products of an unsaturated fatty acid or a derivative thereof.

16. Use according to Claim 15, where the unsaturated fatty acid or the ester thereof is a compound of the formula (I)

$$R^1 - (CH_2)_x - CH = CH - (CH_2)_y - COR^2 \quad (I),$$

where $R^1$ is selected from the group which comprises hydrogen, HO-, HS-, CHO-, $R^2OC$-, unsubstituted or substituted, preferably halogenated, alkyl, cycloalkyl, heterocycloalkyl, aryl and heteroaryl,

where $R^2$ is selected from the group which comprises HO-, substituted or unsubstituted alkoxy, alkenoxy, alkynoxy and cycloalkoxy having one to seven carbon atoms, $-NR^3R^4$, aryloxy and benzyloxy,

where $R^3$ and $R^4$ in each case, and independently of one another, are selected from the group which comprises hydrogen, alkyl, preferably methyl or ethyl, alkenyl, alkynyl, aryl and benzyl,

and where x and y, in each case and independently of one another are 0 or a larger integer.

17. Use according to one of Claims 15 to 16, where the reaction mixture further comprises an organic solvent, preferably one which, in the presence of an aqueous phase at room temperature, forms an organic phase separate from the aqueous phase,

where the organic solvent is selected from the group which comprises $R^5R^6R^7C–O–R^8$ or intramolecular ethers thereof,

where $R^5$, $R^6$ and $R^7$ in each case, and independently of one another, are selected from the group which comprises hydrogen, an alkyl or cycloalkyl having one to seven carbon atoms, and also unsubstituted and substituted aryl, where $R^8$ is selected from the group which comprises hydrogen, an alkyl, cycloalkyl, hydroxyalkyl and a corresponding alkoxyalkyl having one to seven carbon atoms, and unsubstituted or substituted aryl and benzyl, and where preferably at least one of the radicals $R^5$, $R^6$ and $R^7$ is methyl,

and where the organic solvent is yet more preferably 2-methyl-2-butanol.

Claims

1. A method for the ozonolysis of unsaturated fatty acids and derivatives thereof, comprising:

a) ozonolysis of the unsaturated fatty acid or derivative thereof in an organic phase comprising an organic solvent; and

b) contacting the organic phase with an aqueous phase comprising catalase and optionally, a buffer;

wherein the unsaturated fatty acid or the derivative thereof comprises at least one linear carbon chain of at least eight carbon atoms, and

wherein at room temperature, the organic solvent separates as an organic phase when in the presence of an aqueous phase.

2. The method according to claim 1, further comprising contacting an aqueous phase with the organic phase during the ozonolysis.

3. The method according to claim 2, wherein the aqueous phase contacting the organic phase during ozonolysis is separated and removed from the organic phase prior to contacting the organic phase with the aqueous phase comprising catalase.

4. The method according to claim 1, wherein the unsaturated fatty acid or the derivative thereof is a compound of formula (I):

$$R^1—(CH_2)_x—CH=CH—(CH_2)_y—COR^2 \qquad (I),$$

wherein

$R^1$ is selected from the group consisting of hydrogen, HO—, HS—, CHO—, $R^2OC$—, unsubstituted or substituted alkyl, cycloalkyl, heterocycloalkyl, aryl and heteroaryl,

$R^2$ is selected from the group consisting of HO—, substituted or unsubstituted alkoxy, alkenoxy, alkynoxy and cycloalkoxy having one to seven carbon atoms, —$NR^3R^4$, aryloxy and benzyloxy,

$R^3$ and $R^4$ are each independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl and benzyl, and

x and y, are each, independently, 0 or a larger integer.

5. The method according to claim 4, wherein

$R^1$ is hydrogen,

$R^2$ is HO—, methoxy or ethoxy, and
a sum of x and y is nine or more.

6. The method according to claim 1, wherein the fatty acid or the derivative is at least one selected from the group consisting of oleic acid, erucic acid and esters thereof.

7. The method according to claim 1, wherein the organic solvent is at least one selected from the group consisting of compounds of formula:

$R^5R^6R^7C—O—R^8$

or intramolecular ethers thereof,
wherein
$R^5$, $R^6$ and $R^7$ are each independently selected from the group consisting of hydrogen, an alkyl group of one to seven carbon atoms, a cycloalkyl group of one to seven carbon atoms, an unsubstituted aryl group and a substituted aryl group, and
$R^8$ is selected from the group consisting of hydrogen, an alkyl, cycloalkyl, hydroxyalkyl or alkoxyalkyl group having one to seven carbon atoms, an unsubstituted aryl group, a substituted aryl group and a benzyl group.

8. The method according to claim 7, wherein the organic solvent is at least one of a compound of formula

$R^5R^6R^7C—OH$,

wherein $R^5$, $R^6$ and $R^7$ are independently selected from the group consisting of hydrogen, methyl, ethyl, propyl, butyl and pentyl.

9. The method according to claim 7, wherein at least one of $R^5$, $R^6$ and $R^7$ is methyl.

10. A method for the ozonolysis of unsaturated fatty acids and derivatives thereof, comprising:
a) ozonolysis of the unsaturated fatty acid or derivative thereof in an organic phase comprising an organic solvent; and
b) contacting the organic phase with an aqueous phase comprising catalase and optionally, a buffer;

wherein the unsaturated fatty acid or the derivative thereof comprises at least one linear carbon chain of at least eight carbon atoms and,
wherein the organic solvent is 2-methyl-2-butanol.

11. The method according to claim 1, wherein a volume per cent of the aqueous phase in contact with the organic phase, is from more than 0 to 50 percent of a total volume of the two phases.

12. The method according to claim 1, wherein the aqueous phase comprising catalase is in contact with the organic phase during the ozonolysis.

13. The method according to claim 1, wherein the catalase is beef liver catalase or a variant thereof.

14. The method according to claim 1, wherein the aqueous phase comprises a buffer and the pH of the aqueous phase before contacting with the organic phase, is from 3 to 11.

15. The method according to claim 14, wherein the pH of the aqueous phase before contacting with the organic phase, is from 5 to 8.

16. A method for removing reactive oxygen species from a reaction mixture comprising ozonolysis products of an unsaturated fatty acid or a derivative thereof and an organic solvent, comprising:
contacting the reaction mixture with a catalase
wherein said organic solvent, in the presence of an aqueous phase at room temperature, forms an organic phase separate from the aqueous phase.

17. The method according to claim 16, wherein the unsaturated fatty acid or the ester thereof is a compound of formula (I):

$$R^1—(CH_2)_x—CH=CH—(CH_2)_y—COR^2 \qquad (I),$$

wherein
$R^1$ is selected from the group consisting of hydrogen, HO—, HS—, CHO—, $R^2OC$—, unsubstituted or substituted alkyl, cycloalkyl, heterocycloalkyl, aryl and heteroaryl,

$R^2$ is selected from the group consisting of HO—, substituted or unsubstituted alkoxy, alkenoxy, alkynoxy and cycloalkoxy having one to seven carbon atoms, —$NR^3R^4$, aryloxy and benzyloxy, $R^3$ and $R^4$ are each independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl and benzyl, and

x and y, are each, independently, 0 or a larger integer.

18. The method according to claim 16, wherein

the organic solvent is selected from the group consisting of compounds having a formula:

$$R^5R^6R^7C—O—R^8$$

or intramolecular ethers thereof,

wherein

$R^5$, $R^6$ and $R^7$ are each independently selected from the group consisting of hydrogen, an alkyl group of one to seven carbon atoms, a cycloalkyl group of one to seven carbon atoms, an unsubstituted aryl group and a substituted aryl group, and

$R^8$ is selected from the group consisting of hydrogen, an alkyl, cycloalkyl, hydroxyalkyl or alkoxyalkyl group having one to seven carbon atoms, an unsubstituted aryl group, a substituted aryl group and a benzyl group.

19. The method according to claim 18, wherein the organic solvent is 2-methyl-2-butanol.