AMENDED CLAIMS
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Amended Claims

1. A method for solubilising and separating carboxylic acids with a solubilizing compound from aqueous or organic solutions, emulsions, suspensions arising in medical therapy, medical analytics, food analytics, food processing, oil processing, oil analytics, fuel processing, modulation of chemical or physico-chemical reactions, solubilization of poorly solvable molecules, analytics in pharmaceutical or chemical industy or science, removal of carboxylic acids from sewage from private, commercial or industrial cleanings, removal of carboxylic acids from bioreactor processes, organogelation or nanoemulsification of carboxylic acids, wherein said solubilizing compound contains at least one amidino group and/or at least one guanidino group and wherein the solubilizing compound has a partition coefficient between n-octanol and water of $K_{OW} \leq 6.30$, and wherein the method comprises the following steps:
   i) Providing the solution or emulsion or suspension containing the carboxylic acids;
   ii) Addition of at least equimolar amounts of at least one solubilizing compound;
   iii) separating the solubilized carboxylic acids from the solution or emulsion or suspension by phase separation, filtration, nanofiltration, dialysis, absorption, complexation, electrophoresis, evaporation, distillation and/or extraction.

2. A method according to claim 1, wherein step iii) is achieved by means of one of the following separation methods or a combination thereof:
passing the carboxylic acids separately or together with the at least one solubilizing compound through a separation membrane or a tube or hollow capillary assembly by applying a concentration gradient, a thermic gradient, a physico-chemical gradient, a pneumatic gradient, an electric gradient or a combination thereof; or
performing phase separation by combining two or more media building phase separations; or
passing the carboxylic acids together with the at least one solubilizing compound through a phase separation interface that allows the passage of

said carboxylic acids and said at least one solubilizing compound by applying a concentration gradient, a thermic gradient, a physico-chemical gradient, a pneumatic gradient, an electric gradient or a combination thereof, wherein the phase separation interface consists of a gel, an organogel or a solid material or a combination thereof; or

filtrating the carboxylic acids by using at least one solubilizing compound; or

nanofiltrating the carboxylic acids by using at least one solubilizing compound; or

dialyzing the carboxylic acids by using at least one solubilizing compound; or

adsorbing the carboxylic acids by using at least one solubilizing compound; or

complexing the carboxylic acids by using at least one solubilizing compound; or

distilling the carboxylic acids by using at least one solubilizing compound; or

separating the carboxylic acids by using at least one solubilizing compound by supercritical fluid extraction.

3. A method according to claim 1, comprising the following steps:

a) Preparing said solution by reducing ionic strength by means of complexation, adsorbtion, separation or dialysis of bound and unbound cations and anions;

b) Adjusting the pH of the solution by means of adding an acid or a base;

c1) Adjusting the molarity of the solubilizing compound to be in the range of 1:10 to 20:1 compared to the estimated concentration of the carboxylic acids to be solubilized; and

d) Adding said solubilizing compound in a solid form or in a solution to said carboxylic acid-containing aqueous or organic solution for generating a micro- or nanoemulsion;

optionally comprising any of the steps

a1) liberation of carboxylic acids bound by complexation or covalent binding

c2) If the solubilizing compound is administered in a solution, adjusting the pH of said solution in order to optimize compatibility and reaction conditions with the carboxylic acids to be solubilized by means of acidification or alkanisation;

e) Adding esterases, hydrolases or a complex builder;

f) Adding water and/or a cosolvent to the solution; and/or

g) Optimizing reaction conditions by means of heating and/or mixing the solution, thereby generating an improved micro- or nano-emulsion.

4. A method according to claim 3 comprising additionally the steps after step g):

g2) Conducting the reactive solution from a first chamber to a second chamber through a separation panel using nanofiltration technique by applying a concentration gradient, a chemical gradient, a pneumatic gradient, an electric gradient or a combination thereof;

optionally comprising the steps

h) Removing the associates of carboxylic acid and solubilizing compound from the filtrated solution through convection of an acceptor solution being led through an inlet into said second chamber and allowed to flow off through an outlet of said second chamber; and

i) Removing the purified solution from said second chamber through a further outlet.

5. A method according to claim 3, wherein the aqueous solution is the *ex vivo* blood sample of a subject from which blood micro- and/or nanoemulsions of fatty acids shall be removed, additionally comprising the following steps g1) to m) after step g):

g1) Liberating esterified fatty acids in the blood of a subject by hydrolases immobilized on support materials inside said first chamber thus generating a micro- or nanoemulsion;

h) Pumping the filtrated solution from said second chamber to a first chamber of a second dialyser;

i) Conducting the carboxylic acid-containing solution from said first chamber of the second dialyser to a second chamber of the second dialyser through a second separation panel by applying a concentration gradient, a chemical gradient, a pneumatic gradient, an electric gradient or a combination thereof;

j) Removing the associates of carboxylic acid and solubilizing compound passing through said second separation panel by means of a tertiary circulation;

k) Pumping the carboxylic acid acceptor solution from an acceptor solution storage container into said second chamber of the second dialyser;

l) Removing the loaden carboxylic acid acceptor solution into a waste container; and

m) Reconducting the purified solution containing the solubilizing compound exiting said first chamber of the second dialyser to the inlet of said second chamber of the first dialyser.

6. A method according to claim 5, wherein the effect is reached by means of dialysis, hemofiltration, hemoperfusion, centrifuge-plasma-separation, plasma-apheresis, cascade-filtration and thermo-filtration.

7. A method according to claim 5 or 6, wherein the separation efficacy is increased by additional hydrolysis of esterified fatty acids, enhacement of lipolysis and/or the use of a central venous blood aspiration site for blood purification.

8. A method according to any one of claims 1 – 7 wherein the medical indication for applying said method is selected from diabetes mellitus, metabolic syndrome, overweight, obesity, arterial hypertension, hypertriglyceridemia, hypercholesterinemia, hyperuricemia, cellulitis, atherosclerosis, fatty liver, lipomatosis, ventricular premature beats, ventricular tachycardia and supraventricular fibrillation.

9. A method according to any one of claims 1 – 4, wherein the solution to be purified arises from plants, organisms, fossile materials, natural or synthethic reaction mixtures.

10. A method according to any one of claims 1 – 9, wherein the use of said solubilizing compound leads to micro- or nanoemulsion of said carboxylic acids and allows their separation by means of complexation, adsorption, absorption, diffusion, osmosis, dialysis, filtration, nanofiltration, distillation, fluid-fluid extraction or supercritical fluid extraction using a concentration gradient, a thermic gradient, an electrical gradient, a physico-chemical gradient or a combination thereof.

11. A method according to any one of claims 1 – 10, wherein the at least one solubilizing compound is added to an emulsion, solution or suspension containing the carboxylic acids in order to use said emulsion to liberate, decomplex, detach, react, aggregate, complex, coagulate, flocculate, sediment or separate the carboxylic acid-containing complexes.

12. A method according to claim 10 or 11, wherein micro- or nanoemulsions are used for diminishing a physico-chemical or chemical reaction, enabling, enhancing the up-take and transport of reaction products or components in biological or chemical reaction processes, detaching, solubilizing, liberating, convecting, transporting substances by vesicle up-take or enabling or

enhancing the penetration of the emulsified carboxylic acids through hydrophilic or amphiphilic media or solids.

13. Device for solubilizing and separating carboxylic acids with a solubilizing compound in an aqueous or organic medium for use in medical therapy, medical analytics, food analytics, food processing, oil processing, oil analytics, fuel processing, chemical and pharmacologica or pharmceutical processings, analytics in pharmaceutical or chemical industy or science, removal of carboxylic acids from sewage from private, commercial or industrial cleanings, removal of carboxylic acids from bioreactor processes, cleanings of oily solid matters organogelation or nanoemulsification of carboxylic acids, wherein said solubilizing compound contains at least one amidino group and/or at least one guanidino group and wherein the solubilizing compound has a partition coefficient between n-octanol and water of $K_{OW} < 6.30$, and wherein the device is comprising

i) A first chamber for reacting the carboxylic acid-containing aqueous or organic medium with the solubilizing compound of general formula (I) or (II);
ii) A second chamber for receiving the solubilized carboxylic acids;
iii) A separation panel between said first chamber and said second chamber comprising a separation membrane, a tube, or hollow capillary assembly; and
iv) Means for conducting said reactive solution from said first chamber to said second chamber through said separation panel by applying a concentration gradient, a thermic gradient, a physico-chemical gradient, a pneumatic gradient, an electric gradient or a combination thereof.

14. Device according to claim 13, comprising

a) A first chamber for reacting the carboxylic acid-containing aqueous medium with the solubilizing compound,
having a first inlet for said carboxylic acid-containing aqueous medium;
b) A container for said solubilizing compound, having a second inlet for filling said container with said solubilizing compound and being connected to said first chamber via a third inlet;
c) A second chamber for receiving the filtrated reactive solution;
d) A separation panel between said first chamber and said second chamber comprising a separation membrane or a hollow capillary assembly; and
e) Means for conducting said reactive solution from said first chamber to said second chamber through said separation panel by applying a

concentration gradient, a thermic gradient, an electric gradient, a physico-chemical gradient, or a combination thereof;
optionally comprising

f) Means for removing the associates of carboxylic acid and solubilizing compound from said filtrated solution by means of removing said filtrated solution through convection of an acceptor solution being fed through a fourth inlet into said second chamber and allowed to flow off through a first outlet out of said second chamber; and

g) Means for removing the purified solution from said second chamber through a second outlet.

15. Device according to claim 13, wherein the carboxylic acid-containing medium is blood or plasma from a subject in need thereof, or blood or plasma that is subject of pruification, comprising parts a) to e) and additionally parts

f) Means for conducting blood or plasma from said subject or said purification procedure to said first chamber (610) of a dialyser (603) through said first inlet;

g) A pumping system and mixing system (602) that allows feeding in the solubilizing compound from said container (601) and mixing the solution;

h) Support materials (604) in said first chamber on which hydrolases are immobilized in order to liberate esterified fatty acids;

i) A first separation panel between said first chamber of a second dialyser and second chamber of a first dialyser, comprising a separation membrane (605) or a hollow capillaries assembly;

j) Means for conducting the carboxylic acid-containing solution from said first chamber of the first dialyser to a second chamber of the first dialyser by applying a concentration gradient, a chemical gradient, a pneumatic gradient, an electric gradient or a combination thereof;

k) Means of pumping (606) said filtrated solution from said second chamber to a first chamber of a second dialyser (607);

l) Means for removing the associates of carboxylic acid and solubilizing compound passing through said second separation panel of the second dialyser (607) by means of a tertiary circulation;

m) An acceptor solution storage container;

n) Means for pumping (612) the carboxylic acid acceptor solution from said acceptor solution storage container (609) into said second chamber of the second dialyser;

o) Means for removing the loaden carboxylic acid acceptor solution into a waste container (608);

p) Means for reconducting the purified solution containing the solubilizing compound exiting said first chamber of the second dialyser to the inlet of said second chamber of the first dialyser; and

q) Means for reconducting the reunited blood fractions exiting the first chamber of the first dialyser into the circulation of the subject (611).

16. Device according to claim 13, wherein the carboxylic acid-containing medium is an oil or an emulsion (O/W, W/O) or a fluid/fluid system arising during pharmaceutical, chemical or industrial processing, comprising parts a) to g) and additionally parts

h) Means for mixing the carboxylic acid-containing solution and the solubilizing compound by means of heating, sonification, laminar or turbulent flow conditions in said first chamber;

i) Means for transferring the mixed emulsion to said second chamber and means for phase separation by gravity or centrifugation;

j) A third chamber for receiving the purified oil from the second outlet of the second chamber;

k) A fourth chamber for receiving the associates of carboxylic acid and solubilizing compound from the first outlet of the second chamber;

l) A reservoir for a water-soluble acid;

m) Means for suspending said water-soluble acid from said reservoir into said fourth chamber,

n) Means for mixing the solution in said fourth chamber;

o) A fifth chamber suitable for phase separation by gravity for receiving the mixed solution from said fourth chamber;

p) Means for conducting the mixed solution from said fourth chamber to said fifth chamber;

q) A sixth chamber for receiving the purified carboxylic acids from said fifth chamber;

r) Means for conducting the purified carboxylic acids from said fifth chamber to said sixth chamber;

s) A seventh chamber for receiving the solution containing the solubilizing compound and the water-soluble acid gathering on the bottom of said fifth chamber;

t) Means for conducting the solution containing the solubilizing compound and the water-soluble acid to a seventh chamber;

u) Means for conducting the solution from the seventh chamber through an electrodialysis device or an ion exchanger for separating the solubilizing

compound to a catholyte chamber and the added water-soluble acid to an anolyte chamber;

v) Means for conducting the solution from the catholyte chamber to said container for the solubilizing compound;

w) Means for conducting the solution from the anolyte chamber to the reservoir for the water-soluble acid;

x) Means for conducting the purified retinate solution after electrodialysis to a hydrophilic filter membrane; and

y) Means for re-using the aqueous filtrate; and

optionally comprising

z) Means for suspending and mixing an organic solvent to the solution of the seventh chamber.

Claims

1. A method for solubilising and separating carboxylic acids with a solubilizing compound from aqueous or organic solutions, emulsions, suspensions arising in medical therapy, medical analytics, food analytics, food processing, oil processing, oil analytics, fuel processing, modulation of chemical or physico-chemical reactions, solubilization of poorly solvable molecules, analytics in pharmaceutical or chemical industy or science, removal of carboxylic acids from sewage from private, commercial or industrial cleanings, removal of carboxylic acids from bioreactor processes, organogelation or nanoemulsification of carboxylic acids, wherein said solubilizing compound contains at least one amidino group and/or at least one guanidino group and wherein the solubilizing compound has a partition coefficient between n-octanol and water of Kow < 6.30, and wherein the method comprises the following steps:

   i) providing the solution or emulsion or suspension containing the carboxylic acids;

   ii) adding of at least equimolar amounts of at least one solubilizing compound; iii) separating the solubilized carboxylic acids from the solution or emulsion or suspension by phase separation, filtration, nanofiltration, dialysis, absorption, complexation, electrophoresis, evaporation, distillation and/or extraction.

2. The method according to claim 1, wherein step iii) is achieved by means of one of the following separation methods or a combination thereof: passing the carboxylic acids separately or together with the at least one solubilizing compound through a separation membrane or a tube or hollow capillary assembly by applying a concentration gradient, a thermic gradient, a physico-chemical gradient, a pneumatic gradient, an electric gradient or a combination thereof; or performing phase separation by combining two or more media building phase separations; or passing the carboxylic acids together with the at least one solubilizing compound through a phase separation interface that allows the passage of said carboxylic acids and said at least one solubilizing compound by applying a concentration gradient, a thermic gradient, a physico-chemical gradient, a pneumatic gradient, an electric

gradient or a combination thereof, wherein the phase separation interface consists of a gel, an organogel or a solid material or a combination thereof; or filtrating the carboxylic acids by using at least one solubilizing compound; or nanofiltrating the carboxylic acids by using at least one solubilizing compound; or dialyzing the carboxylic acids by using at least one solubilizing compound; or adsorbing the carboxylic acids by using at least one solubilizing compound; or complexing the carboxylic acids by using at least one solubilizing compound; or distilling the carboxylic acids by using at least one solubilizing compound; or separating the carboxylic acids by using at least one solubilizing compound by supercritical fluid extraction.

3. The method according to claim 1, comprising the following steps:
a) preparing said solution by reducing ionic strength by means of complexation, adsorbtion, separation or dialysis of bound and unbound cations and anions;
b) adjusting the pH of the solution by means of adding an acid or a base;
c1) adjusting the molarity of the solubiiizing compound to be in the range of 1:10 to 20:1 compared to the estimated concentration of the carboxylic acids to be solubilized; and
d) adding said solubilizing compound in a solid form or in a solution to said carboxylic acid-containing aqueous or organic solution for generating a micro- or nanoemulsion;
optionally comprising any of the steps
a1) liberation of carboxylic acids bound by complexation or covalent binding c2) If the solubilizing compound is administered in a solution, adjusting the pH of said solution in order to optimize compatibility and reaction conditions with the carboxylic acids to be solubilized by means of acidification or alkanisation; e) adding esterases, hydrolases or a complex builder;
f) adding water andlor a cosolvent to the solution; and/or
g) optimizing reaction conditions by means of heating and/or mixing the solution, thereby generating an improved micro- or nano-emulsion.

4. The method according to claim 3 comprising additionally the steps after step g):

g2) conducting the reactive solution from a first chamber to a second chamber through a separation panel using nanofiltration technique by applying a concentration gradient, a chemical gradient, a pneumatic gradient, an electric gradient or a combination thereof; optionally comprising the steps

h) removing the associates of carboxylic acid and solubilizing compound from the filtrated solution through convection of an acceptor solution being led through an inlet into said second chamber and allowed to floh off through an outlet of said second chamber; and

i) removing the purified solution from said second chamber through a further outlet.

5. The method according to claim 3, wherein the aqueous solution is the ex vivo blood sample of a subject from which blood micro- and/or nanoemulsions of fatty acids shall be removed, additionally comprising the following steps g1) to m) after step g):

g1) liberating esterified fatty acids in the blood of a subject by hydrolases immobilized on support materials inside said first chamber thus generating a micro- or nanoemulsion;

h) pumping the filtrated solution from said second chamber to a first chamber of a second dialyser;

i) conducting the carboxylic acid-containing solution from said first chamber of the second dialyser to a second chamber of the second dialyser through a second separation panel by applying a concentration gradient, a chemical gradient, a pneumatic gradient, an electric gradient or a combination thereof;

j) removing the associates of carboxylic acid and solubilizing compound passing through said second separation panel by means of a tertiary circulation;

k) pumping the carboxylic acid acceptor solution from an acceptor solution storage container into said second chamber of the second dialyser;

l) removing the loaden carboxylic acid acceptor solution into a waste container; and

m) reconducting the purified solution containing the solubilizing compound exiting said first chamber of the second dialyser to the inlet of said second chamber of the first dialyser.

6. The method according to claim 5, wherein the effect is reached by means of dialysis, hemofiltration, hemoperfusion, centrifuge-plasma-separation, plasma-apheresis, cascade-filtration and thermo-filtration.

7. The method according to claim 5, wherein the separation efficacy is increased by additional hydrolysis of esterified fatty acids, enhacement of lipolysis andlor the use of a central venous blood aspiration site for blood purification.

8. The method according to any one of claims 1, wherein the medical indication for applying said method is selected from diabetes mellitus, metabolic syndrome, overweight, obesity, arterial hypertension, hypertriglyceridemia, hypercholesterinemia, hyperuricemia, cellulitis, atherosclerosis, fatty liver, lipomatosis, ventricular premature beats, ventricular tachycardia and supraventricular fibrillation.

9. The method according to any one of claims 1, wherein the solution to be purified arises from plants, organisms, fossile materials, natural or synthethic reaction mixtures.

10. The method according to any one of claims 1, wherein the use of said solubilizing compound leads to micro- or nanoemulsion of said carboxylic acids and allows their separation by means of complexation, adsorption, absorption, diffusion, osmosis, dialysis, filtration, nanofiltration, distillation, fluid-fluid extraction or supercritical fluid extraction using a concentration gradient, a thermic gradient, an electrical gradient, a physico-chemical gradient or a combination thereof.

11. The method according to any one of claims 1, wherein the at least one solubilizing compound is added to an emulsion, solution or suspension containing the carboxylic acids in order to use said emulsion to liberate, decomplex, detach, react, aggregate, complex, coagulate, flocculate, sediment or separate the carboxylic acidcontaining complexes.

12. The method according to claim 10, wherein micro- or nanoemulsions are used for diminishing a physico-chemical or chemical reaction, enabling, enhancing the up-take and transport of reaction products or components in biological or chemical reaction processes, detaching, solubilizing, liberating, convecting, transporting substances by vesicle up-take or enabling or enhancing the penetration of the emulsified carboxylic acids through hydrophilic or amphiphilic media or solids.