

PURIFICATION OF A FEEDSTOCK COMPRISING LIPIDS

FIELD OF THE INVENTION

The present invention generally relates to a process for purifying a feedstock comprising lipids. Specifically, the process comprises purifying a feedstock comprising lipids of plant, animal and/or microbial origins, and the process comprises a step of treating the feedstock with an aqueous mineral acid solution in elevated temperature followed by a bleaching step including filtration, to obtain a purified feedstock.

BACKGROUND OF THE INVENTION

Vegetable oils, but also other oils and fats of animal and microbial origin, comprises lipids, such as fatty acids or triglycerides. Various oils and fats are used in various applications as such, but also as starting material in a range of industrial processes. In one application the lipids of the oils and fats are industrially converted to biofuel components, such as fatty acid methyl esters (FAME) and hydrogenated vegetable oils (HVO). HVO is an umbrella or collective term that encompasses hydrocarbons produced from fatty acids and triglycerides of vegetable, animal and microbial origin. In the hydrogenation process the lipids are hydrogenated to remove oxygen and other heteroatoms, and hydrocarbons are formed.

Oils and fats typically contain impurities which need to be removed before the further use of the oils and fats. There is a range of various methods for purifying oils and fats, of which some target specific impurities while others are general aiming at removal a range of impurities. Bleaching is a very common purification method for oils and fats used in the food industry as well as in processes aiming at using oils and fats in other industrial processes, such as converting the lipids to biofuel component. Traditionally bleaching was aimed at removing coloured pigments (which gives the name bleaching). While more waste and residue feedstock are used, bleaching is nowadays also aimed to remove other impurities for example phosphorus containing compounds such as phosphatides and phospholipids, metals, soaps, nitrogen and other heteroatom containing compounds.

Generally, the bleaching process is a treatment of oils and fats with an adsorbent, such as bleaching earth or clay, in acidic conditions. The adsorbent needs to be removed from the oils and fats after the treatment, this is typically done by filtration. Filtration of oils and fats, which in themselves are viscous, is challenging and typically puts high requirements on the filtration equipment and its operation. Contaminations and generally low quality of the oils and fats feedstock will

further affect the filtration step negatively. Therefore, there is a need to develop purification methods, which improves and simplifies the bleaching process, including the filtration step.

BRIEF DESCRIPTION OF THE INVENTION

5 An object of the present invention is thus to provide a process so as to solve the above problems relating to the bleaching process. The objects of the invention are achieved by a process, as characterised by what is stated in the independent claim. The preferred embodiments of the invention are disclosed in the dependent claims.

10 Therefore, an object of the current invention is to provide a process for purifying a feedstock comprising the steps of:

- a) providing a feedstock comprising lipids of plant, animal and/or microbial origin,
- b) treating the feedstock with a mineral acid at elevated temperature,
- 15 c) removing or neutralizing the mineral acid after treatment in step b) to obtain an acid treated feedstock,
- d) subjecting the acid treated feedstock to a bleaching step including a filtration step to obtain a purified feedstock, wherein the bleaching step including a filtration step comprises adding a bleaching acid and an adsorbent to the acid
- 20 treated feedstock, wherein the bleaching acid is a carboxylic acid, such as citric acid, phosphoric acid (H_3PO_4) or any combination thereof.

A benefit of the currently disclosed process is to provide an effective purification process for various feedstock comprising lipids of different origin. Many of the feedstock comprising lipids require extensive purification and the purification processes can be complex and difficult to perform and can require extensive optimisation depending on the type of feedstock and impurities to be removed. Therefore, a process aiming to simplify and improve purification processes has significance for the overall process and enable savings in energy and equipment requirements. Especially the filtration step of the bleaching method is crucial for the economy and functionality of the whole process. Therefore, since the current invention improves the filterability of the bleached feedstock, it has a huge significance for the overall process.

DETAILED DESCRIPTION OF THE INVENTION

35 The current invention generally describes a process for purifying a feedstock comprising lipids, where the process comprises treating the feedstock with

mineral acid at elevated temperature, removing or neutralizing the mineral acid and subjecting the acid treated feedstock to a bleaching step including filtration step to obtain a purified feedstock. In the following the invention and its embodiments as well as the technical features are described in more detail.

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Feedstock

The process relates to purifying a feedstock comprising lipids of plant, animal and/or microbial origin. With the term "lipid" is herein meant organic molecules such as fatty acids, tri-, di and monoglycerides, waxes, sterols and other lipidic molecules. The feedstock according to the current invention comprises lipids of plant, animal and/or microbial origin. With plant, animal and/or microbial origin is here typically meant any oil or fats which originates from any plant, animal or microbial source, such as plant oils, plant fats, fish oils, fish fats, animal fats, animal oils, waste fats, waste oils, residue fats, residue oils, mould oils and microbial oils.

15 In one embodiment of the embodiment the feedstock comprising lipids of plant, animal and/or microbial origin is selected from or comprises rapeseed oil, canola oil, colza oil, tall oil, sunflower oil, corn oil, technical/distillers corn oil, soybean oil, hemp oil, olive oil, linseed oil, cottonseed oil, mustard oil, pongamia oil, palm oil, palm oil mill effluent oil (POME), sludge originating from any type of plant oil production, arachis oil, castor oil, coconut oil, suet, tallow, blubber, recycled alimentary fats, used cooking oil (UCO), trap grease, brown grease, gutter oil, fatty acid distillates (FAD) from rice bran oil or palm oil (palm oil fatty acid distillate PFAD), archaeal oil, bacterial oil, fungal oil, protozoal oil, algal oil, fraction of tall oil, crude tall oil, tall oil pitch, peanut oil, crude palm oil, palm seed oil, palm kernel oil, carinata oil, coconut butter, muscat butter oil, sesame oil, maize oil, babassu oil, poppy seed oil, soy oil, laurel seed oil, jatropha oil, camelina oil, seaweed oil, oils from halophiles, poultry fat, dry rendered poultry fat, lard, train oil or any combinations or mixtures thereof.

30 In one embodiment of the embodiment the feedstock comprising lipids of plant, animal and/or microbial origin is selected from or comprises rapeseed oil, canola oil, colza oil, tall oil, sunflower oil, corn oil, technical/distillers corn oil, soybean oil, hemp oil, olive oil, linseed oil, cottonseed oil, mustard oil, palm oil, palm oil mill effluent oil (POME), sludge originating from any type of plant oil production, arachis oil, castor oil, coconut oil, suet, tallow, blubber, recycled alimentary fats, used cooking oil (UCO), trap grease, brown grease, gutter oil, fatty acid distillates (FAD) from rice bran oil or palm oil (palm oil fatty acid distillate PFAD), archaeal

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oil, bacterial oil, fungal oil, protozoal oil, algal oil, fraction of tall oil, crude tall oil, tall oil pitch, peanut oil, crude palm oil, palm seed oil, palm kernel oil, carinata oil, coconut butter, muscat butter oil, sesame oil, maize oil, babassu oil, poppy seed oil, soy oil, laurel seed oil, jatropha oil, camelina oil, seaweed oil, oils from halophiles, poultry fat, dry rendered poultry fat, lard, train oil or any combinations or mixtures thereof.

In one embodiment of the invention the feedstock comprising lipids of animal origin is selected from or comprises suet, tallow, blubber, recycled alimentary fats, used cooking oil (UCO), trap grease, brown grease, gutter oil, poultry fat, dry rendered poultry fat, lard, train oil or any combinations or mixtures thereof.

In one embodiment of the current invention the feedstock is a feedstock containing high amounts of impurities, such as nitrogen in an amount of more than 100 ppm (mg/kg), such as more than 200 ppm (mg/kg) or more than 300 ppm (mg/kg); phosphorus in an amount of more than 50 ppm (mg/kg), such as more than 100 ppm (mg/kg) or more than 200 ppm (mg/kg); metals and/or solids in an amount of more than 100 ppm (mg/kg), such as more than 200 ppm (mg/kg) or more than 300 ppm (mg/kg). Nitrogen (N) is measured according to ASTM D4629, and phosphorus (P) and metals are measured according to ASTM D5185.

In one embodiment of the current invention the feedstock is a feedstock comprising a significant amount of triglycerides, such as at least 10 wt.% triglycerides, at least 20 wt.% triglycerides, at least 30 wt.% triglycerides, at least 40 wt.% triglycerides, at least 50 wt.% triglycerides, at least 60 wt.% triglycerides, at least 70 wt.% triglycerides or at least 80 wt.% triglycerides.

In one embodiment of the current invention the feedstock is free from soapstock. With the term "soapstock" is here meant any chemically treated oil or fats, where the chemical treatment involves alkali neutralisation of the fatty acids in the oil or fat.

Mineral acid treatment

According to the invention the feedstock is treated with a mineral acid. With the term "mineral acid" is here meant any inorganic acid or any acid derived from one or more inorganic compounds. In one embodiment any acid having a pK_a value of equal to or less than about -1 (as measured in water or DMSO at 25 °C) may be regarded as a mineral acid, and can be used as the mineral acid.

In one embodiment the mineral acid is an aqueous solution of the mineral acid. This means that the mineral acid is added to the feedstock to be treated

as an aqueous solution of the mineral acid.

In one embodiment the mineral acid is selected from sulphuric acid (H_2SO_4), hydrochloric acid (HCl), nitric acid (HNO_3), phosphoric acid (H_3PO_4), boric acid (H_3BO_3), hydrofluoric acid (HF), hydrobromic acid (HBr), perchloric acid (HClO_4), hydroiodic acid (HI) or any combination or mixture thereof.

In one embodiment the mineral acid is a strong mineral acid and optionally selected from sulphuric acid (H_2SO_4), hydrochloric acid (HCl), nitric acid (HNO_3), hydrobromic acid (HBr), perchloric acid (HClO_4), hydroiodic acid (HI) or any combination or mixture thereof.

In one embodiment the mineral acid is an aqueous solution of sulphuric acid (H_2SO_4).

Typically, the amount of mineral acid is up to about 10 wt.% based on the weight of the feedstock. The amount of mineral acid can typically be from about 0.1 wt.% to about 10 wt.%, in one embodiment from about 1 wt.% to about 8 wt.%, and in another embodiment from about 2 wt.% to 5 wt.%, based on the weight of the feedstock.

In one embodiment the mineral acid for treating the feedstock at elevated temperature (step b) is a different acid compared to an acid used in the bleaching step including a filtration step (step d).

The mineral acid treatment of the feedstock is performed at elevated temperature. Typically, the elevated temperature is at least about 50 °C, such as from about 50 °C to about 150 °C. In an embodiment of the invention the elevated temperature is a temperature from about 60 °C to about 140 °C, such as from about 70 °C to about 130 °C, or from about 80 °C to about 120 °C, or from about 90 °C to about 110 °C.

In one embodiment of the current invention treating the feedstock with a mineral acid in elevated temperature is performed for at least 2 minutes, such as from about 2 minutes to about 30 minutes, or from about 5 minutes to about 20 minutes.

In one embodiment of the current invention the process further comprises adding an adsorbing material to the feedstock before mineral acid treatment or during mineral acid treatment together with the aqueous mineral acid solution. In one embodiment the adsorbing material is a mineral based adsorbent, a silica-based adsorbent, an amorphous silica adsorbent, such as silica gel, silica hydrogel or silica xerogel, or any combination thereof. In one embodiment the amount of adsorbing material, if added, is added in an amount from about 0.5 wt.% to about

5 wt.%, such as from about 1 wt.% to about 4 wt.% or from 1.5 wt.% to about 3 wt.%, based on the weight of the feedstock.

Removal or neutralization of mineral acid

5 The process according to the invention further comprises removing or neutralizing the mineral acid after the acid treatment at elevated temperature, to obtain an acid treated feedstock. The removal of the mineral acid can be performed with any suitable method such as a water wash. A water wash step can be performed by adding water to the acid treated feedstock and mixing or purging water
10 through the acid treated feedstock and then removing the aqueous phase from the oil phase. A water wash is typically performed several times to ensure removal of all mineral acid from the acid treated feedstock. The completeness of acid removal can easily be monitored, if necessary, by measuring the pH of washing water after each washing step. The neutralization of the mineral acid can be performed e.g. by
15 addition of a base (such as an alkaline solution).

 This step is essential for adjusting the pH of the feedstock to a suitable range for the consequent bleaching process by removing the excess of mineral acid or by neutralizing the mineral acid. It improves the filterability of the bleached feedstock, leading to energy and equipment savings. Residual mineral acid could
20 hinder the effectiveness of bleaching agents or adsorbents, but its removal ensures optimal pH for enhanced bleaching and filtration efficiency.

Bleaching step

 The acid treated feedstock is further subjected to a bleaching step including a filtration step to obtain a purified feedstock. With the bleaching step
25 herein meant any typical bleaching step, which can be used for oil and fat purification. The bleaching step according to the invention includes adding a bleaching acid and an adsorbent to the acid treated feedstock, followed by a filtration step. The bleaching step is typically performed by adding a bleaching acid and an adsorbent
30 to the acid treated feedstock. Water can optionally also be added together with the bleaching acid and adsorbent. The bleaching can be performed in a temperature from about 50 °C to 120 °C, such as from about 60 °C to 110 °C, or about 70 °C to 100 °C. In one embodiment of the invention the bleaching acid is a carboxylic acid, such as citric acid, phosphoric acid (H₃PO₄) or any combination thereof. In one em-
35 bodiment the adsorbent used in the bleaching step is a bleaching earth, a bleaching clay, activated carbon, amorphous silica or any combination thereof. In one

embodiment the bleaching step including a filtration step comprises adding a bleaching agent and an adsorbent, wherein the bleaching acid is a carboxylic acid, such as citric acid, phosphoric acid (H_3PO_4) or any combination thereof, and the adsorbent is a bleaching earth, a bleaching clay, activated carbon, amorphous silica
5 or any combination thereof.

The bleaching step according to the current invention also includes a filtration step. The filtration step can be any filtration step suitable for industrial scale filtration of oils and fats. The combination of bleaching and filtration steps ensures that the resulting feedstock is purified to a degree such as a high degree,
10 suitable for further use.

Other Embodiments

In one embodiment of the current invention the process further comprises one or more drying step(s), such as a drying step after the mineral acid treatment and/or a drying step before filtration of the bleached feedstock.
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In one embodiment of the current invention the process is performed as follows

- a) providing a feedstock comprising lipids of animal origin,
- b) treating the feedstock with an aqueous sulphuric acid solution in a
20 temperature from about 70 °C to about 120 °C,
- c) removing the aqueous sulphuric acid solution after treatment in step b) by washing the acid treated feedstock with water to obtain an acid treated feedstock,
- d) subjecting the acid treated feedstock to a bleaching step, where the
25 bleaching step comprising treating the acid treated feedstock with citric acid and an adsorbent in a temperature of about 80 °C to 100 °C and filtrating the bleached acid treated feedstock to obtain a purified feedstock.

Additional treatment steps

In one embodiment of the current invention the method further comprises additional process steps, such as additional purification steps and/or one or more hydrotreatment steps.
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In one embodiment of the current invention the method further comprises hydrotreating the obtained purified feedstock. The hydrotreatment process can be a desulfurization process. Any suitable desulfurization process is possible.
35 In one embodiment the hydrotreatment or desulfurization process of the obtained

purified feedstock is performed in the presence of hydrogen and a hydrotreating catalyst. The hydrotreating catalyst can be a supported or unsupported catalyst comprising at least one component selected from IUPAC group 6, 8 or 10 of the Periodic Table of Elements. In one embodiment the active site of the hydrotreating catalyst is Ni, Mo or Co. The support of the hydrotreating catalyst if present is preferably alumina and/or silica, preferably the support is Al₂O₃. The hydrotreating catalyst can also be unsupported NiMoW.

The supported hydrotreating catalyst is usually employed as sulfided catalyst to ensure that the catalyst is in its active (sulfided) form. Turning the catalyst into its active (sulfided) form may be achieved by sulfiding it in advance (i.e. before starting the hydrotreating reaction) and/or by adding sulfur containing feed (containing sulfur e.g. as an organic or inorganic sulfide). The feed may contain the sulfur from the start, or sulfur additives may be added to the feed.

The conditions in which the purified feedstock is hydrotreated are typical hydrotreatment conditions. In one embodiment of the invention the conditions contain one or more of the following:

- a H₂ to oil ratio is 150 – 400 Nm³/stdm³, preferably 180 – 250 Nm³/stdm³;
- a LHSV of 0.5 – 2.0 h⁻¹, preferably 1.0 – 1.5 h⁻¹;
- a temperature of 300-400 °C, preferably 350-390 °C
- a pressure of 4000-6000 kPa(a), preferably 4800-5500 kPa(a).

In one embodiment of the current invention the hydrotreatment process is further followed by isomerising the hydrotreated feedstock. The isomerisation process may be carried out in the presence of an isomerisation catalyst, and preferably in the presence of hydrogen added to the isomerisation process. Suitable isomerisation catalysts contain a molecular sieve and/or a metal selected from Group VIII of the periodic table and optionally a carrier. Preferably, the isomerisation catalyst contains SAPO-11, or SAPO-41, or ZSM-22, or ZSM-23, or ferrierite, and Pt, Pd, or Ni, and Al₂O₃, or SiO₂. Typical isomerisation catalysts are, for example, Pt/SAPO-11/Al₂O₃, Pt/ZSM-22/Al₂O₃, Pt/ZSM-23/Al₂O₃, and Pt/SAPO-11/SiO₂. The isomerisation catalysts may be used alone or in combination. In a preferred embodiment, the isomerisation catalyst is a noble metal bifunctional catalyst, such as Pt-SAPO and/or Pt-ZSM-catalyst, which is used in combination with hydrogen. The isomerisation process can be conducted at a temperature of 200-500 °C, such as 280-400 °C, such as 280-370 °C and at a pressure of 1 MPa to 15 MPa (absolute), such as 2 MPa to 10 MPa (absolute).

Technical Effects

The current process is particularly suitable for a feedstock of low quality, meaning having high amounts of impurities. However, also feedstock with low amounts of impurities can benefit from the current method. Low-quality feedstock can be very difficult or even impossible to purify using a bleaching method, since the filterability of the treated feedstock is poor or challenging. The current invention therefore enables use of such feedstock in a purification, which could not otherwise be bleached due to problems associated with the filterability of the bleached feedstock.

The technical effect of the current invention regards the performance of the bleaching step and especially the filterability of the bleached feedstock. The treatment of the feedstock with a mineral acid such as an aqueous mineral acid solution in elevated temperature according to the current invention significantly improves the filterability of the bleached feedstock. A crucial aspect of this process is the subsequent removal or neutralization of the mineral acid, which is performed using suitable methods (such as removal of the mineral acid by water washing). The effective removal or neutralization of the mineral acid is essential for adjusting the pH of the feedstock to a suitable range for the subsequent bleaching process. By eliminating excess mineral acid or by neutralizing the mineral acid, the process reduces filtering resistance, allowing the bleached feedstock to flow more freely through the filtration medium.

The improved filterability of the bleached feedstock means that the filtering resistance is improved, meaning reduced. This means that the pressure difference over the filter can be lower, and the bleached feedstock moves more easily through the filter. In batch filtration it means the filtration time will be shorter, and in continuous filtration mode it means the throughput flux will be higher through the filtration unit. The filterability of a feed in a defined system can be measured as *filtration resistance*, which has the unit $\text{GPa} \cdot \text{s/kg}^2$. Filtration resistance can be measured as pressure drop / quantity of fluid flowing through the filter. Alternatively, the filtration time can be measured, which is the time for the liquid to flow through the filter. Measuring methodology alter depending on filtration design.

EXAMPLES

Example 15 *Mineral acid treatment*

Two different animal fat feedstock were treated with strong mineral acid in elevated temperature. The treatment was performed as follows. An amount of 160 g of feedstock, two different animal fat of various quality, and named AF1 and AF2, was heated to 80 °C. Water (4 mL) and H₂SO₄ (95-97 %, 1.6 g) was added to the feedstock. The feedstock and aqueous solution were stirred vigorously, using a high shear mixer. The temperature was held at 80 °C during additional magnetic stirring at 500 RPM for 20 minutes. After the treatment the aqueous phase was separated from the oil phase, and the oil phase was washed using water. An acid treated feedstock was obtained.

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Bleaching

The two acid treated feedstock (AF1 and AF2) from above were subjected to a bleaching step. In addition, a reference feedstock (REF) which was not treated with acid was also bleached. Bleaching tests included an initial citric acid (CA) and water treatment step. Acid and water were added to the acid treated feedstock obtained above. The oil-acid-water mixture was mixed for 2 minutes with a high shear mixer and then magnetically mixed for 5 minutes. Then, acid activated bleaching earth absorbent was added to the mixture and wet (85 °C, 800 mbar, 20 min) and dry (105 °C, 80 mbar, 25 min) bleaching were subsequently executed.

25 The treated feedstock was subsequently filtered using a pressurised system and the filtering parameters (filtration time and filtration resistance) were determined experimentally. The results are shown in Table 1 below.

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Table 1. Filtration resistance and time for two different animal fat feedstock (AF1 and AF2) and various purification processes

Process	Feed	Filtration resistance [GPa *s/kg ²]	Filtration time [min]
BL	AF1	2406	16.5
SAT + BL	AF1	925	9.5
BL	AF2	70545	Interrupted after 102 min, when 93 g was filtered
SAT + BL	AF2	273	5.5

BL = Bleaching including filtration

5 SAT = Strong acid treatment according to invention

The results show that the acid treatment significantly improved the filterability of the feedstock. Both filtration resistance and filtration time were improved when the samples were treated with mineral acid before the bleaching. Filtration was not possible for sample AF2 without the acid treatment, and the filtration was interrupted after 102 min, when about 55% of the material was filtered.

Example 2

15 A Low Quality Animal Fat (LQAF) was treated in three various purification methods. One sample was subjected to a strong acid treatment followed by bleaching and filtration (SAT + BL). One sample was used as reference and only bleached and filtrated (BL). One sample was used as an alternative reference and was blended (diluted) with a good quality animal fat before filtration (AF + BL).

20 The acid treatment for LQAF was performed as follows: the sample was heated at 80 °C with conc. H₂SO₄ (1.0 wt.%) with a small water addition of 2.5 wt.% for a set time. The acid excess was washed away with water or neutralised by base. The bleaching step for all samples was performed as in example 1.

25 The three samples were filtered, and the results are shown below in table 2. In addition to the filtration properties the amounts of impurities (N, P, Metals; N was measured according to ASTM D4629; P and metals according to ASTM D5185) were analysed for the feedstock and the purified samples.

The results of Table 2 show that the acid treatment significantly improved the filterability of the samples, both regarding filtration resistance and filtering time. Diluting the bleached sample with good quality animal fat slightly improved the filterability, but not as much as the acid treatment did.

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Table 2. Filtration resistance and time as well as amounts of impurities for three different purification methods for LQAF (N = nitrogen; P = phosphorus; M = Metals)

Feed			Impurities [mg/kg]
LQAF			N: 546 P: 403 M: 757
Process	Filtration resistance [GPa * s/kg ²]	Filtration time [min]	Impurities [mg/kg]
BL	603	12	N: 291 P: 45 M: 20
AF + BL	605	9	N: 169 P: 5 M: 1
SAT + BL	304	6	N: 269 P: 32 M: 13

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It will be obvious to a person skilled in the art that, as the technology advances, the inventive concept can be implemented in various ways. The invention and its embodiments are not limited to the examples described above but may vary within the scope of the claims.

CLAIMS

1. A process for purifying a feedstock, the process comprising the steps of:
- a) providing a feedstock comprising lipids of plant, animal and/or microbial origin,
 - b) treating the feedstock with a mineral acid at elevated temperature,
 - c) removing or neutralizing the mineral acid after treatment in step b) to obtain an acid treated feedstock,
 - d) subjecting the acid treated feedstock to a bleaching step including a filtration step to obtain a purified feedstock, wherein the bleaching step including a filtration step comprises adding a bleaching acid and an adsorbent to the acid treated feedstock, wherein the bleaching acid is a carboxylic acid, such as citric acid, phosphoric acid (H_3PO_4) or any combination thereof.
2. The process according to claim 1, wherein the mineral acid is an aqueous solution of the mineral acid.
3. The process according to claim 1 or 2, wherein the mineral acid is sulphuric acid (H_2SO_4), hydrochloric acid (HCl), nitric acid (HNO_3), phosphoric acid (H_3PO_4), boric acid (H_3BO_3), hydrofluoric acid (HF), hydrobromic acid (HBr), perchloric acid (HClO_4), hydroiodic acid (HI) or any combination or mixture thereof.
4. The process according to any previous claim, wherein the mineral acid is sulphuric acid (H_2SO_4), hydrochloric acid (HCl), nitric acid (HNO_3), hydrobromic acid (HBr), perchloric acid (HClO_4), hydroiodic acid (HI) or any combination or mixture thereof.
5. The process according to any previous claim, wherein the amount of mineral acid in step b) is up to about 10 wt.%, such as from about 0.1 wt.% to about 10 wt.%, specifically from about 1 wt.% to about 8 wt.%; based on the weight of the feedstock.
6. The process according to any previous claim, wherein the elevated temperature in step b) is at least 50 °C, such as from about 50 °C to about 150 °C, specifically from 60 °C to 140 °C, more specifically from 80 °C to 120 °C.
7. The process according to any previous claim, wherein an adsorbing material is further added to the feedstock before step b) or in step b) together with the mineral acid.
8. The process according to claim 7, wherein the adsorbing material is a mineral based adsorbent, a silica-based adsorbent, an amorphous silica adsorbent, such as silica gel, silica hydrogel or silica xerogel, or any combination thereof.

9. The process according to claim 7 or 8, wherein the amount of adsorbing material is about 0.5 wt.% to about 5 wt.% based on the weight of the feedstock.

10. The process according to any previous claim, wherein the removal of the mineral acid from the acid treated feedstock in step c) is performed using a water wash step, wherein water is added to the acid treated feedstock and aqueous phase is separated from oil and/or fat phase.

11. The process according to any previous claim, wherein the bleaching step including a filtration step comprises treating the acid treated feedstock at a temperature from about 50 °C to about 120 °C, prior to the filtration step, optionally water is also added to the acid treated feedstock.

12. The process according to any previous claim, wherein the process comprises one or more drying step(s), such as a drying step after step b) and/or a drying step before the filtration step.

13. The process according to any previous claim, wherein the feedstock comprising lipids of plant, animal and/or microbial origin is selected from plant oils, plant fats, fish oils, fish fats, animal fats, animal oils, waste fats, waste oils, residue fats, residue oils, mould oils and microbial oils; specifically oils or fats are selected from rapeseed oil, canola oil, colza oil, tall oil, sunflower oil, corn oil, technical/distillers corn oil, soybean oil, hemp oil, olive oil, linseed oil, cottonseed oil, mustard oil, pongamia oil, palm oil, palm oil mill effluent oil (POME), sludge originating from any type of plant oil production, arachis oil, castor oil, coconut oil, suet, tallow, blubber, recycled alimentary fats, used cooking oil (UCO), trap grease, brown grease, gutter oil, fatty acid distillates (FAD) from rice bran oil or palm oil (palm oil fatty acid distillate PFAD), archaeal oil, bacterial oil, fungal oil, protozoal oil, algal oil, fraction of tall oil, crude tall oil, tall oil pitch, peanut oil, crude palm oil, palm seed oil, palm kernel oil, carinata oil, coconut butter, muscat butter oil, sesame oil, maize oil, babassu oil, poppy seed oil, soy oil, laurel seed oil, jatropha oil, camelina oil, seaweed oil, oils from halophiles, poultry fat, dry rendered poultry fat, lard, train oil or any combinations or mixtures thereof.

14. The process according to any previous claim, wherein the feedstock is a feedstock containing high amounts of impurities, such as nitrogen in an amount of more than 100 ppm; phosphorus in an amount of more than 50 ppm; metals and/or solids in an amount of more than 100 ppm.

15. The process according to any previous claim, wherein the feedstock comprises at least 10 wt.% triglycerides, such as at least 20 wt.% triglycerides or at least 30 wt.% triglycerides or at least 80 wt.% triglycerides.

16. The process according to any previous claim, wherein the feedstock is free from soapstock.

17. The process according to any previous claim, wherein the process is performed as follows:

- 5 a) providing a feedstock comprising lipids of animal origin,
 b) treating the feedstock with an aqueous sulphuric acid solution in a temperature from about 70 °C to about 120 °C,
 c) removing the aqueous sulphuric acid solution after treatment in step b) by washing the acid treated feedstock with water to obtain an acid treated feed-
10 stock,
 d) subjecting the acid treated feedstock to a bleaching step, where the bleaching step comprises treating the acid treated feedstock with citric acid and an adsorbent in a temperature of about 80 °C to 100 °C and filtrating to obtain a purified feedstock.

15 18. The process according to any previous claim, wherein the process further comprises hydrotreating the obtained purified feedstock, and optionally followed by isomerising the hydrotreated feedstock.

 19. The process according to claim 18, wherein hydrotreating the obtained purified feedstock is performed in the presence of hydrogen and a hydrotreating catalyst, and the hydrotreating catalyst is supported or unsupported
20 Ni, Mo or Co, and hydrotreatment conditions are the following:

- a H₂ to oil ratio is 150 – 400 Nm³/stdm³, preferably 180 – 250 Nm³/stdm³;
- a LHSV of 0.5 – 2.0 h⁻¹, preferably 1.0 – 1.5 h⁻¹;
- 25 - a temperature of 300-400 °C, preferably 350-390 °C
- a pressure of 4000-6000 kPa(a), preferably 4800-5500 kPa(a).

 20. The process according to claim 18 or 19, wherein the process is followed by isomerising the hydrotreated feedstock, and the isomerisation is performed in the presence of an isomerisation catalyst, and the isomerisation catalyst
30 contains SAPO-11, or SAPO-41, or ZSM-22, or ZSM-23, or fernerite, and Pt, Pd, or Ni, and Al₂O₃, or SiO₂, and the conditions in the isomerisation are a temperature of 200-500 °C, such as 280-400 °C, such as 280-370 °C and at a pressure of 1 MPa to 15 MPa (absolute), such as 2 MPa to 10 MPa (absolute).