DEMULSIFIERS FOR RENEWABLE FEEDS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the priority benefit of U.S. Provisional Patent Application Serial No. 63/558,763 filed February 28, 2024, the entirety of which is incorporated herein by reference.

FIELD

[0002] The disclosed technology relates to demulsifier compositions and methods of use thereof. In particular, the disclosed technology relates to demulsifier compositions comprising one or more dispersants, and methods of use thereof.

BACKGROUND

[0003] Renewable feedstocks, used in the fuel production industry, contain high amounts of metals and other contaminants. Removal of metals from these renewable feedstocks is a major concern. These metals poison the catalyst of hydrotreaters and lower run times. To remove these metals, pretreatment processes where the renewable feedstock is washed with low pH water (~2 pH) is traditionally done to remove these contaminants. This "washing" step is done by mixing both water and feed with high shear rates resulting in an emulsion that is difficult to resolve. Since these renewable feedstocks are different in nature than conventional crude oils, standard demulsifiers such as resin alkoxylates work poorly. Additionally, since these renewable feedstocks do not have the standard emulsion stabilizing surfactants found in crude oil, different types of demulsifiers are needed.

SUMMARY

[0004] The disclosed technology provides for demulsifier compositions for resolving emulsions in renewable feedstocks used in renewable fuel production processes, the demulsifier compositions comprising one or more dispersants.

[0005] Various aspects of the disclosure relate to a demulsifier composition for resolving emulsions in a renewable feedstock, the demulsifier composition comprising one or more dispersants.

[0006] Various aspects of the disclosure additionally relate to a method of resolving emulsions in a renewable feedstock, the method comprising adding to the renewable feedstock a demulsifier composition comprising one or more dispersants.

[0007] Various aspects of the disclosure further relate to a method of removing contaminants from a renewable feedstock, the method comprising treating the renewable feedstock with a low pH water to create an emulsion; and adding to the emulsion a demulsifier composition comprising one or more dispersants.

BRIEF DESCRIPTION OF THE FIGURES

[0008] Those of skill in the art will understand that the figures, described below, are for illustrative purposes only. The figures are not intended to limit the scope of the present teachings in any way.

[0009] FIG. 1 illustrates the improved water content of a renewable vegetable feedstock after treatment with embodiments of the demulsifier composition of the disclosure, wherein the demulsifier compositions includes a sulfonate derivative or a combination of a sulfonate derivative and a succinic acid derivative, as compared to untreated example renewable feedstock.

[0010] FIG. 2 illustrates the improved water content of a renewable vegetable feedstock after treatment with an embodiment of the demulsifier composition of the disclosure, wherein the demulsifier composition includes a sulfonate derivative, as compared to untreated example renewable feedstock, and example renewable feedstock treated with other demulsifiers known in the art.

[0011] FIG. 3 illustrates the improved water content of a renewable vegetable/tallow feedstock after treatment with an embodiment of the demulsifier composition of the disclosure, wherein the demulsifier composition includes a succinic acid derivative, as compared to untreated example renewable feedstock, and example renewable feedstock treated with other demulsifiers known in the art.

[0012] FIG. 4 illustrates the improved free water content of a renewable tallow feedstock emulsion with a wash water treated with an embodiment of the demulsifier composition of the disclosure, wherein the demulsifier composition includes a sulfonate derivative, as compared to an untreated sample and demulsifiers known in the art.

DETAILED DESCRIPTION

[0013] Approximating language, as used herein throughout the specification and claims, may be applied to modify any quantitative representation that could permissibly vary without resulting in a change in the basic function to which it is related. Accordingly, a value modified by a term or terms, such as "about", is not limited to the precise value specified. In at least some instances, the approximating language may correspond to the precision of an instrument for measuring the value. Range limitations may be combined and/or interchanged, and such ranges are identified and include all the sub-ranges stated herein unless context or language indicates otherwise. Other than in the operating examples or where otherwise indicated, all numbers or expressions referring to quantities of ingredients, reaction conditions and the like, used in the specification and the claims, are to be understood as modified in all instances by the term "about".

[0014] "Optional" or "optionally" means that the subsequently described event or circumstance may or may not occur, or that the subsequently identified material may or may not be present, and that the description includes instances where the event or circumstance occurs or where the material is present, and instances where the event or circumstance does not occur or the material is not present.

[0015] As used herein, the terms "comprises", "comprising", "includes", "including", "has", "having", or any other variation thereof, are intended to cover a non-exclusive inclusion. For example, a process, method, article or apparatus that comprises a list of elements is not necessarily limited to only those elements, but may include other elements not expressly listed or inherent to such process, method, article, or apparatus.

[0016] The singular forms "a", "an", and "the" include plural referents unless the context clearly dictates otherwise.

[0017] The disclosed technology provides for demulsifier compositions for resolving emulsions in renewable feedstocks used in renewable fuel production processes comprising one or more dispersants.

[0018] The compositions and methods disclosed herein have been found to be effective in resolving emulsions and lowering the water content in renewable feedstocks. More specifically, it was found that dispersants, for example those that include sulfonate chemistries, succinic acid-based chemistries and combinations thereof, effectively lowered the water content in the effluent feed after mixing.

[0019] As used herein, the term "demulsifier" refers to a chemical substance or formulation used to break down and separate emulsions.

[0020] As used herein, the term "emulsion" refers to a mixture of two immiscible liquids, such as oil and water, stabilized by an emulsifying agent.

[0021] As used herein, the term "renewable feedstock" refers to raw materials or substances derived from sustainable, replenishable sources that can be used as inputs for various industrial processes.

[0022] In various aspects of the disclosed technology, demulsifier compositions for resolving emulsions in renewable feedstocks are disclosed. In various aspects, the demulsifier composition may include one or more dispersants. In various aspects, the one or more dispersants may be selected from a sulfonate derivative; a sulfonic acid derivative, including, but not limited to a hydrocarbyl derivative of sulfonic acid; a sulfo-alkanoate; a sulfosuccinate; a sulfate derivative; a succinic acid derivative, alkenyl thiophosphonic acid and its reaction products with polyhydric alcohols; alkenyl phosphonate; reaction products of fatty acids and polyamine; reaction products of fatty acids, formaldehyde and polyamine; reaction products of fatty acid and hydroxylated amine; reaction products of alkylphenol and formaldehyde; reaction products of alkylphenol, formaldehyde and polyamine; and mixtures thereof. In some embodiments, a hydrocarbyl derivative of sulfonic acid includes, but is not limited to, an alkyl derivative of sulfonic acid, a cycloalkyl derivative of sulfonic acid, or an aryl derivative of sulfonic acid. In one embodiment, the hydrocarbyl derivative of sulfonic acid is a naphthyl derivative of sulfonic acid. In some aspects, the demulsifier composition may comprise a mixture of a sulfonate derivative and a succinic acid derivative.

[0023] In various aspects, suitable sulfonate derivatives may include any sulfonate derivative capable of resolving emulsions generated during processing of renewable feedstocks. In some aspects, suitable sulfonate derivatives may include metal, ammonium or amine salts of alkyl sulfonate; metal, ammonium or amine salts of aryl sulfonate; hydrocarbyl sulfonates; and mixtures thereof.

[0024] In various aspects, suitable succinic acid derivatives may include any succinic acid derivative capable of resolving emulsions generated during processing of renewable feedstocks. In some aspects, suitable succinic acid derivatives may include alkenyl succinic acids or anhydride; alkenyl succinic acid or anhydride reaction products with polyamines; alkenyl succinic acid reaction products with polyhydric alcohols; reaction products of alkene, maleic anhydride and polyamines; reaction products of alkene, maleic anhydride and polyols; reaction products of alkene, maleic anhydride and alkanolamines; and mixtures thereof. In one embodiment, the succinic acid derivative includes a polyisobutylene succinimide.

[0025] In some embodiments, the dispersant includes dodecylbenzenesulfonic acid, sodium 2-ethyl hexyl sulfate, sodium (C_{10}-C_{13})-alkyl benzene sulfonate, sodium (C_{14}-C_{16})-olefin sulfonate, alkyl aryl sulfonic acid, alkyl cylcoalkyl sulfonic acid, ammonium alcohol (C_6-C_{10}) ether sulfonate, or polyisobutylene succinimide.

[0026] In one embodiment, the alkyl aryl sulfonic acid includes a dialkyl aryl sulfonic acid. In another embodiment, the "aryl" group in the alkyl aryl sulfonic acid is benzene. In one embodiment, the alkyl aryl sulfonic acid is a (C_3-C_{30})-alkyl aryl sulfonic acid. In another embodiment, the alkyl aryl sulfonic acid is a (C_3-C_{16})-alkyl aryl sulfonic acid. In another embodiment, the alkyl aryl sulfonic acid is a (C_6-C_{16})-alkyl aryl sulfonic acid. In one embodiment, the alkyl aryl sulfonic acid is a di-(C_3-C_{30})-alkyl aryl sulfonic acid. In another embodiment, the alkyl aryl sulfonic acid is a di-(C_3-C_{16})-alkyl aryl sulfonic acid. In another embodiment, the alkyl aryl sulfonic acid is a di-(C_6-C_{16})-alkyl aryl sulfonic acid. In one embodiment, the alkyl aryl sulfonic acid is a dodecyl benzene sulfonic acid.

[0027] In one embodiment, the alkyl cycloalkyl sulfonic acid includes a dialkyl cycloalkyl sulfonic acid. In another embodiment, the "cycloalkyl" group in the alkyl cycloalkyl sulfonic acid is naphthalene. In one embodiment, the alkyl cycloalkyl sulfonic acid is a (C_3-C_{30})-alkyl cycloalkyl sulfonic acid. In another embodiment, the alkyl cycloalkyl sulfonic acid is a (C_3-C_{16})-alkyl cycloalkyl sulfonic acid. In another embodiment, the alkyl cycloalkyl sulfonic acid is a (C_6-C_{16})-alkyl cycloalkyl sulfonic acid. In one embodiment, the alkyl cycloalkyl sulfonic acid is a di-(C_3-C_{30})-alkyl cycloalkyl sulfonic acid. In another embodiment, the alkyl cycloalkyl sulfonic acid is a di-(C_3-C_{16})-alkyl cycloalkyl sulfonic acid. In one embodiment, the alkyl cycloalkyl sulfonic acid is diisopropyl naphthalene sulfonic acid.

[0028] In one embodiment, the demulsifier composition includes a dodecylbenzenesulfonic acid and a polyisobutylene succinimide.

[0029] In various aspects, the one or more dispersants may be present in an amount of between about 0.1 ppmA to about 5000 ppmA, or about 0.1, 0.5, 1, 10, 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, or 5000 ppmA, or about 1 ppmA to about 1000 ppmA or about 1 ppmA to about 500 ppmA, or about 10 ppmA to about 100 ppmA or about 100 ppmA to about 1000 ppmA or about 1 ppmA to about 100 ppmA or about 100 ppmA to about 500 ppmA, or any amount between any of these values. In one embodiment, the dispersants may be present in an amount of about 10 ppmA to

about 200 ppmA. In another embodiment, the dispersants may be present in an amount of about 20 ppmA to about 160 ppmA. In another embodiment, the dispersants may be present in an amount of about 10 ppmA to about 50 ppmA.

[0030] In various aspects, the sulfonate derivative may be present in an amount of between about 0.1 ppmA to about 5000 ppmA, or about 0.1, 0.5, 1, 10, 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, or 5000 ppmA, or about 1 ppmA to about 1000 ppmA or about 1 ppmA to about 500 ppmA, or about 10 ppmA to about 100 ppmA or about 100 ppmA to about 1000 ppmA or about 1 ppmA to about 100 ppmA or about 100 ppmA to about 500 ppmA, or any amount between any of these values. In one embodiment, the sulfonate derivative may be present in an amount of about 1 ppmA to about 60 ppmA. In another embodiment, the sulfonate derivative may be present in an amount of about 10 ppmA to about 60 ppmA. In another embodiment, the sulfonate derivative may be present in an amount of about 10 ppmA to about 50 ppmA.

[0031] In various aspects, the succinic acid derivative may be present in an amount of between about 0.1 ppmA to about 5000 ppmA, or about 0.1, 0.5, 1, 10, 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, or 5000 ppmA, or about 1 ppmA to about 1000 ppmA or about 1 ppmA to about 500 ppmA, or about 10 ppmA to about 100 ppmA or about 100 ppmA to about 1000 ppmA or about 1 ppmA to about 100 ppmA or about 100 ppmA to about 500 ppmA, or any amount between any of these values.

[0032] In various aspects, the demulsifier compositions of the disclosed technology may further comprise one or more resin alkoxylates. In various aspects, suitable resin alkoxylates may include polyetheramine-based resin alkoxylates, polyol-based resin alkoxylates, epoxy-based resin alkoxylates, polyamine-based resin alkoxylates, and the like, or mixtures thereof.

[0033] In various aspects, the demulsifier compositions of the disclosed technology may further comprise a suitable carrier solvent. Example carrier solvents may include non-aromatic carrier solvents such as terpenes, water, renewable naphtha, renewable diesel, dimethyl ester (e.g. DME-100), and the like, or mixtures thereof.

[0034] In various aspects, the demulsifier compositions of the disclosed technology may be used in a method of resolving emulsions in renewable feedstocks used in renewable fuel production processes. In other aspects, the demulsifier compositions of the disclosed technology may be used in a method of lowering the water content of renewable feedstocks used in renewable fuel production processes. In various aspects, the methods may comprise adding to the renewable feedstock a demulsifier composition comprising one or more dispersants. In various aspects, the one or more dispersants may be selected from a sulfonate derivative; a sulfonic acid derivative, including, but not limited to a hydrocarbyl derivative of sulfonic acid; a sulfo-alkanoate; a sulfosuccinate; a sulfate derivative; a succinic acid derivative, alkenyl thiophosphonic acid and its reaction products with polyhydric alcohols; alkenyl phosphonate; reaction products of fatty acids and polyamine; reaction products of fatty acids, formaldehyde and polyamine; reaction products of fatty acid and hydroxylated amine; reaction products of alkylphenol and formaldehyde; reaction products of alkylphenol, formaldehyde and polyamine; and mixtures thereof. In some embodiments, a hydrocarbyl derivative of sulfonic acid includes, but is not limited to, an alkyl derivative of sulfonic acid, a cycloalkyl derivative of sulfonic acid, or an aryl derivative of sulfonic acid. In one embodiment, the hydrocarbyl derivative of sulfonic acid is a naphthyl derivative of sulfonic acid. In some aspects, the demulsifier composition may comprise a mixture of a sulfonate derivative and a succinic acid derivative.

[0035] In various aspects, suitable sulfonate derivatives may include any sulfonate derivative capable of resolving emulsions generated during processing of renewable feedstocks. In some aspects, suitable sulfonate derivatives may include metal, ammonium or amine salts of alkyl sulfonate; metal, ammonium or amine salts of aryl sulfonate; hydrocarbyl sulfonates; and mixtures thereof.

[0036] In various aspects, suitable succinic acid derivatives may include any succinic acid derivative capable of resolving emulsions generated during processing of renewable feedstocks. In some aspects, suitable succinic acid derivatives may include alkenyl succinic acids or anhydride; alkenyl succinic acid or anhydride reaction products with polyamines; alkenyl succinic acid reaction products with polyhydric alcohols; reaction products of alkene, maleic anhydride and polyamines; reaction products of alkene, maleic anhydride and polyols; reaction products of alkene, maleic anhydride and alkanolamines; and mixtures thereof. In one embodiment, the succinic acid derivative includes a polyisobutylene succinimide.

[0037] In some embodiments, the dispersant includes dodecylbenzenesulfonic acid, sodium 2-ethyl hexyl sulfate, sodium (C_{10}-C_{13})-alkyl benzene sulfonate, sodium (C_{14}-C_{16})-olefin sulfonate, alkyl aryl sulfonic acid, alkyl cylcoalkyl sulfonic acid, ammonium alcohol (C_6-C_{10}) ether sulfonate, or polyisobutylene succinimide.

[0038] In one embodiment, the alkyl aryl sulfonic acid includes a dialkyl aryl sulfonic acid. In another embodiment, the "aryl" group in the alkyl aryl sulfonic acid is benzene. In one embodiment, the alkyl aryl sulfonic acid is a (C_3-C_{30})-alkyl aryl sulfonic acid. In another embodiment, the alkyl aryl sulfonic acid is a (C_3-C_{16})-alkyl aryl sulfonic acid. In another embodiment, the alkyl aryl sulfonic acid is a (C_6-C_{16})-alkyl aryl sulfonic acid. In one embodiment, the alkyl aryl sulfonic acid is a di-(C_3-C_{30})-alkyl aryl sulfonic acid. In another embodiment, the alkyl aryl sulfonic acid is a di-(C_3-C_{16})-alkyl aryl sulfonic acid. In another embodiment, the alkyl aryl sulfonic acid is a di-(C_6-C_{16})-alkyl aryl sulfonic acid. In one embodiment, the alkyl aryl sulfonic acid is a dodecyl benzene sulfonic acid.

[0039] In one embodiment, the alkyl cycloalkyl sulfonic acid includes a dialkyl cycloalkyl sulfonic acid. In another embodiment, the "cycloalkyl" group in the alkyl cycloalkyl sulfonic acid is naphthalene. In one embodiment, the alkyl cycloalkyl sulfonic acid is a (C_3-C_{30})-alkyl cycloalkyl sulfonic acid. In another embodiment, the alkyl cycloalkyl sulfonic acid is a (C_3-C_{16})-alkyl cycloalkyl sulfonic acid. In another embodiment, the alkyl cycloalkyl sulfonic acid is a (C_6-C_{16})-alkyl cycloalkyl sulfonic acid. In one embodiment, the alkyl cycloalkyl sulfonic acid is a di-(C_3-C_{30})-alkyl cycloalkyl sulfonic acid. In another embodiment, the alkyl cycloalkyl sulfonic acid is a di-(C_3-C_{16})-alkyl cycloalkyl sulfonic acid. In one embodiment, the alkyl cycloalkyl sulfonic acid is diisopropyl naphthalene sulfonic acid.

[0040] In one embodiment, the demulsifier composition includes a dodecylbenzenesulfonic acid and a polyisobutylene succinimide.

[0041] In various aspects, the one or more dispersants may be added in an amount of between about 0.1 ppmA to about 5000 ppmA, or about 0.1, 0.5, 1, 10, 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, or 5000 ppmA, or about 1 ppmA to about 1000 ppmA or about 1 ppmA to about 500 ppmA, or about 10 ppmA to about 100 ppmA or about 100 ppmA to about 1000 ppmA or about 1 ppmA to about 100 ppmA or about 100 ppmA to about 500 ppmA, or any amount between any of these values. In one embodiment, the dispersants may be present in an amount of about 10 ppmA to

about 200 ppmA. In another embodiment, the dispersants may be present in an amount of about 20 ppmA to about 160 ppmA. In another embodiment, the dispersants may be present in an amount of about 10 ppmA to about 50 ppmA.

[0042] In various aspects, the sulfonate derivative may be present in an amount of between about 0.1 ppmA to about 5000 ppmA, or about 0.1, 0.5, 1, 10, 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, or 5000 ppmA, or about 1 ppmA to about 1000 ppmA or about 1 ppmA to about 500 ppmA, or about 10 ppmA to about 100 ppmA or about 100 ppmA to about 1000 ppmA or about 1 ppmA to about 100 ppmA or about 100 ppmA to about 500 ppmA, or any amount between any of these values. In one embodiment, the sulfonate derivative may be present in an amount of about 1 ppmA to about 60 ppmA. In another embodiment, the sulfonate derivative may be present in an amount of about 10 ppmA to about 60 ppmA. In another embodiment, the sulfonate derivative may be present in an amount of about 10 ppmA to about 50 ppmA.

[0043] In various aspects, the succinic acid derivative may be added in an amount of between about 0.1 ppmA to about 5000 ppmA, or about 0.1, 0.5, 1, 10, 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, or 5000 ppmA, or about 1 ppmA to about 1000 ppmA or about 1 ppmA to about 500 ppmA, or about 10 ppmA to about 100 ppmA or about 100 ppmA to about 1000 ppmA or about 1 ppmA to about 100 ppmA or about 100 ppmA to about 500 ppmA, or any amount between any of these values.

[0044] In other aspects, the demulsifier compositions of the disclosed technology may be used in a method of removing contaminants from a renewable feedstock, the method comprising treating the renewable feedstock with a low pH water to produce an emulsion; and adding to the emulsion a demulsifier composition comprising a sulfonate derivative, a succinic acid derivative, or mixtures thereof. In various aspects, treating the renewable feedstock may comprise mixing the renewable feedstock with water, such as a low pH water. In some aspects, the low pH water may be characterized by a pH of less than 7, or less than 6, less than 5, less than 4, less than 3, or less than 2. In some aspects, treating the renewable feedstock may comprise mixing the renewable feedstock with water at a high shear rate.

[0045] In various aspects, the methods of the disclosure may be used to resolve emulsions in any type of renewable feedstock. In some aspects, the methods may be used to resolve emulsions in renewable feedstocks that include plant or animal materials, such as plant oils or animal-based oils, or combinations thereof. Examples of plant oils may include vegetable oils such as soybean oil, corn oil, palm oil, or the like. Examples of animal materials or animal-based oils may include animal fats, such as tallow, or animal wastes. In some embodiments, the renewable feedstock is a blend of soybean oil and tallow. Other example feedstocks may include materials derived from industrial, agricultural, or municipal waste streams that can be repurposed as feedstocks.

EXAMPLES

[0046] The present technology will be further described in the following examples, which should be viewed as being illustrative and should not be construed to narrow the scope of the disclosed technology or limit the scope to any particular embodiments.

[0047] Example 1

[0048] Example 1 simulates a dewater process and resolve of a renewable feedstock and wash water in a vessel. An example vegetable oil feedstock emulsion (25% by volume wash water) was prepared by blending the vegetable oil feedstock and wash water in a high speed blender at temperature and pressure. The emulsion was treated with various embodiments of the demulsifier compositions of the disclosure, namely, (A) a blend of 40 ppmA of polyisobutylene succinimide (PIBSI) and 40 ppmA of dodecylbenzenesulfonic acid (DDBSA); (B) a blend of 40 ppmA of PIBSI and 60 ppmA of DDBSA; and (C) 20 ppmA of DDBSA. The emulsion was left at temperature to resolve and the amount of water remaining in the vegetable oil feedstock for each sample, including a Blank, was determined. Results are shown in FIG. 1. FIG. 1 illustrates that the demulsifier chemistries of the disclosure were effective in lowering the water content of the feedstock to less than 0.1% by volume.

[0049] Example 2

[0050] Example 2 simulates a dewater process and resolve of a renewable feedstock and wash water in a vessel. An example vegetable oil feedstock emulsion (25% by volume wash water) was prepared by blending the vegetable oil feedstock and wash water in a high speed blender at temperature and pressure. The emulsion was treated with various resin alkoxylate demulsifiers (comparative samples 1-6) at a dosage of 20 ppmA each, as shown in FIG. 2. Resin Alkoxylate #1 is nonyl phenol resin ethoxylate and amyl resin ethoxylate, Resin

Alkoxylate #2 is nonyl phenol resin ethoxylate, Resin Alkoxylate #3 is amyl resin ethoxylate, Resin Alkoxylate #4 is nonyl phenol resin ethoxylate and amyl resin ethoxylate, Resin Alkoxylate #5 is nonyl phenol resin ethoxylate and Resin Alkoxylate #6 is nonyl phenol resin ethoxylate and amyl resin ethoxylate. Sample DDBSA is 20 ppmA of a sulfonate-based chemistry, Dodecylbenzenesulfonic acid, of the disclosure. The emulsion was left at temperature to resolve and the amount of water remaining in the vegetable oil feedstock for each sample, including a Blank, was determined and the results are shown in FIG. 2. FIG. 2 illustrates that the sulfonate-based chemistry was the only demulsifier effective in lowering the water content of the feedstock to less than 0.1% by volume.

[0051] Example 3

[0052] Example 3 simulates a dewater process and resolve of a renewable feedstock and wash water in a vessel. An example vegetable oil and tallow blend feedstock emulsion (20% by volume wash water with a pH of 3) was prepared by blending the vegetable oil and tallow blend feedstock and wash water in a high speed blender at temperature and pressure. The emulsion was treated with various comparative demulsifiers, including 15 ppmA of alkyl diol and 15 ppmA of a polyamine-based chemistry (Polyamine #2), as shown in FIG. 3, as well as 15 ppmA of a succinic acid-based chemistry, Polyisobutylene succinimide (PIBSI), of the disclosure. The emulsion was left at temperature to resolve and the amount of water remaining in the feedstock for each sample, including a Blank, was determined and the results are shown in FIG. 3. FIG. 3 illustrates that the succinic acid-based chemistry was the most effective in lowering the water content of the feedstock as compared to the other demulsifiers tested.

[0053] Example 4

[0054] A BTEX analysis was conducted for a sulfonate-based demulsifier of the disclosure. As shown in Table 1 below, the sulfonate-based demulsifier was also effective in removing hydrocarbons from the water phase of an example renewable feedstock.

[0055] Table 1

Treatment	Benzene	Toluene	Ethylbenzene	o-Xylene
Blank	<0.05 mg/L	6.5 mg/L	<0.05 mg/L	<0.05 mg/L
Sulfonate-based demulsifier	<0.05 mg/L	<0.05 mg/L	<0.05 mg/L	<0.05 mg/L

[0056] Example 5

[0057] Example 5 simulates a dewater process and resolve of a renewable feedstock and wash water in a vessel. A soybean oil and tallow blend renewable feedstock emulsion was prepared by blending the soybean oil and tallow blend feedstock and wash water in a high

speed blender at temperature and pressure. The emulsion was treated with various embodiments of demulsifier compositions of the disclosure as shown in Table 2. The renewable feedstock emulsion was left at temperature to resolve and the water content (volume %) remaining in the renewable feedstock for each sample, including a Blank, was measured. Results are shown in Table 2.

[0058] Table 2

Treatment	H_2O (Vol. %)	Dosage (ppmA)
Blank	0.350	0
Dodecylbenzenesulfonic acid	0.020	15
Sodium 2-ethyl hexyl sulfate	0.015	15
Sodium (C_{10}-C_{13})-alkyl benzene sulfonate	0.040	15
Diisopropyl naphthalene sulfonic acid	0.020	15
Ammonium alcohol (C_6-C_{10}) ether sulfonate	0.200	15
Sodium (C_{14}-C_{16})-olefin sulfonate	0.150	15

[0059] All of the dispersants in Table 2 displayed improved resolution of the renewable feedstock (reduced water content) in comparison to the Blank sample. The demulsifier chemistries of the disclosure were effective in significantly lowering the water content of the renewable feedstock.

[0060] Example 6

[0061] Example 6 simulates a dewater process and resolve of a renewable feedstock and wash water in a vessel. A soybean oil renewable feedstock emulsion was prepared by blending the soybean oil and tallow blend feedstock and wash water in a high speed blender at temperature and pressure. The emulsion was treated with various embodiments of demulsifier compositions of the disclosure as shown in Table 3. The renewable feedstock emulsion was left at temperature to resolve and the water content (volume %) remaining in the renewable feedstock for each sample, including a Blank, was measured. Results are shown in Table 3.

[0062] Table 3

Treatment	H_2O (Vol. %)	Dosage (ppmA)
Blank	0.013	0
Dodecylbenzenesulfonic acid	0.004	20
Sodium 2-ethyl hexyl sulfate	0.005	20

Sodium (C_{10}-C_{13})-alkyl benzene sulfonate	0.005	20
Diisopropyl naphthalene sulfonic acid	0.003	20
Ammonium alcohol (C_6-C_{10}) ether sulfonate	0.005	20
Sodium (C_{14}-C_{16})-olefin sulfonate	0.003	20

[0063] All of the dispersants displayed improved resolution of the renewable feedstock (reduced water content) in comparison to the Blank sample. The demulsifier chemistries of the disclosure were effective in significantly lowering the water content of the renewable feedstock.

[0064] Example 7

[0065] A tallow renewable feedstock emulsion was prepared by blending the tallow feedstock and wash water having a pH of 4.2 in a high speed blender at temperature and pressure. The emulsion was treated with an exemplary demulsifier, dodecylbenzenesulfonic acid (DDBSA) at a dosage amount of 50 ppmA. The emulsion was also treated with resin alkoxylate demulsifiers (comparative samples 7 and 8) as provided in Example 2 at a dosage of 50 ppmA each. Resin Alkoxylate #7 is butyl/nonyl phenol resin ethoxylate and nonyl resin ethoxylate and Resin Alkoxylate #8 is nonyl phenol resin ethoxylate, butyl phenol propoxylate/ethoxylate and nonyl/amyl resin ethoxylate. The % volume of free water was measured in each emulsion sample, including a blank sample, and the data is shown in FIG. 4. FIG. 4 shows that the DDBSA sample exhibited the highest % of free water compared with the comparative samples and the blank. Higher levels of free water in an emulsion are a measure of how well the emulsion will resolve and separate out the water from the feedstock.

[0066] While embodiments of the disclosed technology have been described, it should be understood that the present disclosure is not so limited and modifications may be made without departing from the disclosed technology. The scope of the disclosed technology is defined by the appended claims, and all devices, processes, and methods that come within the meaning of the claims, either literally or by equivalence, are intended to be embraced therein.

CLAIMS

1. A demulsifier composition for resolving emulsions in a renewable feedstock, the demulsifier composition comprising one or more dispersants.

2. The demulsifier composition of claim 1, wherein the one or more dispersants is selected from a sulfonate derivative; a sulfonic acid derivative; a sulfo-alkanoate; a sulfosuccinate; a sulfate derivative; a succinic acid derivative, alkenyl thiophosphonic acid and its reaction products with polyhydric alcohols; alkenyl phosphonate; reaction products of fatty acids and polyamine; reaction products of fatty acids, formaldehyde and polyamine; reaction products of fatty acid and hydroxylated amine; reaction products of alkylphenol and formaldehyde; reaction products of alkylphenol, formaldehyde and polyamine; and mixtures thereof.

3. The demulsifier composition of claim 1, wherein the composition comprises a mixture of a sulfonate derivative and a succinic acid derivative.

4. The demulsifier composition of claim 2, wherein the sulfonate derivative is selected from metal, ammonium or amine salts of alkyl sulfonate; metal, ammonium or amine salts of aryl sulfonate; metal, ammonium or amine salts of hydrocarbyl sulfonates; and mixtures thereof.

5. The demulsifier composition of claim 2, wherein the succinic acid derivative is selected from alkenyl succinic acids or anhydride; alkenyl succinic acid or anhydride reaction products with polyamines; alkenyl succinic acid reaction products with polyhydric alcohols; reaction products of alkene, maleic anhydride and polyamines; reaction products of alkene, maleic anhydride and polyols; reaction products of alkene, maleic anhydride and alkanolamines; and mixtures thereof.

6. The demulsifier composition of claim 2, wherein the sulfonic acid derivative is a hydrocarbyl derivative of sulfonic acid.

7. The demulsifier composition of claim 1, wherein the one or more dispersants is present in the composition in an amount of about 0.1 ppmA to about 5000 ppmA.

8. The demulsifier composition of claim 7, wherein the one or more dispersants is present in an amount of about 10 ppmA to about 100 ppmA.

9. The demulsifier composition of claim 2, wherein the composition comprises a sulfonate derivative in an amount of about 0.1 ppmA to about 5000 ppmA.

10. The demulsifier composition of claim 9, wherein the sulfonate derivative is present in an amount of about 1 ppmA to about 100 ppmA.

11. The demulsifier composition of claim 2, wherein the composition comprises a succinic acid derivative in an amount of about 0.1 ppmA to about 5000 ppmA.

12. The demulsifier composition of claim 11, wherein the succinic acid derivative is present in an amount of about 1 ppmA to about 100 ppmA.

13. The demulsifier composition of any one of claims 1-12, wherein the renewable feedstock comprises animal-based oils, plant-based oils, and combinations thereof.

14. The demulsifier composition of claim 13, wherein the animal-based oil comprises tallow.

15. The demulsifier composition of any one of claims 1-12, wherein the composition further comprises a resin alkoxylate.

16. The demulsifier composition of any one of claims 1-15, wherein the composition further comprises a non-aromatic carrier solvent.

17. A method of lowering the water content of a renewable feedstock comprising adding the demulsifier composition of any one of claims 1-16 to the renewable feedstock.

18. A method of resolving emulsions in a renewable feedstock, the method comprising:

adding to the renewable feedstock a demulsifier composition comprising one or more dispersants.

19. The method of claim 18, wherein the one or more dispersants is selected from a sulfonate derivative; a sulfonic acid derivative; a sulfo-alkanoate; a sulfosuccinate; a sulfate derivative; a succinic acid derivative, alkenyl thiophosphonic acid and its reaction products with polyhydric alcohols; alkenyl phosphonate; reaction products of fatty acids and polyamine; reaction products of fatty acids, formaldehyde and polyamine; reaction products of fatty acid and hydroxylated amine; reaction products of alkylphenol and formaldehyde; reaction products of alkylphenol, formaldehyde and polyamine; reaction products of alkene, maleic anhydride and polyamines; reaction products of alkene, maleic anhydride and polyols; reaction products of alkene, maleic anhydride and alkanolamines or a mixture thereof.

20. The method of claim 19, wherein the one or more dispersants comprises a mixture of a sulfonate derivative and a succinic acid derivative.

21. The method of claim 19, wherein the sulfonate derivative is selected from metal, ammonium or amine salts of alkyl sulfonate; metal, ammonium or amine salts of aryl sulfonate; metal, ammonium or amine salts of hydrocarbyl sulfonates; and mixtures thereof.

22. The method of claim 19, wherein the succinic acid derivative is selected from alkenyl succinic acids or anhydride; alkenyl succinic acid or anhydride reaction products with polyamines; alkenyl succinic acid reaction products with polyhydric alcohols; reaction products of alkene, maleic anhydride and polyamines; reaction products of alkene, maleic anhydride and polyols; reaction products of alkene, maleic anhydride and alkanolamines and mixtures thereof.

23. The method of claim 19, wherein the sulfonic acid derivative is a hydrocarbyl derivative of sulfonic acid.

24. The method of any one of claims 17-22, wherein the renewable feedstock comprises animal-based oils, plant-based oils, or combinations thereof.

25. The method of claim 24, wherein the animal-based oil comprises tallow.

26. A method of removing contaminants from a renewable feedstock, the method comprising:

treating the renewable feedstock with a low pH water to create an emulsion; and

adding to the emulsion a demulsifier composition comprising one or more dispersants.

27. The method of claim 26, wherein the one or more dispersants is selected from a sulfonate derivative; a sulfonic acid derivative; a sulfo-alkanoate; a sulfosuccinate; a sulfate derivative; a succinic acid derivative, alkenyl thiophosphonic acid and its reaction products with polyhydric alcohols; alkenyl phosphonate; reaction products of fatty acids and polyamine; reaction products of fatty acids, formaldehyde and polyamine; reaction products of fatty acid and hydroxylated amine; reaction products of alkylphenol and formaldehyde; reaction products of alkylphenol, formaldehyde and polyamine; or a mixture thereof.

28. The method of claim 26 or 27, wherein treating the renewable feedstock comprises mixing the renewable feedstock with the low pH water at a high shear rate.

29. The method of any one of claims 26-28, wherein the low pH water has a pH of about 2.

30. The method of claim 27, wherein the one or more dispersants comprises a mixture of a sulfonate derivative and a succinic acid derivative.

31. The method of claim 27, wherein the sulfonate derivative is selected from metal, ammonium or amine salts of alkyl sulfonate; metal, ammonium or amine salts of aryl sulfonate; metal, ammonium or amine salts of hydrocarbyl sulfonates; and mixtures thereof.

32. The method of claim 27, wherein the succinic acid derivative is selected from alkenyl succinic acids or anhydride; alkenyl succinic acid or anhydride reaction products with polyamines; alkenyl succinic acid reaction products with polyhydric alcohols; reaction products of alkene, maleic anhydride and polyamines; reaction products of alkene, maleic

anhydride and polyols; reaction products of alkene, maleic anhydride and alkanolamines and mixtures thereof.

33. The method of claim 27, wherein the sulfonic acid derivative is a hydrocarbyl derivative of sulfonic acid.

34. The method of any one of claims 26-33, wherein the renewable feedstock comprises animal-based oils, plant-based oils, or combinations thereof.

35. The method of claim 34, wherein the animal-based oil comprises tallow.