

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE**

CARGILL, INCORPORATED AND
INTERNATIONAL FLORA TECHNOLOGIES
LTD.,

Plaintiffs,

v.

VANTAGE SPECIALTY CHEMICALS, INC.,

Defendant.

C.A. No. _____

JURY TRIAL DEMANDED

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiffs Cargill, Incorporated (“Cargill”) and International Flora Technologies Ltd. (d/b/a FloraTech) (“FloraTech,” collectively “Plaintiffs”), bring this action for willful patent infringement against Vantage Specialty Chemicals, Inc. (“Vantage”). Plaintiffs allege as follows:

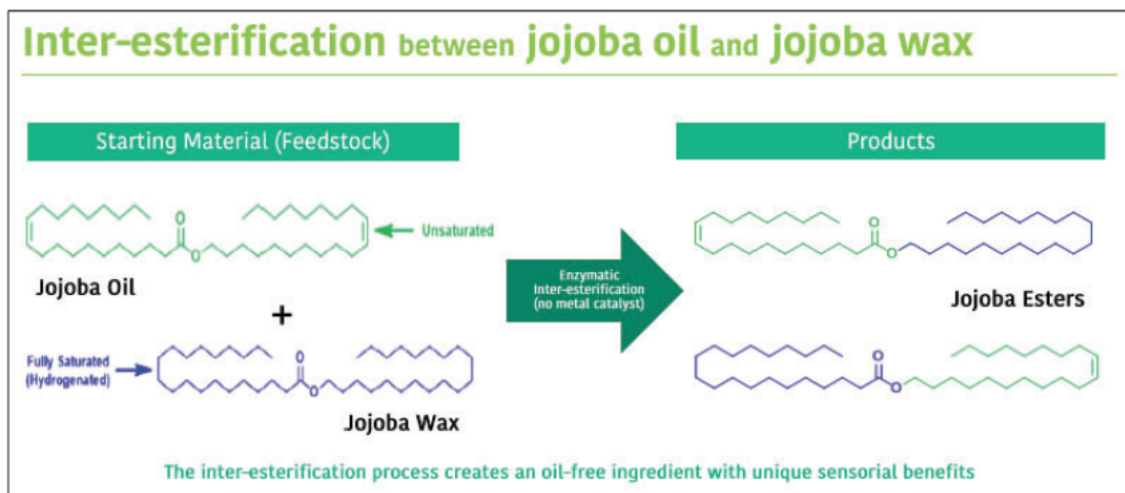
NATURE OF ACTION

1. This is an action for infringement of United States Patent No. 11,248,245 (“the ‘245 patent”) under the Patent Laws of the United States, 35 U.S.C. § 1 *et seq.*, including § 271(a). Plaintiffs bring this action to enforce their patent rights covering its product line of personal care and cosmetic ingredients derived from jojoba oil.

2. In 2021, Cargill purchased FloraTech. FloraTech, a Cargill company, is headquartered in Phoenix and has a product line focused on personal care and cosmetic ingredients, primarily products derived from jojoba oil. Jojoba oil is an extract from the seeds of the desert jojoba plant. It has long been used as an emollient to help retain the natural moisture present in the skin.

3. Since 1971, FloraTech has marketed quality botanically-derived ingredients to formulators of cosmetic and personal care products. It is, and has been, an industry leader in the jojoba field with its line of Floraesters® products, due to the superior quality of these products. The superior quality of one such product, Floraesters® 20, is a result of the enzymatic process embodied in the '245 patent.

4. On information and belief, Vantage has been trying to supply Plaintiffs' customers with a chemically-manufactured copy of its Floraesters® 20 product for years, but the quality and performance of Vantage's product was lacking. Recently, Vantage announced and promoted a new product—Liponate™ Jojoba 20—as an alternative to Floraesters® 20. As shown below, Vantage touts that its Liponate™ Jojoba 20 product is made through an enzymatic process.



Source: Liponate™ Jojoba 20-SS-2020 marketing document, available at <https://www.vantagegrp.com/en-US/Product/Page/a4e8c79c-49f1-431e-ad63-7457543de5e9/Liponate-Jojoba-20>

5. On information and belief, Vantage's manufacturing methods for its Liponate™ Jojoba 20 product infringe one or more of the claims of the '245 patent.

THE PARTIES

6. Plaintiff Cargill, Incorporated is a privately-owned Delaware corporation with its principal place of business at 15407 McGinty Road West, Wayzata, Minnesota 55391. Cargill is a leading global provider of food, agricultural, beauty, and risk management products and services employing about 155,000 employees.

7. Plaintiff International Flora Technologies Ltd. is a wholly-owned subsidiary of Cargill with its principal place of business at 291 E. El Prado Ct. Chandler, Arizona 85225. FloraTech exclusively develops, manufactures, and markets innovative natural emollients and derivatives for beauty and personal care applications.

8. Upon information and belief, Vantage is a corporation organized and existing under the laws of Delaware with its principal place of business at 1751 Lake Cook Road, Suite 550, Deerfield, Illinois 60015. On information and belief, Vantage may be served through its registered agent for service, The Corporation Trust Company at Corporation Trust Center 1209 Orange Street, Wilmington, Delaware 19801.

JURISDICTION AND VENUE

9. This Court has subject matter jurisdiction over the action under 28 U.S.C. §§ 1331 and 1338(a) because the action concerns a federal question arising under the Patent Laws of the United States, including 35 U.S.C. § 271.

10. This Court has personal jurisdiction over Vantage because, on information and belief, Vantage is a corporation organized and existing under the laws of Delaware, is qualified to do business in Delaware, and has appointed a registered agent for service of process in Delaware. Therefore, Vantage has purposefully availed itself to the privileges of conducting business in Delaware and consented to general jurisdiction in Delaware.

11. In addition, this Court has personal jurisdiction over Vantage because, *inter alia*, Vantage, either directly or through its subsidiaries, agents, and/or affiliates, has purposefully availed itself of the benefits and protections of Delaware's laws such that it should reasonably anticipate being haled into court in this District. On information and belief, Vantage—either directly or through its subsidiaries, agents, and/or affiliates—develops, manufactures, imports, markets, offers to sell, sells, and/or distributes a broad range of personal care and beauty products, including emollients, throughout the United States, including in Delaware, and therefore transacts business within Delaware relating to Plaintiffs' claims, and/or has engaged in systematic and continuous business contacts within Delaware.

12. Upon information and belief, Vantage is in the business of, among other things, manufacturing and selling personal care and beauty products, including emollients, either directly or through various operating subsidiaries, agents, affiliates, and/or partners throughout the United States, including in Delaware.

13. Venue is proper in this Court with respect to Vantage pursuant to 28 U.S.C. § 1400(b) because Vantage is a corporation organized and existing under the laws of the State of Delaware.

THE ASSERTED '245 PATENT

14. On February 15, 2022, the United States Patent and Trademark (USPTO) duly and legally issued the '245 patent, titled "Processes and systems for catalytic manufacture of wax ester derivatives," and naming Jeff Addy, Clay Daly, and James H. Brown as inventors. A true and correct copy of the '245 patent is attached to this complaint as **Exhibit 1**.

15. The '245 patent was assigned to Cargill as part of Cargill's purchase of FloraTech in June 2021.

16. FloraTech has an exclusive license to make, use, and sell under the '245 patent, effective as of February 15, 2022.

17. The '245 patent describes and claims methods for producing a transesterified jojoba wax ester product from a feedstock of jojoba wax esters and hydrogenated jojoba wax esters. The process described and claimed by the '245 patent involves contacting the feedstock with a lipase, and catalytically transesterifying the wax esters in the feedstock with the lipase to form a transesterified product. Notably, an oxidative stability index ("OSI") of the transesterified product may be greater than an OSI of the feedstock.

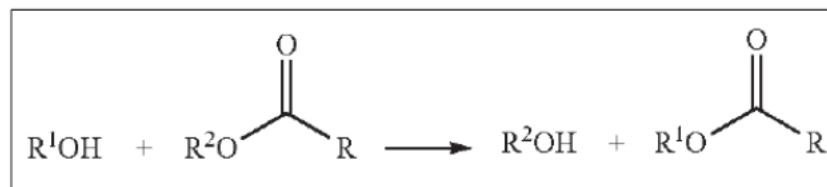
18. FloraTech sells the transesterified product line, for the benefit of both FloraTech and Cargill, under the trade name Floraesters®.

ACTS GIVING RISE TO THIS ACTION FOR VANTAGE'S PATENT INFRINGEMENT

Producing Transesterified Wax Esters

19. A wax ester is formed from the reaction of a fatty acid and a fatty alcohol, which results in the formation of an ester group that links two carbon chains. '245 patent at 1:12-14. Wax esters are found in various animals and plants, including the jojoba plant (*Simmondsia chinensis*). *Id.* at 1:14-16. Wax esters are used in various applications, including cosmetic and personal care products. *Id.* at 1:16-18.

20. Transesterification involves the process of exchanging acyl groups located on each side of an ester group with an acyl group contained in an alcohol group, as illustrated below:



'245 patent at 3:28-36.

21. Conventionally, transesterification of jojoba oil has been done with the use of a chemical catalyst, such as sodium methyllate (methoxide) or sodium hydroxide. *See id.* at 3:66-4:25; 7:24-48. Side reactions, however, occur between the catalyst and components of the feedstock and/or reactants during the transesterification process. *Id.* These side reactions create byproducts that reduce the yield of the process and alter the properties of the transesterified product. *Id.*

22. Some of the property changes occur because of damage to the feedstock esters caused by the high temperatures and low pressures required to carry out chemical catalytic transesterification. *Id.* Importantly, the reaction of the chemical catalyst removes or degrades the steryl esters, sterols, tocopherols, hydrocarbons, and volatile ingredients in the jojoba oil. *Id.* The resulting transesterified product may have little or none of these components remaining intact following chemical catalytic transesterification. *Id.*

23. This degradation and/or removal of these components changes the functionality and physical properties of the transesterified product. *Id.* In particular, the degradation and/or removal of the tocopherols and other naturally occurring antioxidants may reduce the OSI of the transesterified product to below the OSI of the original jojoba oil. *Id.* OSI correlates to a product's shelf life. *See id.* at 8:29-33.

FloraTech's Novel Approach to Transesterification

24. In the course of its research and development, FloraTech discovered a novel process that uses enzymes as a catalyst to facilitate the transesterification reaction.

25. On December 19, 2014, FloraTech filed its first patent application with the USPTO for inventions related to its enzymatic process for the transesterification reaction.

26. On June 23, 2016, the USPTO published FloraTech's application for its innovative enzymatic processes and systems as U.S. Publication No. 2016/0177349A1 ("349 publication"). The '349 publication disclosed, *inter alia*, that "the enzymatic transesterification process takes place at the melting point of the jojoba oil (and any hydrogenated jojoba oil included in the feedstock) under substantially atmospheric pressure. The reaction also proceeds without removing/degrading the tocopherols or volatiles naturally contained in the jojoba oil." '349 publication at [0054]. The '349 publication also disclosed, "[s]urprisingly, however, the OSI of the enzymatically catalyzed transesterified product is greater than that of the feedstock." *Id.* at [0058].

27. FloraTech's innovative enzymatic processes for transesterification result in a transesterified product with increased OSI and accordingly, a longer shelf life.

28. FloraTech's innovations also provide savings in energy and other utilities necessary to manufacture and convey its products.

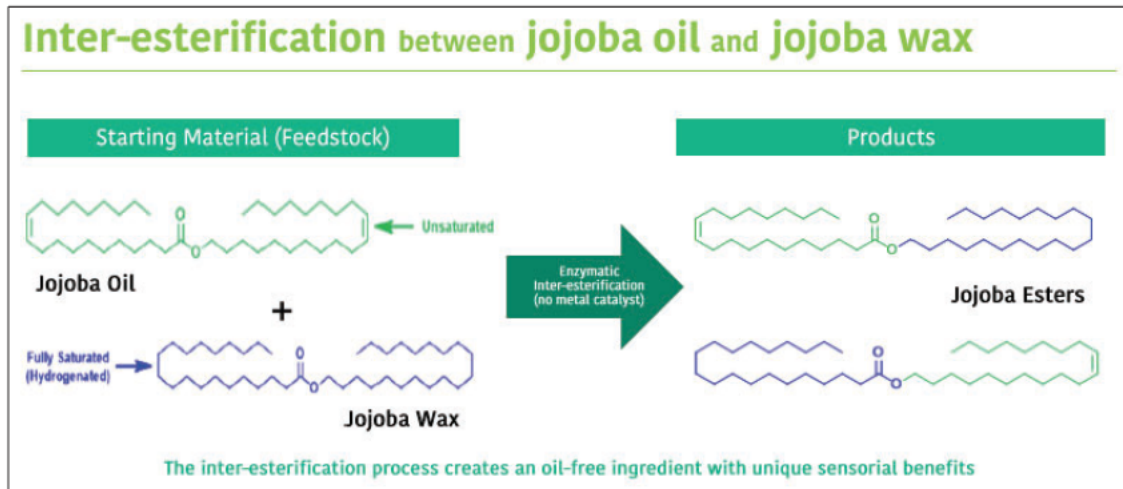
29. FloraTech's innovations also provide processing efficiencies that provide savings throughout the manufacturing process.

Vantage Copied FloraTech's Enzymatic Process

30. For years, Vantage has been trying to supply Plaintiffs' customers with a chemically-manufactured copy of FloraTech's Floraesters® 20 product, but its quality and performance was lacking. On information and belief, Vantage's manufacturing process for it Liponate™ Jojoba products until recently used a conventional chemical catalyst for transesterification of jojoba oil.

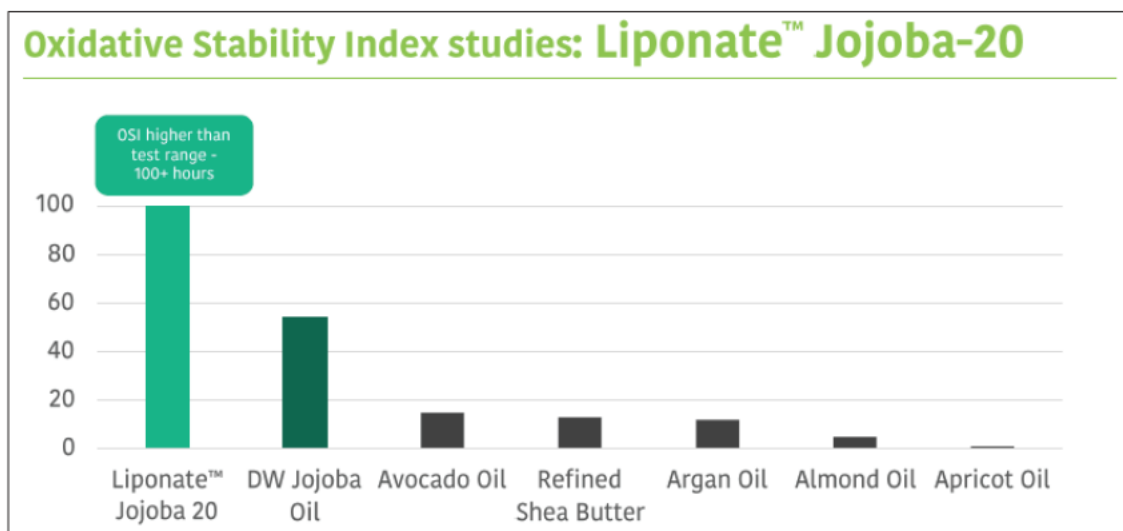
31. Vantage recently introduced and now promotes a new product—Liponate™ Jojoba 20—as an alternative to FloraTech's Floraesters® 20. As shown below, Vantage touts in

its marketing materials to customers, attached to this complaint as **Exhibit 2**, that its Liponate™ Jojoba 20 product is made through an enzymatic process:



Source: Liponate™ Jojoba 20-SS-2020 marketing document, available at <https://www.vantagegrp.com/en-US/Product/Page/a4e8c79c-49f1-431e-ad63-7457543de5e9/Liponate-Jojoba-20>

32. Further, as shown below, Vantage also touts in its marketing materials to customers that the enzymatic process results in a jojoba product with higher OSI than the original feedstock:



Source: Liponate™ Jojoba 20-SS-2020 marketing document, available at <https://www.vantagegrp.com/en-US/Product/Page/a4e8c79c-49f1-431e-ad63-7457543de5e9/Liponate-Jojoba-20>

33. In February 2022, Plaintiffs sent a letter to FloraTech's longstanding customer notifying it that the USPTO recently had issued the '245 patent, covering FloraTech's innovative Floraesters® product line. The letter noted that the '245 patent protects the process that enzymatically converts jojoba oil and hydrogenated jojoba oil into the Floraesters® 20 product that FloraTech supplies.

34. On information and belief, Plaintiffs' customer shared the contents of the February 2022 letter with Vantage. As a result, Vantage has had actual knowledge of the '245 patent as of at least March 2022, and also has had knowledge that its enzymatic process infringes the '245 patent. Despite this knowledge, Vantage continues to manufacture and sell its Liponate™ Jojoba 20 product.

35. At a minimum, Vantage is aware of the '245 patent as of the filing and service of this Complaint.

COUNT I – INFRINGEMENT OF THE '245 PATENT

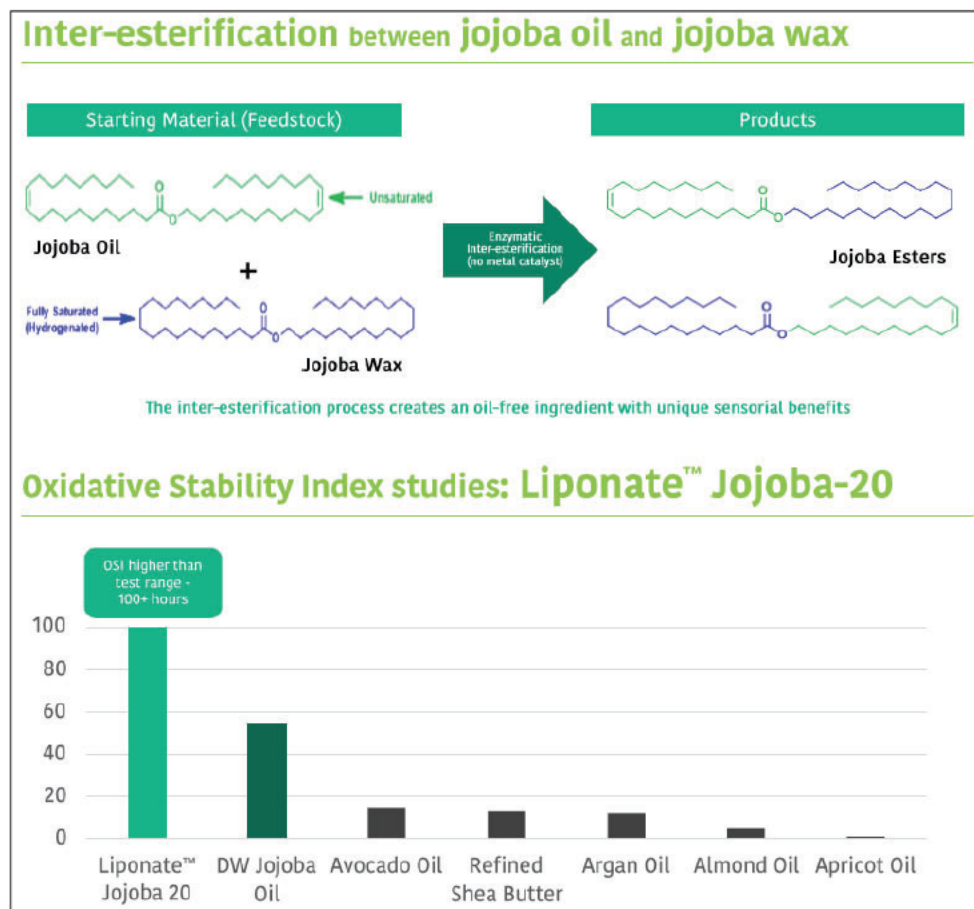
36. Plaintiffs hereby incorporate by reference Paragraphs 1-35 of this complaint, as if fully set forth herein.

37. Vantage has directly infringed and continues to directly infringe various process claims of the '245 patent, including at least claim 1, under 35 U.S.C. § 271(a) by making the accused Liponate™ Jojoba 20 product in the United States using each step of the claimed methods.

38. Vantage has made and continues to make its Liponate™ Jojoba 20 product by a process, which on information and belief includes providing a feedstock comprising jojoba wax esters and hydrogenated jojoba wax esters, wherein the amount of hydrogenated jojoba wax esters is 20% to 50% by weight of the feedstock; contacting the feedstock with a lipase; and transesterifying the jojoba wax esters and the hydrogenated jojoba wax esters in the feedstock with

the lipase to form a transesterified product; wherein an oxidative stability index (OSI) of the transesterified product is greater than an OSI of the feedstock.

39. For example, as seen in the following excerpt from Vantage's marketing brochure for the accused Liponate™ Jojoba 20 product, Vantage's process starts with a feedstock comprising jojoba wax esters and hydrogenated jojoba wax esters, that goes through an enzymatic inter-esterification (i.e., transesterification), resulting in a transesterified product with an increased oxidative stability index compared to the original feedstock.



Source: Liponate™ Jojoba 20-SS-2020 marketing document, available at <https://www.vantagegrp.com/en-US/Product/Page/a4e8c79c-49f1-431e-ad63-7457543de5e9/Liponate-Jojoba-20>

40. Plaintiffs have not granted, and Vantage has not requested, a license or permission to use the '245 patent.

41. On information and belief, Vantage has been willfully infringing the '245 patent since at least on or about March 2022 after it learned of the contents of the February 2022 letter from Plaintiffs to their customer identifying the '245 patent and its patented process. On further information and belief, Vantage has no good faith defense to Plaintiffs' infringement allegations, yet deliberately and wantonly continues its infringement.

42. On information and belief, Plaintiffs are not aware of any other manufacturers of jojoba oil or jojoba wax using their novel enzymatic process beyond those set forth herein. Accordingly, Vantage's actions have directly and proximately impaired Plaintiffs' business efforts, have irreparably harmed Plaintiffs and will continue to irreparably harm Plaintiffs unless and until they are permanently enjoined.

43. By its actions, Vantage's infringement of the '245 patent has damaged, and continues to damage, Plaintiffs in an amount yet to be determined, of at least a reasonable royalty and/or lost profits that Plaintiffs would have made but for Vantage's infringing acts.

44. This is an exceptional case. Plaintiffs are entitled to attorneys' fees and costs under 35 U.S.C. § 285 as a result of the infringement of the '245 patent by Vantage.

DEMAND FOR JURY TRIAL

45. Plaintiffs hereby demand trial by jury on all claims and issues so triable.

PRAYER FOR RELIEF

46. Wherefore, Plaintiffs respectfully request that this Court enter judgment against Vantage as follows:

- A. That the asserted claims of the '245 patent have been infringed by Vantage;
- B. An award of all of Vantage's sales of products found to infringe, i.e., lost profits;

- C. An award of compensatory damages as a result of Vantage's infringement of the '245 patent, together with interest, including pre-judgment and post-judgment interest, costs, and in no event less than a reasonable royalty;
- D. An accounting to determine the damages to be awarded to Plaintiffs as a result of Vantage's infringement, including an accounting for infringing sales not presented at trial and an award of additional damages for any such infringing sales;
- E. That Vantage's infringement of the '245 patent has been willful;
- F. An award of all other damages permitted by 35 U.S.C. § 284, including increased damages up to three times the amount of compensatory damages found;
- G. A permanent injunction that requires Vantage, its officers, directors, employees, relations and successors in interest to cease and desist from (1) infringing the '245 patent and (2) making, using, selling, offering for sale and/or importing the accused Liponate™ Jojoba 20 product;
- H. That this case is exceptional under 35 U.S.C. § 285 and that Plaintiffs are awarded their attorneys' fees; and
- I. Such other relief, including other monetary and equitable relief, as this Court deems just and proper.

Dated: July 26, 2022

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Exhibit 1



US011248245B2

(12) **United States Patent**
Addy et al.

(10) **Patent No.: US 11,248,245 B2**

(45) **Date of Patent: *Feb. 15, 2022**

(54) **PROCESSES AND SYSTEMS FOR
CATALYTIC MANUFACTURE OF WAX
ESTER DERIVATIVES**

(71) Applicant: **International Flora Technologies,
Ltd.**, Chandler, AZ (US)

(72) Inventors: **Jeff Addy**, Chandler, AZ (US); **Clay
Daly**, Chandler, AZ (US); **James H.
Brown**, Chandler, AZ (US)

(73) Assignee: **International Flora Technologies,
Ltd.**, Chandler, AZ (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 1138 days.

This patent is subject to a terminal dis-
claimer.

(21) Appl. No.: **14/578,075**

(22) Filed: **Dec. 19, 2014**

(65) **Prior Publication Data**

US 2016/0177349 A1 Jun. 23, 2016

(51) **Int. Cl.**
C12P 7/64 (2006.01)
C11C 3/00 (2006.01)
C11C 3/10 (2006.01)

(52) **U.S. Cl.**
CPC **C12P 7/6436** (2013.01); **C11C 3/003**
(2013.01); **C11C 3/10** (2013.01)

(58) **Field of Classification Search**
CPC C12P 7/6436; C11C 3/003
USPC 435/134
See application file for complete search history.

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Assistant Examiner — Srikanth Patury

(74) *Attorney, Agent, or Firm* — Fish & Richardson P.C.

(57) **ABSTRACT**

Processes for transesterifying wax esters. Implementations may include: providing a feedstock including wax esters, contacting the feedstock with a lipase, and catalytically transesterifying the wax esters in the feedstock with the lipase to form a transesterified product. An oxidative stability index (OSI) of the transesterified product may be greater than an OSI of the feedstock.

5 Claims, 4 Drawing Sheets

Specification includes a Sequence Listing.

US 11,248,245 B2

Page 2

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US 11,248,245 B2

Page 3

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U.S. Patent

Feb. 15, 2022

Sheet 1 of 4

US 11,248,245 B2

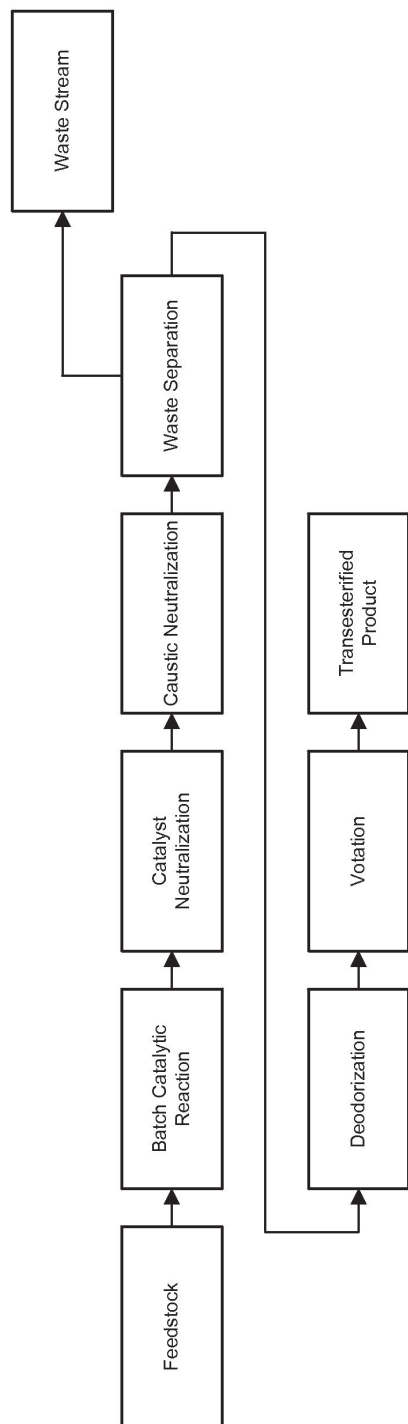


FIG. 1



FIG. 2

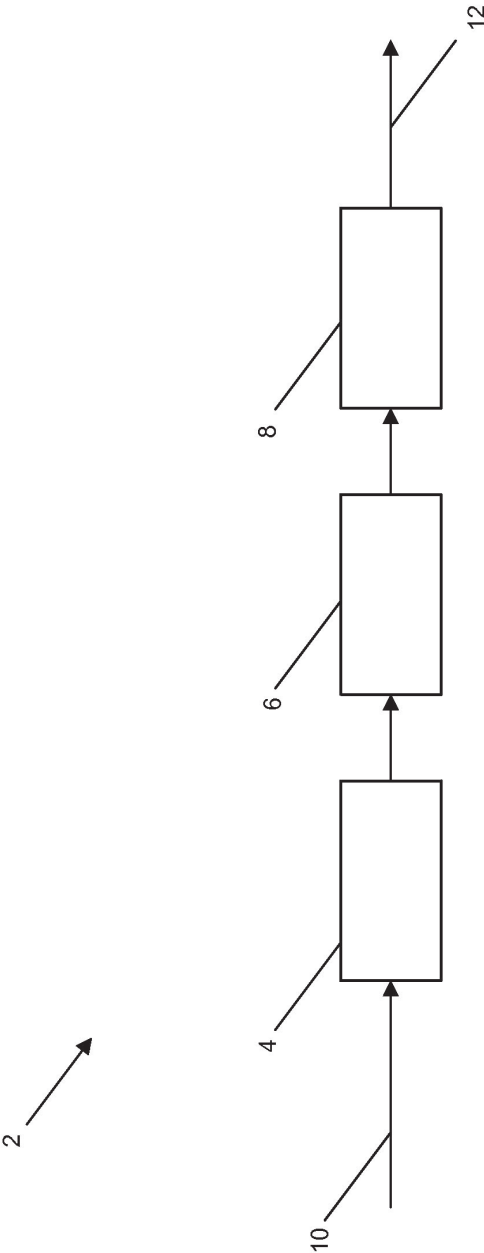


FIG. 3

U.S. Patent

Feb. 15, 2022

Sheet 3 of 4

US 11,248,245 B2

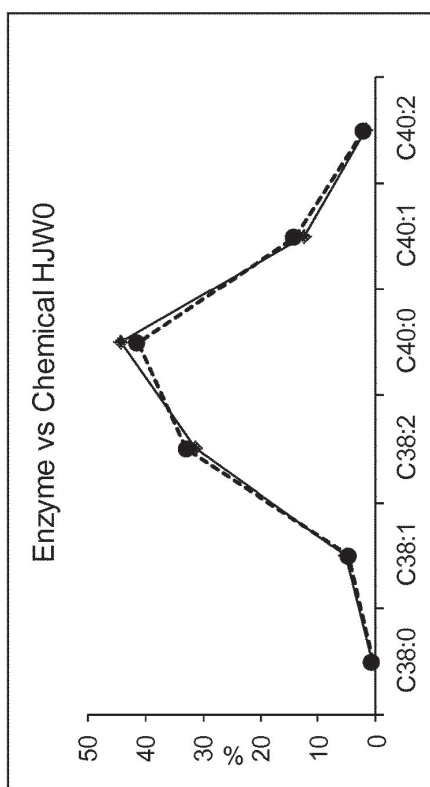


FIG. 4

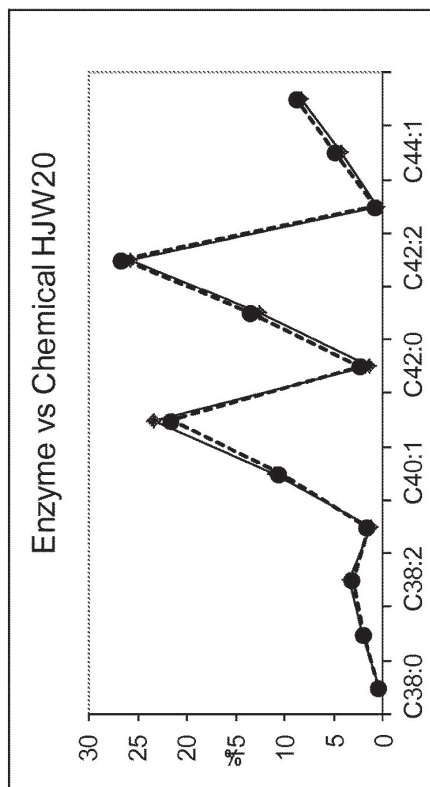


FIG. 5

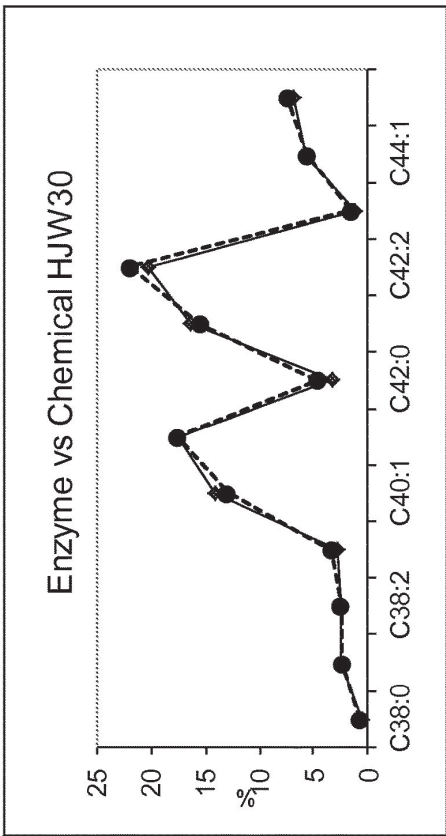


FIG. 6

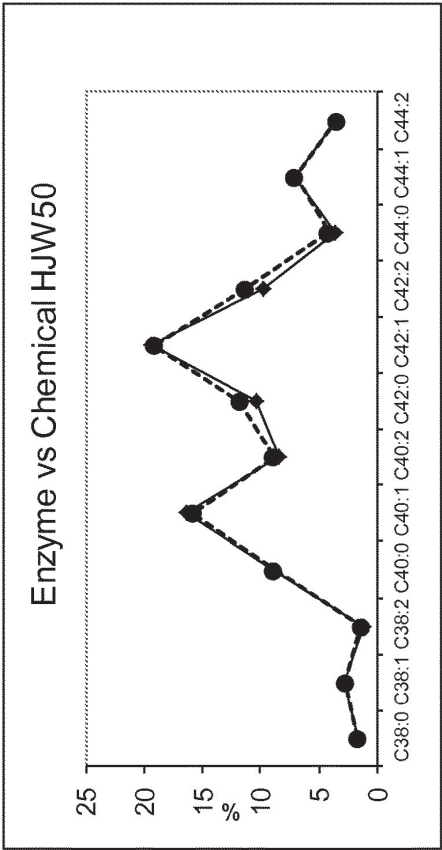


FIG. 7

US 11,248,245 B2

1

PROCESSES AND SYSTEMS FOR CATALYTIC MANUFACTURE OF WAX ESTER DERIVATIVES

BACKGROUND

1. Technical Field

Aspects of this document relate generally to systems and processes for reacting and processing wax esters and wax ester derivatives.

2. Background Art

A wax ester is formed from the chemical reaction of a fatty acid and a fatty alcohol, which results in the formation of an ester group that links two carbon chains. Wax esters are found in various animals and plants, including the jojoba plant (*Simmondsia chinensis*). Wax esters are used in various applications, including in cosmetic and personal care products.

SUMMARY

Implementations of processes for transesterifying wax esters may include: providing a feedstock including wax esters, contacting the feedstock with a lipase, and catalytically transesterifying the wax esters in the feedstock with the lipase to form a transesterified product. An oxidative stability index (OSI) of the transesterified product may be greater than an OSI of the feedstock.

Implementations of process for transesterifying wax esters may include one, all, or any of the following:

The transesterified product may include no methyl esters.

The feedstock may further include an antioxidant and catalytically transesterifying the wax esters in the feedstock with the lipase may further include catalytically transesterifying without one of removing and degrading the antioxidant in the feedstock.

The feedstock may further include a skin conditioning agent and a volatile compound and catalytically transesterifying the wax esters in the feedstock with the lipase may further include catalytically transesterifying without removing or degrading the skin conditioning agent and the volatile compound in the feedstock.

The wax esters of the feedstock may be jojoba wax esters.

The jojoba wax esters may further include hydrogenated jojoba wax esters.

A dropping point of the transesterified product may be greater than a dropping point of the feedstock and the dropping point may increase as a percentage of hydrogenated jojoba wax esters in the feedstock increases.

Implementations of a process for transesterifying wax esters may include providing a feedstock including wax esters, contacting the feedstock with a lipase, and catalytically transesterifying the wax esters in the feedstock with the lipase to form a transesterified product. The catalytic transformation may take place at greater than or equal to 98% yield.

Implementations of processes for transesterifying wax esters may include one, all or any of the following:

The transesterified product may include no methyl esters.

The feedstock may further include an antioxidant and catalytically transesterifying the wax esters in the feedstock with the lipase may further include catalytically transesterifying without removing or degrading the antioxidant in the feedstock.

The wax esters of the feedstock may be jojoba wax esters.

The jojoba wax esters may further include hydrogenated jojoba wax esters.

2

A dropping point of the transesterified product may be greater than a dropping point of the feedstock and the dropping point may increase as a percentage of hydrogenated jojoba wax esters in the feedstock increases.

Implementations of a process for transesterifying wax esters may include providing a feedstock including jojoba wax esters, contacting the feedstock with a lipase catalyst, and catalytically transesterifying the jojoba wax esters in the feedstock with the lipase to form a transesterified product. The yield of the catalytic transesterification may be greater than 4001 kilograms of product per kilogram of immobilized lipase catalyst.

Implementations of a process of transesterifying wax esters may include one, all, or any of the following:

The transesterified product may include no methyl esters.

The feedstock may further include an antioxidant and catalytically transesterifying the jojoba wax esters in the feedstock with the lipase may further include catalytically transesterifying without removing or degrading the antioxidant in the feedstock.

The feedstock may further include a skin conditioning agent and a volatile compound and catalytically transesterifying the jojoba wax esters in the feedstock with the lipase may further include catalytically transesterifying without removing or degrading the skin conditioning agent the skin conditioning agent and/or the volatile compound in the feedstock.

The jojoba wax esters may further include hydrogenated jojoba wax esters.

A dropping point of the transesterified product may be greater than a dropping point of the feedstock and the dropping point of the transesterified product may increase as a percentage of hydrogenated jojoba wax esters in the feedstock increases.

The catalytic transesterification may take place at a greater than or equal to 98% yield.

The foregoing and other aspects, features, and advantages will be apparent to those artisans of ordinary skill in the art from the DESCRIPTION and DRAWINGS, and from the CLAIMS.

BRIEF DESCRIPTION OF THE DRAWINGS

Implementations will hereinafter be described in conjunction with the appended drawings, where like designations denote like elements, and:

FIG. 1 is a flow chart of a conventional chemically catalyzed transesterification process;

FIG. 2 is a flow chart of an enzymatically catalyzed transesterification process;

FIG. 3 is a process diagram showing an implementation of three enzymatically catalyzed transesterification reactors in series;

FIG. 4 is a comparison chart showing the distribution of jojoba wax ester carbon lengths in a transesterified product stream from a jojoba wax ester feedstock for a chemically catalyzed process and an enzyme catalyzed process;

FIG. 5 is a comparison chart showing the distribution of jojoba wax ester carbon lengths in a transesterified product stream from a jojoba wax ester combined with about 20% by weight of hydrogenated jojoba wax ester feedstock for a chemically catalyzed process and an enzyme catalyzed process;

FIG. 6 is a comparison chart showing the distribution of jojoba wax ester carbon lengths in a transesterified product stream from a jojoba wax ester combined with about 30% by

US 11,248,245 B2

3

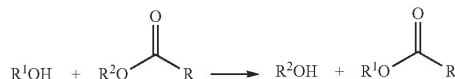
weight of hydrogenated jojoba wax ester feedstock for a chemically catalyzed process and an enzyme catalyzed process;

FIG. 7 is a comparison chart showing the distribution of jojoba wax ester carbon lengths in a transesterified product stream from a jojoba wax ester combined with about 50% by weight of hydrogenated jojoba wax ester feedstock for a chemically catalyzed process and an enzyme catalyzed process.

DESCRIPTION

This disclosure, its aspects and implementations, are not limited to the specific components, assembly procedures or method elements disclosed herein. Many additional components, assembly procedures and/or method elements known in the art consistent with the intended processes and systems for transesterifying wax esters will become apparent for use with particular implementations from this disclosure. Accordingly, for example, although particular implementations are disclosed, such implementations and implementing components may comprise any shape, size, style, type, model, version, measurement, concentration, material, quantity, method element, step, and/or the like as is known in the art for such processes and systems for transesterifying wax esters, and other implementing components and methods, consistent with the intended operation and methods.

Transesterification involves the process of exchanging acyl groups located on each side of an ester group with an acyl group contained in an alcohol group, as illustrated below:



Transesterification for naturally occurring or structured or synthetic esters permits altering of various physical properties of the transesterified product when compared to the original feedstock. By non-limiting example, physical properties such as viscosity, dropping point, oil (oxidative) stability index (OSI), carbon chain distribution, and other properties of the transesterified product may be greater, equal to, or less than the corresponding values of the original wax ester-containing feedstocks. These changes take place at least in part because the chain lengths of the resulting ester products are randomized compared to the distribution in the original wax ester feedstock, which may alter the functionality of the transesterified material in a mixture and/or the thermal properties of the material.

Conventionally, transesterification of wax esters is accomplished using several different methods. Methods and systems for transesterifying jojoba oil that include the use of an acidic bentonite-type clay at temperatures between 150C-350C are disclosed in U.S. Pat. No. 4,329,298 to Brown, et al., entitled "Isomerization of Jojoba Oil and Products Thereof," filed Aug. 15, 1980 and issued May 11, 1982 and in U.S. Pat. No. 4,360,387 to Brown, et al., entitled "Isomorphous Jojoba Oil Compositions Containing Trans-Isomerized Jojoba Oil," filed Mar. 9, 1981, issued Nov. 23, 1982, the disclosures of both of which are hereby incorporated entirely herein by reference. When using the process described in the foregoing patents for transesterification, a 5%-10% loss of the original jojoba oil was observed.

Other conventional transesterification reactions use a chemical catalyst, such as sodium methylate (methoxide) or

4

sodium hydroxide. While the reaction is catalytic, side reactions between the catalyst and components of the feedstock and/or reactants occur during transesterification process. These side reactions create byproducts that reduce the yield of the process and alter the properties of the transesterified product. Some of the property changes occur because of damage/changes to the feedstock esters caused by the high temperatures (100C-230C) and low pressures (<7 mmHg) required to carry out chemical catalytic transesterification. Other property changes occur because these conditions and/or the chemical catalysts themselves degrade, destroy, or reduce the effectiveness of other sub-components of the wax ester feedstock. Where the wax ester feedstock is derived from a natural source, such as in a jojoba wax ester feedstock, existing antioxidants, sterols, hydrocarbons, and other volatile compounds (volatile in comparison to the volatility of the wax esters) react with the chemical catalyst in side reactions. The resulting transesterified product may have little or none of any of these components remaining intact following chemical catalytic transesterification and/or may reduce the effectiveness of these components. Furthermore, the transesterified product may include artifacts of these components which are undesirable or have undesirable effects in the product or subsequent mixtures that include the product.

Chemically catalyzed transesterification of wax esters is carried out in a batch reactor, and the catalyst cannot, accordingly, be recovered for reuse from the transesterification product. Referring to FIG. 1, a process flow diagram for a conventional transesterification process is illustrated. As illustrated, the feedstock containing wax esters is processed in a batch catalytic reaction. Following batch processing, the reaction is stopped using an acid and/or water such as citric acid to neutralize the remaining catalyst. At this point, the reactor contents are then checked for the presence of free fatty acids, which, if present requires the use of a neutralization process for the free fatty acids. The batch reactants are then moved into a waste separation step, in which the solution is washed with soft water to remove soaps and salts in the reactor material and separate them from the oil/lipid portion of the reactor material that contains the transesterified product to form a waste stream and a transesterified product stream. The transesterified product in the transesterified product stream is then bleached to remove remaining color bodies, soaps, and other undesirable byproducts formed during the chemically catalyzed transesterification reaction. The transesterified product stream is then deodorized and votated to produce a finished transesterified product. The process of votation is a controlled crystallization process or tempering process in which the transesterified product is agitated under controlled conditions to form a transesterified product with a desired consistency and crystalline structure for later use. Votation includes various heating, chilling, flash chilling, and other pressure adjustments to provide the desired consistency and/or structure.

In this document, various processes for transesterifying wax esters are disclosed that use enzymes to catalytically facilitate the transesterification reaction. In particular implementations, the enzymes are lipases, which are proteins that various biological organisms use to catalyze the hydrolysis and/or esterification of various compounds, such as lipids. As used herein, "lipase" means any enzyme or protein capable of being used in a transesterification reaction of a wax ester.

Referring to FIG. 2, a process flow diagram for an enzymatically catalyzed transesterification process is illus-

US 11,248,245 B2

5

trated. As illustrated, the wax ester feedstock passes through one or more catalytic reactors that allow a continuous catalytic transesterification reaction to take place. While it is possible to batch process wax ester feedstocks using enzymes, continuous processing has many well-known advantages over batch processing. Following the continuous catalytic transesterification reaction, the transesterified product is deodorized and votated to produce a finished transesterified product stream. As can be observed, there are fewer process steps in an enzymatically catalyzed transesterification process. Furthermore, as will be discussed in detail below, because there are little or no side reactions between the enzyme catalysts and the reactants, while the transesterification results of the enzyme catalyzed process are very similar to chemically catalyzed process, the properties and components of an enzyme catalyzed transesterified product stream differ in important ways while retaining essentially the same functional characteristics.

Referring to FIG. 3, a process flow diagram of an implementation of a continuous enzymatic reactor system 2 for enzymatic catalyzed transesterification of wax esters is illustrated. As illustrated, the system 2 includes three reactors 4, 6, 8 connected in series. Each reactor contains the enzyme and is designed to place the incoming wax ester feedstock 10 in contact with the enzyme. Following processing, the transesterified product 12 exits the final reactor 8 for subsequent processing/collection. In particular implementations, the enzyme is immobilized on a substrate material designed to facilitate interaction of the incoming wax ester feedstock. In other implementations, the enzyme is immobilized on the internal structure(s) of the reactor itself or is free flowing within the reactor system and recycled back to the reactor(s). In the implementation illustrated in FIG. 3, the reactors are packed bed reactors. Those of ordinary skill in the art will readily be able to select various reactor components and other piping, pumps, filters, and other process equipment to facilitate the use of the enzymatic reactors using the principles disclosed herein.

Many different enzymes may be employed in enzymatic catalytic transesterification reactions for wax esters, including those that are derived/obtained from biological organisms, those made synthetically, and those that are entirely artificial, whether made biologically and/or synthetically. For those enzymes that are lipases, these may include, one, some, any, or any combination of lipases derived from the following organisms: *Aspergillus niger*, *Aspergillus oryzae*, *Bacillus subtilis*, *Bacillus thermocatenulatus*, *Burkholderia cepacia*, *Burkholderia glumae*, *Candida rugosa*, *Candida antarctica A*, *Candida antarctica B*, *Candida cylindracea*, *Candida parapsilosis*, *Chromobacterium viscosum*, *Geotrichum candidum*, *Geotrichum* sp., *Mucor miehei*, *Humicola lanuginosa*, *Penicillium camembertii*, *Penicillium chrysogenum*, *Penicillium roquefortii*, *Pseudomonas cepacia*, *Pseudomonas aeruginosa*, *Pseudomonas fluorescens*, *Pseudomonas fragi*, *Pseudomonas alcaligenes*, *Pseudomonas mendocina*, *Rhizopus arrhizus*, *Rhizomucor miehe*, *Staphylococcus hyicus*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Staphylococcus warneria*, *Staphylococcus xylosus*, *Thermomyces lanuginosus*, *Aspergillus* sp., *Bacillus* sp., *Burkholderia* sp., *Candida* sp., *Chromobacterium* sp., *Geotrichum* sp., *Mucor* sp., *Humicola* sp., *Penicillium* sp., *Pseudomonas* sp., *Rhizopus* sp., *Staphylococcus* sp., and *Thermomyces* sp.

In particular implementations, the lipase may be the following: a lipase from *Thermomyces lanuginosus* marketed under the tradenames LIPOZYME TL IM™ or LIPEX™ by Novozymes A/S of Bagsvaerd, Denmark and

6

immobilized on a substrate also manufactured by Novozymes. A representative sequence listing of the lipase is included as SEQ ID NO: 1 herein. In other implementations, the lipase may be that marketed under the tradename NOVOZYME™ by Novozymes, A/S derived from *Candida antarctica*, a representative sequence listing for which is included as SEQ ID NO: 2 herein. In various implementations, the lipases may be any of the following: those marketed under the tradenames CALB L™, NOVOZYME 435™, NOVOCOR AD L™, and LIPOLASE 100L™ by Novozymes; those marketed under the tradenames CALB™, CALA™, and CRL™ by c-LEcta, GMBH of Leipzig, Germany; those marketed under the tradenames LIPASE A “AMANO” 12™, LIPASE AY “AMANO” 30SD™, LIPASE G “AMANO” 50™, LIPASE R “AMANO”™, LIPASE DF “AMANO” 15™, LIPASE MER “AMANO”™, and NEWLASE F™ by Amano Enzyme Inc. of Nagoya, Japan; those marketed under the tradenames LIPASE MY™, LIPASE OF™, LIPASE PL™, LIPASE PLC/PLG™, LIPASE QLM™, LIPASE QLC/QLG™, LIPASE SL™, and LIPASE TL™, by Meito Sangyo Co., Ltd., of Nagoya, Japan.

In other implementations, the lipase may be a lipase from *Candida antarctica A*, a lipase from *Candida antarctica B*, *Candida rugosa* or any combination thereof. In various implementations, the lipases may be any disclosed in U.S. Patent Application Publication No. 20140017741 (the ‘714 publication) to Nielsen, et al., entitled “Esterification Process,” filed Oct. 1, 2013 and published Jan. 16, 2014, the disclosure of which is hereby entirely incorporated herein by reference. Those lipases disclosed in the sequence listings for the various patent applications listed in para. [0026]-[0029] in the ‘714 publication, previously incorporated by reference, each of which applications are hereby entirely incorporated by reference herein, may also be those utilized in particular implementations. In various implementations, the lipases may be those have at least 60%, at least 70%, at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, or even at least 99% identity to any of the lipases disclosed herein, in the ‘714 publication, and in the patent applications disclosed in the ‘714 publication, all of which have been previously incorporated by reference.

A wide variety of wax esters may be processed using the enzymatic catalytic transesterification processes disclosed herein. By non-limiting example, wax esters contained in the following materials may be included in the wax ester feedstocks processed using the principles disclosed herein: beeswax, Chinese wax, shellac wax, whale spermaceti, lanolin, carnauba wax, ouricuri wax, jojoba oil, candelilla wax, esparto wax, Japan wax, rice bran oil, sunflower wax, ozocerite, ozokerite, and montan wax. Any other natural or synthetically produced wax esters may also be processed using the principles disclosed herein. Various examples are discussed in this document regarding wax esters in jojoba oil feedstocks, but these examples are merely given to illustrate the principles disclosed herein.

Jojoba oil derived from the seeds of the jojoba plant contains wax esters and other components that have been noted to be useful for various functions. These include steryl esters, sterols, and various hydrocarbons that can be useful as skin conditioning agents in cosmetics and personal care products. Antioxidants, like tocopherols, are also included, along with various volatile ingredients naturally present in the oil, which are volatile in comparison with the wax esters. The wax esters in jojoba oil generally vary between 34 and 48 carbons in length. A detailed analysis of the wax ester distribution, structural characteristics, and other components

US 11,248,245 B2

7

in jojoba oil may be found in the paper by Thomas K. Miwa, entitled "Structural Determination and Uses of Jojoba Oil," *J. Amer. Oil Chem. Soc.*, Vol. 61, No. 2 (February 1984), p. 407-410, the disclosure of which is hereby incorporated entirely herein by reference. It has been observed that jojoba oil derived from plants from South America, Israel, and North America differ somewhat in chemical composition, but these differences are slight and have not been observed to produce any effect on the product functional characteristics. Details on the composition of jojoba oil from Chile may be found in the article by Cappillino et al., entitled "Composition of Chilean Jojoba Seeds," *Ind. Crops and Prod.*, v. 17, p. 177-182 (2003), the disclosure of which is hereby incorporated entirely herein by reference. Additional information on the differences in jojoba oil produced from jojoba seeds from Chile, North America, Israel, and the rest of South America may be found in the presentation by Cappillino et al., "Composition of Chilean Jojoba Seed," given at the 5th New Crops Symposium in Atlanta, Ga. Nov. 10-13, 2001, a copy of which is included herewith at Appendix B, the disclosure of which is hereby incorporated entirely herein by reference.

Transesterification of jojoba oil has conventionally been done using the chemically catalyzed processes discussed herein. When such chemical catalyzed processes are used, side reactions form various fatty acid methyl esters and leave various free fatty alcohols when sodium methoxide is used. The resulting transesterified product stream may include 5% or less by weight of these fatty acid methyl esters, which may function as an emollient, and the free fatty alcohols, which may function as an emollient and viscosity controller. As was previously discussed however, the reaction of the chemical catalyst removes or degrades the sterol esters, sterols, tocopherols, hydrocarbons, and volatile ingredients in the jojoba oil. This degradation and/or removal of these components changes the functionality and physical properties of the transesterified product stream. In particular, the degradation and/or removal of the tocopherols and other naturally occurring antioxidants reduces the OSI of the transesterified product to below the OSI of the original jojoba oil. As jojoba oil includes between about 0 to about 500 ppm of tocopherols with the major component being gamma-tocopherol, elimination of the natural tocopherols has a significant effect on the oxidative stability of the mixture. An addition of 500 ppm of tocopherols can enhance the oxidative stability of the material by about 50% to about 200% of the original oxidative stability.

Table 1 lists some process parameters and some characteristics of the transesterified product stream for a chemically catalyzed transesterification process and those for an enzymatically catalyzed transesterification process.

TABLE 1

Process Parameter	Chemical Catalyst	Enzymatic Catalyst
Reaction Temperature	100 C.-230 C.	10 C.-70 C.
Reaction Pressure	<7 mm Hg	760 mm Hg (ambient)
Product Color	Increased (changes color)	No changes
Soap Formation	Yes	No change
Transesterification Yield	85%-95%	>98%

Table 2 shows observed effect of the chemically catalyzed process and various enzymatically catalyzed processes on the various naturally present components in jojoba oil as well as side reaction byproducts.

8

TABLE 2

Transesterified Product Component	Skin Care Formula Function	Chemical Catalyst	Enzyme Catalyst
5 Steryl Esters	Skin Conditioning Agent	Removed/Degraded	Functionally Unaffected
Sterols	Skin Conditioning Agent	Removed/Degraded	Functionally Unaffected
10 Tocopherols	Antioxidant	Removed/Degraded	Functionally Unaffected
Hydrocarbons	Skin Conditioning Agent	Removed/Degraded	Unchanged
Fatty Acid Methyl Esters	Emollient	Formed, <5%	Not formed
15 Free Fatty Alcohols	Emollient, Viscosity Controller	Formed, <5%	Not formed
Volatile Ingredients	Sensory Attributes	Removed/Degraded	Functionally Unaffected

As can be observed from the table, the enzymatic transesterification process takes place at the melting point of the jojoba oil (and any hydrogenated jojoba oil included in the feedstock) under substantially atmospheric pressure. The reaction also proceeds without removing/degrading the tocopherols or volatiles naturally contained in the jojoba oil. Also, the enzyme catalyzed process does not create methyl esters or free fatty alcohols which may limit the applications of the transesterified product as they affect the emollient and/or viscosity behavior of the product. Furthermore, the degradation/removal of the tocopherols in the chemically catalyzed process adversely affects the oxidative stability (measured by the OSI) and accordingly, the shelf life, of the transesterified product. The addition of fatty acid methyl esters creates different material spreading and refractive properties in the chemically transesterified product, even at levels up to about 5% by weight.

Several examples of chemically catalyzed transesterification reactions compared with enzymatically catalyzed transesterification reactions are disclosed in this document, including in FIGS. 4-7. These will be considered in turn.

Example 1

Chemical Catalytic Batch Process Vs. Enzymatically Catalyzed Batch Process

A 1 liter 3-necked glass flask equipped with an agitating blade was loaded with 800 g of refined jojoba oil. The oil was heated to 110C and dried under vacuum for 30 minutes. After drying was completed, a small amount of sodium methyllate (0.3% by weight) was added to the mixture. The transesterification reaction was agitated under vacuum at 120C for two hours. The catalyst was then neutralized with 1 g of citric acid and then treated with a silica and bleaching clay mixture to remove color induced by the reaction and other residual impurities. The transesterified product was a yellow liquid.

A 2 liter jacketed glass reactor equipped with an agitating blade was loaded with 1.2 kg of refined jojoba oil and 48 g (4% by weight) of LIPOZYME TL IM™ (*Thermomyces lanuginosus* lipase) from Novozymes. A layer of nitrogen was blanketed over the oil and the mixture was agitated at ambient temperature. After five hours, the lipase was removed from the mixture and the jojoba derivative was analyzed. The transesterified product was a slightly yellow liquid similar in texture and color to the initial feedstock. Measurement of the wax ester distributions for the feedstock

US 11,248,245 B2

9

and both transesterified products was done using an Hewlett Packard GC 5980 Series II gas chromatograph with a Restek MxT-65TG 30 meter, 0.25 mm ID capillary chromatographic column with a Crossbond 65% diphenyl/35% dimethyl polysiloxane film thickness of 0.1 microns. The gas chromatograph has split/splitless injection and uses an FID detector. Operating parameters of the gas chromatograph were as follows: injection port: 300C, detector: 325C, split ratio: 100:1, 1 microliter injection with oven temperature ramping from 280C to 350C over 20 minutes. Helium carrier gas was used. The concentration of tocopherols was measured using HPLC rather than the gas chromatograph. The equipment used was an Agilent LC 1100 series with an autosampler, quaternary pump, diode array detector (DAD), and an Alltech 2000 ELSD operating with a drift tube temperature of 40.0° C. with 1.7 mL/min Nitrogen. The column used was an Agilent RX-SIL 4.6x50 mm 1.8 um normal phase silica column kept at 40.0° C. The DAD was set to detect UV at wavelengths 210 nm and 295 nm to identify the optically active portion of the tocopherols as they eluted from the column. The mobile phase consisted of an isocratic flow of 98% hexane and 2% isopropanol at 0.5 mL/min with a total run time of 15.00 minutes. Table 3 summarizes the results of both experiments.

TABLE 3

Components	Feedstock Composition	Chemical Catalyst	% Change	Enzyme Catalyst	% Change
Tocopherols	0.04%	0.00%	-0.04%	0.04%	0.00%
Fatty Acid Methyl Esters	0.00%	3.10%	3.10%	0.00%	0.00%
Free Fatty Alcohols	0.00%	1.80%	1.80%	0.00%	0.00%
OSI (hours)	26.5	21.5	-18.87%	38.6	45.66%
Wax Ester Content	98.00%	93.10%	-4.90%	98.00%	0.00%
Wax Ester Distribution					
C36:1	1.12%	1.30%	0.180%	1.20%	0.080%
C38:2	6.02%	4.90%	-0.120%	4.80%	-1.220%
C40:2	27.95%	35.76%	7.810%	34.34%	6.390%
C42:2	50.28%	40.64%	-9.640%	40.92%	-9.360%
C44:2	9.94%	13.75%	3.811%	14.93%	4.991%
C46:2	1.20%	1.89%	0.690%	2.23%	1.030%

Examining the results shows that the formation of fatty acid methyl esters and free fatty alcohols in the chemically catalyzed transesterification reaction produces a product with a lower wax-ester percentage than the original starting material. The results also indicate that the chemically catalyzed reaction destroys the original amount of tocopherols present in the feedstock, which reduces the OSI of the transesterified product. Surprisingly, however, the OSI of the enzymatically catalyzed transesterified product is greater than that of the feedstock. This result indicates that the enzymatic catalysis has an unexpected positive effect on OSI that is not explainable simply by the enzymatic catalyst preserving the natural tocopherols originally present in the feedstock during the reaction. The OSI was measured using an Omnic Scientific Services machine, Model OSI-8-110, according to the procedures set forth in the American Oil Chemist's Society (AOCS) Official Method Cd 12b-92, a copy of which is submitted herewith as Appendix A and incorporated entirely herein by reference.

10

In all of the above examples, no significant difference in the viscosity between the chemically catalyzed and the enzymatically catalyzed transesterified products was observed.

The chemically catalyzed and enzymatically catalyzed transesterified products were tested for performance in a typical cream formulation. Each cream formulation used 3% by weight of each transesterified product (chemically or enzymatically catalyzed) created in the previous experiment. Table 4 shows the formulation details of the cream along with the components and suppliers. Following Table 4 is the mixing procedure used.

TABLE 4

Phase	Tradename	International Nomenclature Cosmetic Ingredient (INCI)	Supplier	Weight percent % (of total)
A	Deionized Water	Water	—	66.27
	VERSENE™ Na2 Crystals	Disodium EDTA	The Dow Chemical Co.	0.03
B	Glycerin, USP	Glycerin	The Dow Chemical Co.	5.00
	KELTROL CG-T™	Xanthan Gum	CP Kelco	0.30
C	FLORAMAC™ Macadamia Oil.	<i>Macadamia integrifolia</i> seed oil.	Floratech	3.00
	FLORAESTERS 30™	Jojoba Esters (and) Tocopherol	Floratech	3.00
	Transesterified Wax Esters	Jojoba Derivative being examined	—	3.00
	Cocoa Butter	<i>Theobroma cacao</i> (Cocoa) seed butter	Cognis Corporation	5.00
	FLORASUN 90™	<i>Helianthus annuus</i> (Sunflower) seed oil (and) Tocopherol	Floratech	2.00
	BOTANISIL CP-33™	Cyclopentasiloxane	Botanigenics, Inc.	4.00
	DOW CORNING 200™ Fluid	Dimethicone	Dow Corning Corporation	0.50
	LEXEMUL 561™	Glyceryl Stearate (and) PEG-100 Stearate	Inolex Chemicals	4.00
	EMULGADE PL™	Cetearyl Glucoside (and) Cetearyl Alcohol	Cognis Corporation	3.00
D	PHENONIP™	Phenoxyethanol (and) Methylparaben (and) Ethylparaben (and) Butylparaben (and) Propylparaben (and) Isobutylparaben	Clariant Corporation	0.90
Total				100

The cream was prepared as follows: Step 1: Dissolve the VERSENE™ Na2 crystals into the deionized water with stirring at 75C to form phase A. Step 2: Mix the KELTROL CG-T™ in the glycerin USP to form phase B. Add phase A to phase B with rapid stirring to form phase AB. Step 3: Combine all ingredients of phase C and 75C using propeller agitation. Add phase C to phase AB at 75C using propeller agitation to form phase ABC. Step 4: Reduce the temperature of the cream to 50C and add phase D to phase ABC with propeller agitation. Cool the batch with moderate agitation to room temperature.

US 11,248,245 B2

11

Table 5 summarizes the viscosity and appearance differences between the two cream formulations. While a viscometer can be used to measure the viscosity of such materials, the test used to calculate the viscosities, a method of calculating the viscosity without a viscometer, includes placing a sample weighting 0.5 g on a piece of horizontally oriented paper and drawing a starting line immediately next to the sample. The paper is then oriented vertically for 30 seconds and then laid flat again. A line is then drawn at the edge of where the sample has finished flowing down the paper. A ruler is then used to measure the distance between the starting line and the ending line. By developing a calibration curve for this method using materials of known viscosity and measuring the length of travel down the paper, a correlation can be developed between the length of travel of the material and the viscosity of the material.

TABLE 5

Transesterified Product Type in Cream	Viscosity	Appearance
Chemically Catalyzed	120,900 cP	White, semi-solid phase
Enzymatically Catalyzed	78,585 cP	White, liquid phase, glossy

Table 5 indicates that the use of enzymatically catalyzed transesterified jojoba oil created a cream formulation that had a viscosity drop of nearly 35% from the viscosity of the chemically catalyzed cream. This data indicates that the enzymatically catalyzed transesterified jojoba oil has the functional effect of lowering the resulting product viscosity compared to chemically catalyzed product. The difference in appearance between the two cream formulations (i.e., the enzymatically catalyzed product having less shine and gloss when applied to a surface) is due to the relative abundance of fatty acid methyl esters in the chemically catalyzed product. Example 2. Continuous Flow Enzymatically Catalyzed Transesterification Using Lipase

A 10 cmx100 cm stainless steel cylinder was filled with 0.5 kg of LIPOZYME TL IM™ immobilized on substrates. The cylinder was equipped with mesh screening material on both ends to secure the enzyme substrates and was sealed and conditioned by evacuating the catalyst of excess moisture and salts used in the enzyme manufacturing process. The cylinder was connected to a metering pump and a pressure gauge monitored by a solenoid that automatically shut down flow if the pressure at the entrance to the cylinder rose above 15 psi. Flow rate was calculated by the rate of conversion obtained from batch reactions using the same enzymatic catalyst and was 0.8 kg/hr. A stock of refined jojoba oil was fed to the reactor cylinder at a constant temperature and pressure, as the cylinder was submerged in a water batch to keep the reactor temperature constant. The resulting product exiting the cylinder was slightly yellow and liquid at room temperature. The properties of the transesterified product produced are summarized in Table 6.

TABLE 6

Components	Feedstock Composition	Enzymatically Catalyzed	% Change
Tocopherols	0.04%	0.04%	0.00%
Fatty Acid Methyl Esters	0.00%	0.00%	0.00%

12

TABLE 6-continued

	Feedstock Composition	Enzymatically Catalyzed	% Change
Free Fatty Alcohols	0.00%	0.00%	0.00%
OSI (hours)	26.5	36.2	36.6%
Wax Ester Content	98%	98%	0%
Wax Ester Distribution			
C36:1	1.12	1.20	0.080%
C38:2	6.02	4.91	-1.110%
C40:2	27.95	35.30	7.350%
C42:2	50.28	41.20	-9.080%
C44:2	9.94	14.79	4.851%
C46:2	1.2	2.14	0.940%

As can be observed, the continuous process created a fully randomized transesterified jojoba oil product that reached full conversion before exiting the reactor. Again, the increase in OSI from the feedstock material was again surprisingly noted. The transesterified product in this example was included in a cream formulation like that in Table 4 and similar visual appearance and viscosity results to the enzymatically catalyzed cream in Table 5 were observed.

Example 3

Continuous Enzymatically Catalyzed Transesterification Using Jojoba Oil and Hydrogenated Jojoba Oil

The same experimental system as in Example 2 was used but modified to operate at 70C in order to maintain a homogenous feedstock mixture of jojoba oil and hydrogenated jojoba oil entering the reactor in the feedstock. Various additional background information on the structure, use, and of transesterification reactions using hydrogenated jojoba wax esters may be found in the articles by James Brown and Robert Kleiman "Trans Isomers in Cosmetics", Parts 1 and 2, *Soap & Cosmetics*, May 2001, p. 33-36 and June 2001, as well as in Sessa et al., "Differential Scanning calorimetry Index for Estimating Level of Saturation in Transesterified Wax Esters," *J. Amer. Oil Chem. Soc.*, v. 73, 271-273 (1996), and David J. Sessa, "Derivation of a Cocoa Butter Equivalent from Jojoba Transesterified Ester via a Differential Scanning Calorimetry Index," *J. Sci. Food Agric.*, v. 72, p. 295-298 (1996) the disclosures of all of which are hereby entirely incorporated herein by reference.

Because of the absence of unsaturated wax esters in the hydrogenated jojoba wax esters (HJW), the progress of the reaction can be measured by observing the formation of monounsaturated wax esters during the reaction. The dropping point, or the temperature at which the transesterified product transitions from a semi-solid to a liquid state, was also monitored. The dropping point was calculated using the method outlined in ASTM D127-63. The results of the processing, with a comparison to a feedstock containing no hydrogenated jojoba wax esters, are included in Table 7.

TABLE 7

Components	Feedstock Composition	0% HJW	20% HJW	30% HJW
Tocopherols	0.04%	0.04%	0.04%	0.04%
Fatty Acid	0.00%	0.00%	0.00%	0.00%
Methyl Esters				
Free Fatty Alcohols	0.00%	0.00%	0.00%	0.00%

US 11,248,245 B2

13

TABLE 7-continued

Components	Feedstock Composition	0% HJW	20% HJW	30% HJW
Wax Ester Content %	98%	98%	98%	98%
Monounsaturated Wax Ester	3	3	31.98	41.50
% Conversion	N/A	99.96%	100.55%	100.01%
Dropping Point (degrees C.)	8	8	44	49

The percent conversion in Table 7 was calculated based on ideal monounsaturated wax ester values derived from the fatty acid and fatty alcohol proportions of the feedstock. These proportions (and the other wax ester distribution data in this document) were determined using the Hewlett Packard gas chromatograph disclosed herein and a solvent to solubilize the samples. During testing, approximately 1 drop of sample was diluted with 10 drops of solvent and 1.0 uL of the resulting mixture was injected into the gas chromatograph. Based on historical data for jojoba wax esters previously obtained and a theoretical randomization of the percentage of the various chain lengths (assuming all esters were transesterified), an ideal value for each wax ester species (i.e., C36:2, C42:2, etc.) can be determined. Since the C42:2 ester is the one that has the largest change from pre- to post-transesterification, it is the one used in Example 3 to monitor conversion of the reactants. The ideal percentage of C42:2 in pure jojoba oil is 41.28% following a complete and total randomization. Accordingly, the conversion of pure jojoba oil can be calculated as:

$$\% \text{ Conversion HJW0} = (\% \text{ C42:2}) / 41.28 \times 100$$

Where HJW0 is a jojoba oil feedstock that does not contain any hydrogenated jojoba wax esters. For the feedstocks that include hydrogenated jojoba oil and wax esters, the percent conversion is monitored by the formation of the monounsaturated species. The species monitored in these reactions include C38:1, C40:1, C42:1, C44:1, and C46:1. The same gas chromatographic procedures used in this document are used to monitor the various reactants during and following the transesterification reaction. Table 8 contains the ideal overall values for monounsaturated wax esters (representing all the individual species percentages added together) for a feedstock containing 20%, 30%, and 50% hydrogenated jojoba wax esters (HJW20, HJW30, and HJW50, respectively).

TABLE 8

Product	Ideal % of Monounsaturated Wax Esters
HJW20	31.20
HJW30	40.00
HJW50	46.50

These values can be used to calculate the percent conversion of jojoba wax esters to the ideal mixture of monounsaturated wax esters given the percentage of the monounsaturated components by weight in the feedstock. The calculation is given as follows:

$$\% \text{ Conversion} = (\% \text{ Monounsaturates}) / (\text{Ideal \% Monounsaturates}) \times 100$$

Because of the nature of the calculation it is possible for the calculation to be greater than 100% depending upon

14

measurement results and the fact that the ideal number is based on historical average data for jojoba oil.

Referring to FIGS. 4-7, various comparison graphs of wax ester distributions for chemically catalyzed transesterified and enzyme catalyzed transesterified jojoba wax esters are illustrated. FIG. 4 is for a pure jojoba oil product (HJW0). The solid line shows the wax ester distribution for the chemically catalyzed process and the dotted line shows the wax ester distribution for the enzymatically catalyzed process. By observation, it is clear that the enzymatically catalyzed process successfully randomizes the various esters very similarly to the chemically catalyzed process. FIGS. 5, 6, and 7 show the wax ester distributions for transesterification products that have 20%, 30%, and 50% by weight hydrogenated jojoba wax esters added in, respectively. The similarity between the solid lines (chemical) and dotted (enzyme) demonstrate how the conversion rates of the enzymatic catalyzed process track those of the chemical catalyzed process. The differences between the two processes may contribute in part to the differences in functional performance and physical properties of the enzymatically catalyzed processed material from the chemically catalyzed material.

Lipases like those disclosed herein are conventionally used for processing triglycerides, and some have been specifically selected for processing triglycerides in particular ways. For example, some lipases are known as 1, 3 specific as they are capable of scissioning the alkyl esters in the 1 and 3 positions in a triglyceride while not affecting the alkyl ester at the 2 position. Such a lipase interacts with the triglyceride molecule on the exterior of the lipase surface. Other lipases operate when the alkyl ester is inserted into the lipase molecule itself. Obviously, 1, 3 lipases will differ in their ability to process various triglyceride molecules based on the structure of the alkyl esters and the triglyceride molecule due to various factors, including steric hindrance and other steric effects.

Interestingly, both 1, 3 lipases and lipases that operate using insertion of a triglyceride work equally well when used in jojoba ester transesterification reactions. This result is unexpected, as these lipases sterically interact quite differently with the molecules they are involved in catalyzing. Without being bound by any theory, it is possible that because a jojoba ester is primarily a long carbon chain without much molecular bending due to the ester group, both 1, 3 lipases and lipases that operate using insertion are able to interact sterically with the jojoba esters in ways that produce substantially the same catalytic effect. In other words, the long chain jojoba ester can fit into the opening in an insertion lipase and also slide into the active areas of a 1, 3 lipase. As this processing characteristic for lipase catalytic processing of jojoba wax esters is not a predictable result, this illustrates a unique aspect of processing jojoba wax esters using lipases.

Furthermore, conventional processing of triglycerides using lipases typically yields up to 4000 kg of product per kg of catalyst before the catalyst must be replaced. A wide variety of factors are attributed to the eventual denaturing of the catalyst, including gumming and contamination of the catalyst with water in the triglyceride feedstock. An example of a conventional transesterification process of a triglyceride vegetable oil feedstock may be found in U.S. Patent Application Publication No. 20130149414 to Favre et al., entitled "Processing of Vegetable Oils," filed Jun. 28, 2011, and published Jun. 13, 2013, the disclosure of which is incorporated entirely herein by reference. Testing using continuous flow reactors containing immobilized lipases on sub-

US 11,248,245 B2

15

strates demonstrated 96 days of 100% conversion using 0.46 kg of catalyst in each column. At the conclusion of this time period at which the catalyst needed to be replaced, 2305.15 kg of product was produced, which resulted in a kg of product to kg of catalyst ratio of 5011. This ratio of kg of product to kg of immobilized catalyst is over 20% greater than the ratio when the same lipase is used for triglyceride production. This result when the lipase is used for catalytic transesterification of jojoba oil significantly exceeds the conventional expectations for the lipase, and is an unexpected result that is not predicted by the results of conventional enzymatic triglyceride processing. In various implementations, the yield of an enzymatically transesterified wax ester reaction may yield least 4001 kg product/kg immobilized catalyst, at least 4100 kg product/kg immobilized catalyst, at least 4200 kg product/kg immobilized catalyst, at

16

least 4300 kg product/kg immobilized catalyst, at least 4500 kg product/kg immobilized catalyst, at least 4700 kg product/kg immobilized catalyst, at least 48000 kg product/kg of immobilized catalyst, at least 4900 kg product/kg of immobilized catalyst, or even at least 5000 kg product/kg of immobilized catalyst.

In places where the description above refers to particular implementations of enzymatic catalytic transesterification systems, processes, and implementing components, sub-components, methods and sub-methods, it should be readily apparent that a number of modifications may be made without departing from the spirit thereof and that these implementations, implementing components, sub-components, methods and sub-methods may be applied to other enzymatic catalytic transesterification systems and processes.

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Gly Ala Ser Pro Ser Ser Val Ser Lys Pro Ile Leu Leu Val Pro Gly
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Thr Ala Leu Tyr Ala Gly Ser Gly Asn Asn Lys Leu Pro Val Leu Thr
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US 11,248,245 B2

17

18

-continued

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Glu	Val	Glu	Lys	Ala	Asp	Ala	Thr	Phe	Leu	Tyr	Ser	Phe	Glu	Asp	Ser
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Glu	Tyr	Trp	Ile	Lys	Ser	Gly	Thr	Leu	Val	Pro	Val	Thr	Arg	Asn	Asp
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US 11,248,245 B2

19

20

-continued

Thr Cys Leu
290

What is claimed is:

1. A process for transesterifying wax esters, the process comprising:

providing a feedstock comprising jojoba wax esters and hydrogenated jojoba wax esters, wherein the amount of hydrogenated jojoba wax esters is 20% to 50% by weight of the feedstock;

contacting the feedstock with a lipase; and transesterifying the jojoba wax esters and the hydrogenated jojoba wax esters in the feedstock with the lipase to form a transesterified product;

wherein an oxidative stability index (OSI) of the transesterified product is greater than an OSI of the feedstock.

2. The process of claim 1, wherein the feedstock consists essentially of the jojoba wax esters and the hydrogenated jojoba wax esters.

3. The process of claim 1, wherein the feedstock does not comprise any free fatty alcohols.

4. The process of claim 1, wherein the transesterified product does not comprise any methyl esters.

5. The process of claim 1, wherein the feedstock does not comprise any methyl esters.

* * * * *

Exhibit 2

Liponate™ Jojoba 20

**Sensorial & natural
emollient for active
formulations**



Liponate™ Jojoba 20

INCI : Jojoba Esters
CAS #: 61789-91-1
EC #: 612-381-6

Multi-functional

Eco-friendly, natural

Emolliency, moisturizing, softening and conditioning effects

Low odor and color

Superior oxidative stability

Improved structural integrity in stick formulations

Recommended applications



All cosmetics

Liponate™ Jojoba 20 is a part of the jojoba ester range developed by Vantage™, designed to offer oil-free wax esters for cosmetic applications.

Jojoba esters are natural, green and sustainable ingredients, derived from jojoba oil and hydrogenated jojoba oil via interesterification. Jojoba esters are available in a wide variety of forms with 5 different melting point ranges. They are ideal for use in a broad range of personal care applications, including products requiring “oil-free” label claims.

Liponate™ Jojoba 20 is a light emollient, available as a paste at room temperature, that transforms the sensorial profile of formulations to add softness, spreadability, and a subtle thickness. Unlike triglyceride oils, jojoba esters provide non-greasy emolliency and are readily absorbed into the skin.

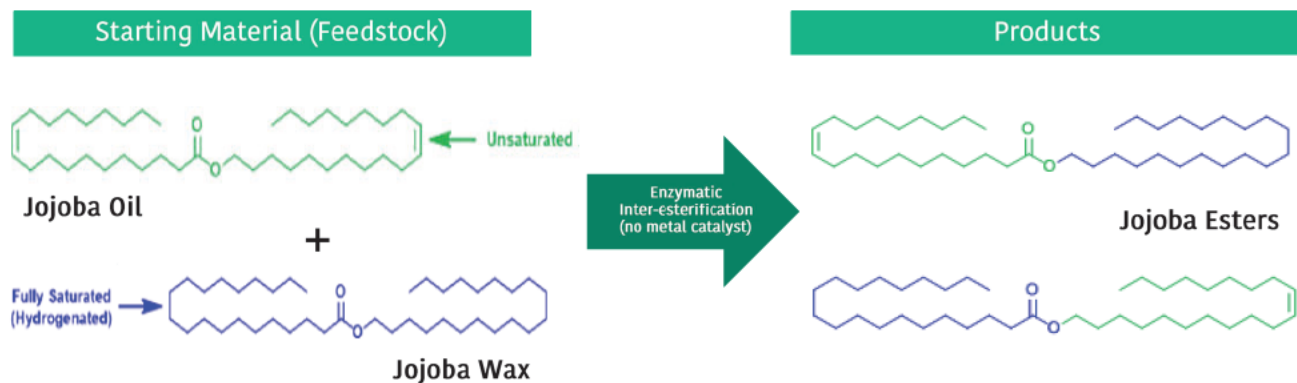
Liponate™ Jojoba 20 is a multi-functional ingredient, ideal for sensitive skin and damaged hair. It has been substantiated in-vivo for skin hydration, skin irritation reduction and contributes to restoring skin barrier after it has been deteriorated. When used in hair care formulations, Liponate™ Jojoba 20 restores and protects hair strands, by protecting them from heat damage and providing deep conditioning that leads to visibly increased shine.

Liponate™ Jojoba 20 is 100% traceable, From Farms to Formulations™, thanks to the complete integration of Vantage™ in jojoba oil and its derivatives. This complete control of the transformation chain of jojoba oil, from harvest to quality control, leads to best-in-class quality jojoba esters.



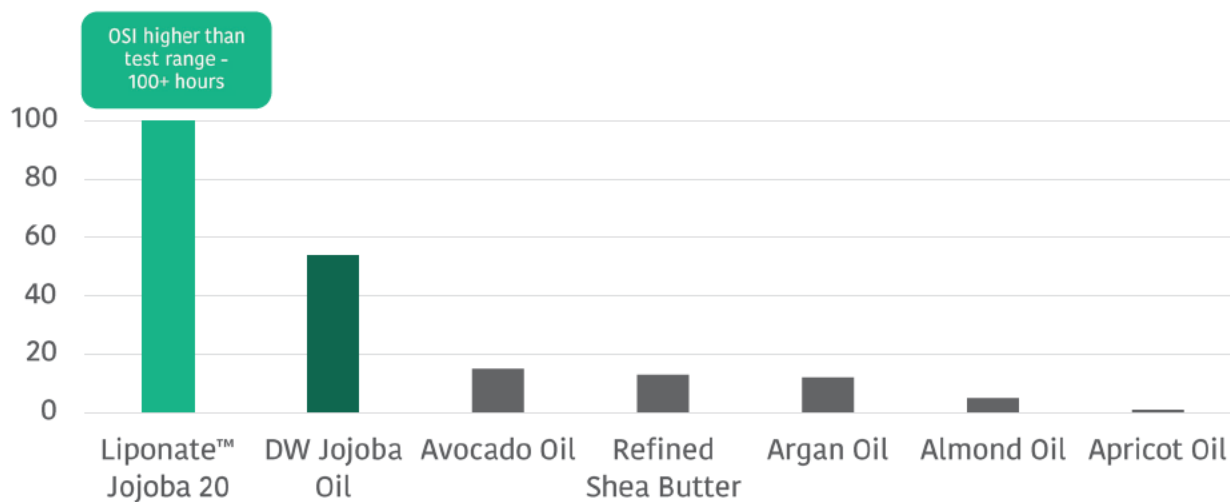
Vantage

Inter-esterification between jojoba oil and jojoba wax



The inter-esterification process creates an oil-free ingredient with unique sensorial benefits

Oxidative Stability Index studies: Liponate™ Jojoba-20



1. Jojoba Oil and jojoba esters display high oxidative stability
2. Jojoba oil and jojoba esters does not oxidize or become rancid and break down under high temperature and pressure.
3. Jojoba oil can be heated to 370°F (188°C) for 96 hours without degradation in composition and carbon chain length*
4. Jojoba oils and jojoba esters prevents formulation degradation in applications requiring high heat or hot pours

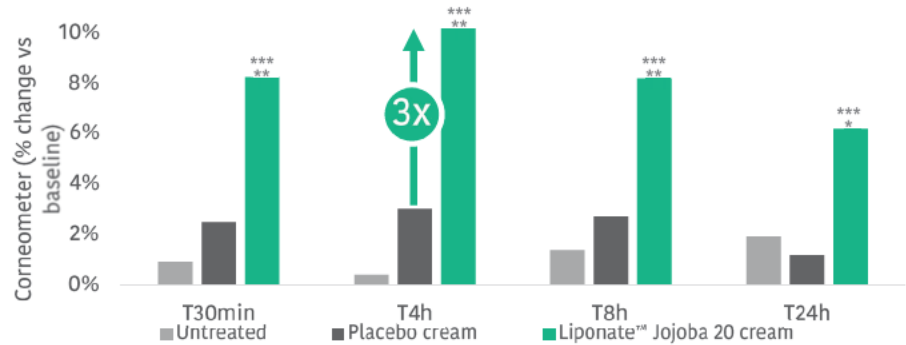
Improvement on skin hydration: Liponate™ Jojoba 20

Increase in skin hydration by Liponate™ Jojoba 20 was statistically significant vs placebo, baseline and untreated area.

Method

- 30 panelist, 20-64 years old with fair, self-perceived dry skin
- One application on arm after Baseline measurement. Double blind randomized application
- Evaluation time points: 30mins, 4hrs, 8hrs, and 24hrs after application.

Within 30 mins of application of Liponate™ Jojoba 20, skin hydration is significantly increased.



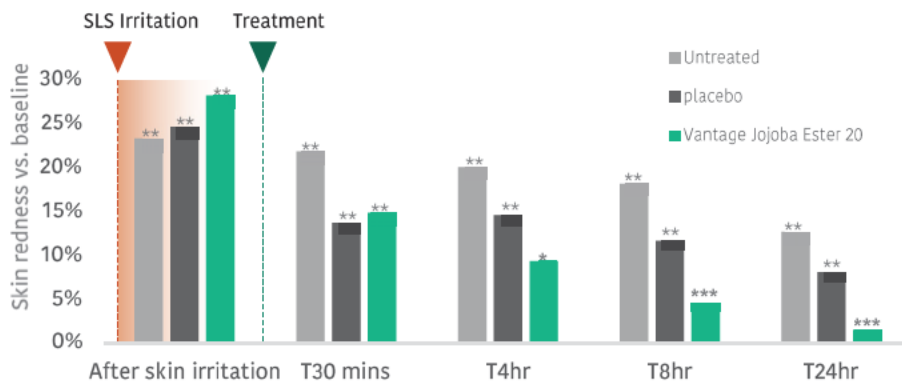
*** highly significant ($p < 0.001$) vs baseline and untreated

** statistically significant vs placebo ($p < 0.05$)

* statistically significant vs placebo ($p < 0.1$)

Reduction of skin redness: Liponate™ Jojoba 20

Reduction of skin redness using 2% Liponate™ Jojoba 20 after 0.3% SLS treatment



- Skin redness increased ~25% after 13hrs of 0.3% SLS treatment
- Appearance of skin redness reduced in 8hr with 2% Liponate™ Jojoba 20; some improvement observed at 4hrs

Liponate™ Jojoba 20 significantly reduces skin redness in 8 hours.

** statistically significant ($p < 0.05$) vs baseline
 * statistically significant ($p < 0.1$) vs placebo, untreated and baseline
 *** statistically significant ($p < 0.05$) vs placebo and untreated and statistically not significant vs baseline

Hair care benefits for damaged hair

Liponate™ Jojoba 20 was compared to DW Jojoba Oil in hair care application. The tests confirmed that the performance of jojoba esters to protect and care for the hair was greater than the one of the original jojoba oil.

55%
reduction in wet combing work

71%
reduction in dry combing work

25%
more protection against heat damage

2x
more shine

Liponate™ Jojoba 20

**Sensorial & natural
emollient for active
formulations**

Appearance @ 25°C	Cream White Paste
Melting Point	42-48°C
Iodine Value cg I/g	64 – 70 mg
Peroxide Value meg O ₂ /kg	4.0 meq/kg maximum
Recommended Use Level	1-10%

Formulation guidelines

Compatible with most oil phase ingredients to include other esters, oils, waxes, fatty alcohols, and gellants.

For high temperature formulation processing, the ester can be incorporated with the oil phase ingredients with appropriate mixing agitation. Ester should not be heated over 95°C.

For anhydrous systems, Liponate™ Jojoba 20 can be incorporated with simple mixing agitation with heat until melted and uniform.

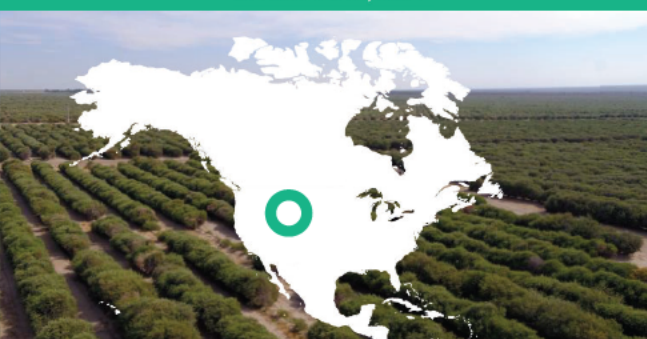
Fully integrated and secured supply chain

In 2012, Vantage™ started its From Farms to Formulations™ initiative to provide total transparency of the supply chain of jojoba oil. Our jojoba is harvested at Vantage™ owned and operated farms and the oil is processed and purified at our facilities. We carry safety stocks of unprocessed seeds and jojoba oil all year long in order to supply our customers without interruption. As the only supplier with geo-diversified farms in Argentina and USA, and a global network of 18 warehouses, Vantage™ is committed to supporting its clients with its global reach and local touch.

Agrinsa farm, Argentina



El Niño farm, USA



Crop selection and
harvest



Jojoba oil extraction
and refining



Controlled enzymatic
inter-esterification



Quality control and
performance evaluation



Our full control over the entire transformation chain guarantees the best and reproducible quality

All data, including any formulations and procedures, supplied to customers, to the knowledge of Vantage™, are supplied in good faith and believed to be reliable and accurate. Please note, however, that Vantage™ does not warrant or guarantee the accuracy, reliability or completeness of the information contained herein, and Vantage specifically disclaims all warranties, including warranties of non-infringement, merchantability and fitness for purpose. It is the user's responsibility to determine the suitability and completeness of such information for the user's particular application (including performing any necessary confirmatory tests). Vantage™ is not responsible or liable for any loss or damage that may occur from the use of this information. Nothing contained herein shall be construed as providing any permission, recommendation, or inducement to practice any patented invention without permission of the patent owner.

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Vantage

www.vantagegrp.com

CIVIL COVER SHEET

The JS 44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. (SEE INSTRUCTIONS ON NEXT PAGE OF THIS FORM.)

I. (a) PLAINTIFFS

CARGILL, INCORPORATED AND
INTERNATIONAL FLORA TECHNOLOGIES LTD.,

(b) County of Residence of First Listed Plaintiff _____
(EXCEPT IN U.S. PLAINTIFF CASES)

(c) Attorneys (Firm Name, Address, and Telephone Number)

Robert M. Oakes (302) 652-5070

Fish & Richardson P.C.

222 Delaware Avenue, 17th Floor, Wilmington, DE 19801

DEFENDANTS

VANTAGE SPECIALTY CHEMICALS, INC.,

County of Residence of First Listed Defendant _____
(IN U.S. PLAINTIFF CASES ONLY)

NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF
THE TRACT OF LAND INVOLVED

Attorneys (If Known)

II. BASIS OF JURISDICTION (Place an "X" in One Box Only)

- ☐ 1 U.S. Government Plaintiff ☒ 3 Federal Question (U.S. Government Not a Party)
- ☐ 2 U.S. Government Defendant ☐ 4 Diversity (Indicate Citizenship of Parties in Item III)

III. CITIZENSHIP OF PRINCIPAL PARTIES (Place an "X" in One Box for Plaintiff and One Box for Defendant)

- | | PTF | DEF | | PTF | DEF |
|---|----------------------------|----------------------------|---|----------------------------|----------------------------|
| Citizen of This State | ☐ 1 | ☐ 1 | Incorporated or Principal Place of Business In This State | ☐ 4 | ☐ 4 |
| Citizen of Another State | ☐ 2 | ☐ 2 | Incorporated and Principal Place of Business In Another State | ☐ 5 | ☐ 5 |
| Citizen or Subject of a Foreign Country | ☐ 3 | ☐ 3 | Foreign Nation | ☐ 6 | ☐ 6 |

IV. NATURE OF SUIT (Place an "X" in One Box Only)

Click here for: [Nature of Suit Code Descriptions](#)

CONTRACT	TORTS	FORFEITURE/PENALTY	BANKRUPTCY	OTHER STATUTES
☐ 110 Insurance ☐ 120 Marine ☐ 130 Miller Act ☐ 140 Negotiable Instrument ☐ 150 Recovery of Overpayment & Enforcement of Judgment ☐ 151 Medicare Act ☐ 152 Recovery of Defaulted Student Loans (Excludes Veterans) ☐ 153 Recovery of Overpayment of Veteran's Benefits ☐ 160 Stockholders' Suits ☐ 190 Other Contract ☐ 195 Contract Product Liability ☐ 196 Franchise	PERSONAL INJURY ☐ 310 Airplane ☐ 315 Airplane Product Liability ☐ 320 Assault, Libel & Slander ☐ 330 Federal Employers' Liability ☐ 340 Marine ☐ 345 Marine Product Liability ☐ 350 Motor Vehicle ☐ 355 Motor Vehicle Product Liability ☐ 360 Other Personal Injury ☐ 362 Personal Injury - Medical Malpractice PERSONAL INJURY ☐ 365 Personal Injury - Product Liability ☐ 367 Health Care/Pharmaceutical Personal Injury Product Liability ☐ 368 Asbestos Personal Injury Product Liability PERSONAL PROPERTY ☐ 370 Other Fraud ☐ 371 Truth in Lending ☐ 380 Other Personal Property Damage ☐ 385 Property Damage Product Liability PRISONER PETITIONS Habeas Corpus: ☐ 463 Alien Detainee ☐ 510 Motions to Vacate Sentence ☐ 530 General ☐ 535 Death Penalty Other: ☐ 540 Mandamus & Other ☐ 550 Civil Rights ☐ 555 Prison Condition ☐ 560 Civil Detainee - Conditions of Confinement	☐ 625 Drug Related Seizure of Property 21 USC 881 ☐ 690 Other LABOR ☐ 710 Fair Labor Standards Act ☐ 720 Labor/Management Relations ☐ 740 Railway Labor Act ☐ 751 Family and Medical Leave Act ☐ 790 Other Labor Litigation ☐ 791 Employee Retirement Income Security Act IMMIGRATION ☐ 462 Naturalization Application ☐ 465 Other Immigration Actions	☐ 422 Appeal 28 USC 158 ☐ 423 Withdrawal 28 USC 157 PROPERTY RIGHTS ☐ 820 Copyrights ☒ 830 Patent ☐ 835 Patent - Abbreviated New Drug Application ☐ 840 Trademark ☐ 880 Defend Trade Secrets Act of 2016 SOCIAL SECURITY ☐ 861 HIA (1395ff) ☐ 862 Black Lung (923) ☐ 863 DIWC/DIWW (405(g)) ☐ 864 SSID Title XVI ☐ 865 RSI (405(g)) FEDERAL TAX SUITS ☐ 870 Taxes (U.S. Plaintiff or Defendant) ☐ 871 IRS—Third Party 26 USC 7609	☐ 375 False Claims Act ☐ 376 Qui Tam (31 USC 3729(a)) ☐ 400 State Reapportionment ☐ 410 Antitrust ☐ 430 Banks and Banking ☐ 450 Commerce ☐ 460 Deportation ☐ 470 Racketeer Influenced and Corrupt Organizations ☐ 480 Consumer Credit (15 USC 1681 or 1692) ☐ 485 Telephone Consumer Protection Act ☐ 490 Cable/Sat TV ☐ 850 Securities/Commodities/Exchange ☐ 890 Other Statutory Actions ☐ 891 Agricultural Acts ☐ 893 Environmental Matters ☐ 895 Freedom of Information Act ☐ 896 Arbitration ☐ 899 Administrative Procedure Act/Review or Appeal of Agency Decision ☐ 950 Constitutionality of State Statutes

V. ORIGIN (Place an "X" in One Box Only)

- ☒ 1 Original Proceeding ☐ 2 Removed from State Court ☐ 3 Remanded from Appellate Court ☐ 4 Reinstated or Reopened ☐ 5 Transferred from Another District (specify) ☐ 6 Multidistrict Litigation - Transfer ☐ 8 Multidistrict Litigation - Direct File

VI. CAUSE OF ACTION

Cite the U.S. Civil Statute under which you are filing (Do not cite jurisdictional statutes unless diversity):
35 U.S.C. § 100 et seq., § 271

Brief description of cause:
Patent Infringement.

VII. REQUESTED IN COMPLAINT:

☐ CHECK IF THIS IS A CLASS ACTION UNDER RULE 23, F.R.Cv.P.

DEMAND \$

CHECK YES only if demanded in complaint:

JURY DEMAND: ☒ Yes ☐ No

VIII. RELATED CASE(S) IF ANY

(See instructions):

JUDGE

DOCKET NUMBER

DATE

Jul 26, 2022

SIGNATURE OF ATTORNEY OF RECORD

/s/ Robert M. Oakes

FOR OFFICE USE ONLY

RECEIPT # _____ AMOUNT _____ APPLYING IFP _____ JUDGE _____ MAG JUDGE _____

INSTRUCTIONS FOR ATTORNEYS COMPLETING CIVIL COVER SHEET FORM JS 44**Authority For Civil Cover Sheet**

The JS 44 civil cover sheet and the information contained herein neither replaces nor supplements the filings and service of pleading or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. Consequently, a civil cover sheet is submitted to the Clerk of Court for each civil complaint filed. The attorney filing a case should complete the form as follows:

- I.(a) **Plaintiffs-Defendants.** Enter names (last, first, middle initial) of plaintiff and defendant. If the plaintiff or defendant is a government agency, use only the full name or standard abbreviations. If the plaintiff or defendant is an official within a government agency, identify first the agency and then the official, giving both name and title.
- (b) **County of Residence.** For each civil case filed, except U.S. plaintiff cases, enter the name of the county where the first listed plaintiff resides at the time of filing. In U.S. plaintiff cases, enter the name of the county in which the first listed defendant resides at the time of filing. (NOTE: In land condemnation cases, the county of residence of the "defendant" is the location of the tract of land involved.)
- (c) **Attorneys.** Enter the firm name, address, telephone number, and attorney of record. If there are several attorneys, list them on an attachment, noting in this section "(see attachment)".
- II. **Jurisdiction.** The basis of jurisdiction is set forth under Rule 8(a), F.R.Cv.P., which requires that jurisdictions be shown in pleadings. Place an "X" in one of the boxes. If there is more than one basis of jurisdiction, precedence is given in the order shown below.
 United States plaintiff. (1) Jurisdiction based on 28 U.S.C. 1345 and 1348. Suits by agencies and officers of the United States are included here.
 United States defendant. (2) When the plaintiff is suing the United States, its officers or agencies, place an "X" in this box.
 Federal question. (3) This refers to suits under 28 U.S.C. 1331, where jurisdiction arises under the Constitution of the United States, an amendment to the Constitution, an act of Congress or a treaty of the United States. In cases where the U.S. is a party, the U.S. plaintiff or defendant code takes precedence, and box 1 or 2 should be marked.
 Diversity of citizenship. (4) This refers to suits under 28 U.S.C. 1332, where parties are citizens of different states. When Box 4 is checked, the citizenship of the different parties must be checked. (See Section III below; **NOTE: federal question actions take precedence over diversity cases.**)
- III. **Residence (citizenship) of Principal Parties.** This section of the JS 44 is to be completed if diversity of citizenship was indicated above. Mark this section for each principal party.
- IV. **Nature of Suit.** Place an "X" in the appropriate box. If there are multiple nature of suit codes associated with the case, pick the nature of suit code that is most applicable. Click here for: [Nature of Suit Code Descriptions](#).
- V. **Origin.** Place an "X" in one of the seven boxes.
 Original Proceedings. (1) Cases which originate in the United States district courts.
 Removed from State Court. (2) Proceedings initiated in state courts may be removed to the district courts under Title 28 U.S.C., Section 1441.
 Remanded from Appellate Court. (3) Check this box for cases remanded to the district court for further action. Use the date of remand as the filing date.
 Reinstated or Reopened. (4) Check this box for cases reinstated or reopened in the district court. Use the reopening date as the filing date.
 Transferred from Another District. (5) For cases transferred under Title 28 U.S.C. Section 1404(a). Do not use this for within district transfers or multidistrict litigation transfers.
 Multidistrict Litigation – Transfer. (6) Check this box when a multidistrict case is transferred into the district under authority of Title 28 U.S.C. Section 1407.
 Multidistrict Litigation – Direct File. (8) Check this box when a multidistrict case is filed in the same district as the Master MDL docket.
PLEASE NOTE THAT THERE IS NOT AN ORIGIN CODE 7. Origin Code 7 was used for historical records and is no longer relevant due to changes in statute.
- VI. **Cause of Action.** Report the civil statute directly related to the cause of action and give a brief description of the cause. **Do not cite jurisdictional statutes unless diversity.** Example: U.S. Civil Statute: 47 USC 553 Brief Description: Unauthorized reception of cable service.
- VII. **Requested in Complaint.** Class Action. Place an "X" in this box if you are filing a class action under Rule 23, F.R.Cv.P.
 Demand. In this space enter the actual dollar amount being demanded or indicate other demand, such as a preliminary injunction.
 Jury Demand. Check the appropriate box to indicate whether or not a jury is being demanded.
- VIII. **Related Cases.** This section of the JS 44 is used to reference related pending cases, if any. If there are related pending cases, insert the docket numbers and the corresponding judge names for such cases.

Date and Attorney Signature. Date and sign the civil cover sheet.