derivatives made from these feedstocks appear to be unknown. Moreover, alkoxylated fatty esters and their derivatives have not been made from the C_{18} unsaturated diesters that can be made readily by self-metathesis of a natural oil.

In sum, traditional sources of fatty acids and esters used for making alkoxylated fatty esters and their derivatives generally have predominantly (or exclusively) *cis*-isomers and lack relatively short-chain (e.g., C_{10} or C_{12}) unsaturated fatty portions. Metathesis chemistry provides an opportunity to generate precursors having shorter chains and mostly *trans*- isomers, which could impart improved performance when the precursors are converted to downstream compositions (e.g., in surfactants). New C_{18} difunctional alkoxylated fatty esters and derivatives are also potentially available from oil or C_{10} unsaturated acid or ester self-metathesis. In addition to an expanded variety of precursors, the unsaturation present in the precursors allows for further functionalization, e.g., by sulfonation or sulfitation.

SUMMARY OF THE INVENTION

The present disclosure relates to alkoxylated fatty ester compositions.

In one aspect, the present disclosure provides an alkoxylated fatty ester having the formula:

$$R^2\text{-CO-O-(AO)}_n\text{-}R^1$$

wherein: R^1 is C_1-C_4 alkyl; AO is C_2-C_4 oxyalkylene; R^2 is R^3-CH=CH-$(CH_2)_7$- or R^1(AO)n-O-CO-$(CH_2)_7$-CH=CH-$(CH_2)_7$-; R^3 is hydrogen or C_1-C_7 alkyl; and n, which is the average number of oxyalkylene units, has a value within the range of 1 to 100; and

wherein when R^3 is C_1-C_7 alkyl, the fatty ester has at least 1 mole % of *trans*-Δ^9 unsaturation.

The present disclosure provides that the compositions comprise a reaction product of a metathesis-derived C_{10}-C_{17} monounsaturated acid, octadecene-1,18-dioic acid, or their ester derivatives with one or more alkylene oxides in the presence of an insertion catalyst to give an alkoxylated fatty ester. The present disclosure further provides that the metathesis-derived C_{10}-C_{17} monounsaturated acid, octadecene-1,18-dioic acid, or its ester derivative is reacted with

a glycol ether or a glycol ether alkoxylate, optionally in the presence of an esterification or transesterification catalyst, to give an alkoxylated fatty ester. The present disclosure also provides that the metathesis-derived C_{10}-C_{17} monounsaturated acid or octadecene-1,18-dioic acid is reacted with one or more alkylene oxides to give a fatty acid alkoxylate, followed by etherification of the fatty acid alkoxylate.

In another aspect, the present disclosure provides a derivative made by sulfonating or sulfitating the fatty ester as disclosed herein.

The present disclosure includes derivatives made by sulfonating or sulfitating the alkoxylated fatty esters. Alkoxylated fatty esters and their derivatives are valuable for a wide variety of end uses, including cleaners, fabric treatment, hair conditioning, personal care (liquid cleansing products, conditioning bars, oral care products), antimicrobial compositions, agricultural uses, and oil field applications.

In another aspect, the present disclosure provides an anionic or a nonionic emulsifier for agricultural compositions comprising the fatty ester or the derivative as disclosed herein.

In a further aspect, the present disclosure provides an agricultural solvent comprising the fatty ester or the derivative as disclosed herein.

In another aspect, the present disclosure provides a water-soluble herbicide composition comprising the fatty ester or the derivative as disclosed herein.

In another aspect, the present disclosure provides an antimicrobial composition comprising the fatty ester or the derivative as disclosed herein.

In a further aspect, the present disclosure provides an aqueous hard-surface cleaner, a handsoap, or a laundry detergent each comprising the fatty ester or the derivative as disclosed herein.

In another aspect, the present disclosure provides the use of the fatty ester or of the derivative as disclosed herein as surfactant, emulsifier, skin-feel agent, film former, rheological modifier, biocide, biocide potentiator, solvent, release agent, conditioner, personal care product, household product, industrial or institutional cleaner, in emulsion polymerization, as wetting agent or dispersant, as inert ingredient in pesticides, as adjuvant for delivery of pesticides for crop protection, home and garden, and professional applications, in oil field applications, as foam moderator or dispersant for

the manufacture of gypsum, cement wall board, concrete additives and firefighting foams, as coalescent for paints and coatings, or as polyurethane-based adhesive.

We claim:

1. An alkoxylated fatty ester having the formula:

$$R^2\text{-CO-O-(AO)}_n\text{-}R^1$$

wherein: R^1 is C_1-C_4 alkyl; AO is C_2-C_4 oxyalkylene; R^2 is R^3-CH=CH-$(CH_2)_7$- or R^1(AO)n-O-CO-$(CH_2)_7$-CH=CH-$(CH_2)_7$-; R^3 is hydrogen or C_1-C_7 alkyl; and n, which is the average number of oxyalkylene units, has a value within the range of 1 to 100; and

wherein when R^3 is C_1-C_7 alkyl, the fatty ester has at least 1 mole % of *trans*-Δ^9 unsaturation.

2. A derivative made by sulfonating or sulfitating the fatty ester of claim **1**.

3. The fatty ester of claim **1** wherein the oxyalkylene is selected from the group consisting of ethylene oxide, propylene oxide, butylene oxides, and combinations thereof, preferably ethylene oxide.

4. The fatty ester of claim **1** wherein AO is oxyethylene and n has a value within the range of 1 to 5, 5 to 15 or 15 to 50.

5. The fatty ester of claim **1** having at least 25 mole % of *trans*-Δ^9 unsaturation when R^3 is C_1-C_7 alkyl.

6. The fatty ester of claim **1** wherein R^1 is methyl.

7. An anionic or nonionic emulsifier for agricultural compositions comprising the fatty ester of claim **1** or the derivative of claim **2**.

8. An agricultural solvent comprising the fatty ester of claim **1** or the derivative of claim **2**.

9. A water-soluble herbicide composition comprising the fatty ester of claim **1** or the derivative of claim **2**.

10. An antimicrobial composition comprising the fatty ester of claim **1** or the derivative of claim **2**.

11. An aqueous hard-surface cleaner, a handsoap, or a laundry detergent each comprising the fatty ester of claim **1** or the derivative of claim **2**.

12. Use of the fatty ester of claim **1** or of the derivative of claim **2** as surfactant, emulsifier, skin-feel agent, film former, rheological modifier, biocide, biocide potentiator, solvent, release agent, conditioner, personal care product, household product, industrial or institutional cleaner, in emulsion polymerization, as wetting agent or dispersant, as inert ingredient in pesticides, as adjuvant for delivery of pesticides for crop protection, home and garden, and professional applications, in oil field applications, as foam moderator or dispersant for the manufacture of gypsum, cement wall board, concrete additives and firefighting foams, as coalescent for paints and coatings, or as polyurethane-based adhesive.