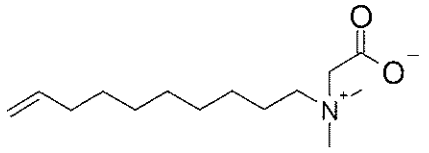
bargain laundry detergents is not easily inferred from surfactant structure, we performed extensive experimental investigations to identify subclasses of surfactants having desirable performance in these areas.

New surfactant classes are always of interest to formulators of laundry detergents. Surfactants based on renewable resources will continue to be in demand as alternatives to petroleum-based surfactants. Traditional natural sources of fatty acids and esters used for making surfactants 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). Formulators will benefit from identification of particular subclasses of surfactants that derive from renewable sources and have desirable attributes for use in laundry detergents.

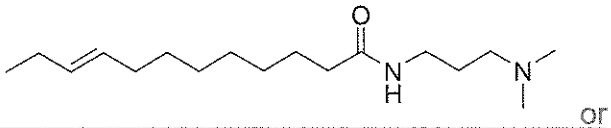
SUMMARY ~~OF THE INVENTION~~

In one ~~aspect~~embodiment, the ~~invention~~ present disclosure relates to a laundry detergent useful for cold-water cleaning. This detergent comprises an anionic surfactant, a nonionic surfactant, a fatty alkyl ester sulfonate, and a surfactant composition derived from a metathesis-derived C_{10}-C_{17} monounsaturated acid, octadecene-1,18-dioic acid, or their ester derivatives. The metathesis-derived surfactant composition is selected from C_{10} betaines, C_{12} or C_{16} amidoamines, C_{12} ethanolamine amides, C_{16} amidoamine sulfonates, C_{18} diamidoamine dioxides, quaternized C_{18} diamidoamine betaines, sulfonated C_{18} low-EO fatty ester alkoxylates, C_{18} amidoamine carboxylates, and amidoamine oxides and sulfobetaines derived from cross-metathesis of palm or soybean oil. In a first aspect, there is provided a laundry detergent useful for cold-water cleaning, comprising 1 to 70 wt.% of an anionic surfactant, 5 to 70 wt.% of a nonionic surfactant, 3 to 25 wt.% of a fatty alkyl ester sulfonate, and 0.5 to 10 wt.% of a metathesis-based surfactant composition selected from the group consisting of:

(a) a C_{10} betaine having the structure:



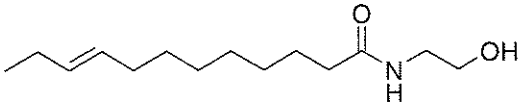
(b) a C_{12} or C_{16} amidoamine having the structure:



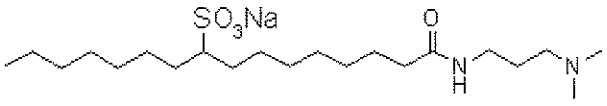
or



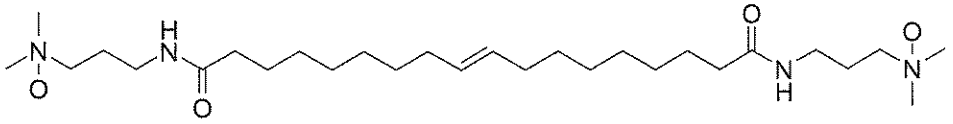
(c) a C_{12} ethanolamine amide having the structure:



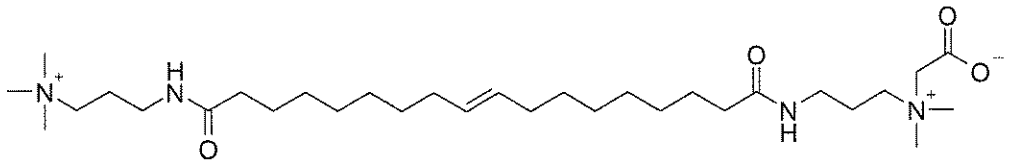
(d) a C_{16} amidoamine sulfonate having the structure:



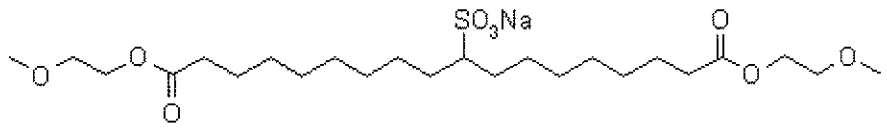
(e) a C_{18} diamidoamine dioxide having the structure:



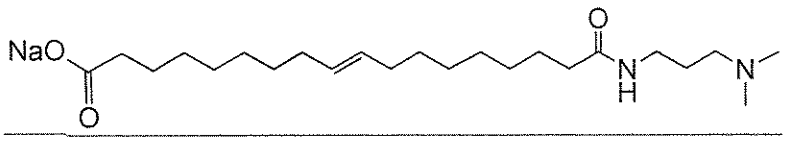
(f) a quaternized C_{18} diamidoamine betaine having the structure:



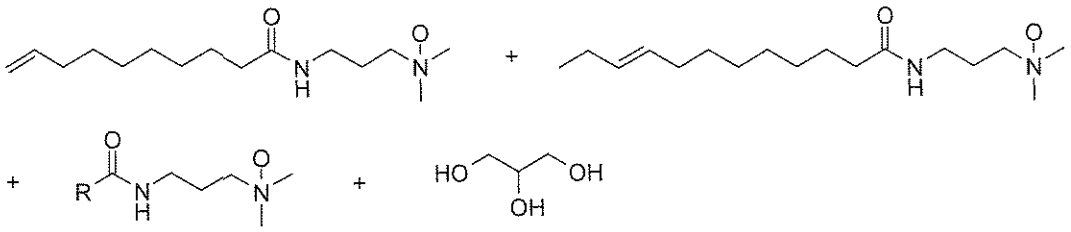
(g) a sulfonated C_{18} low-EO fatty ester alkoxylates having the structure:



(h) a C_{18} amidoamine carboxylate having the structure:



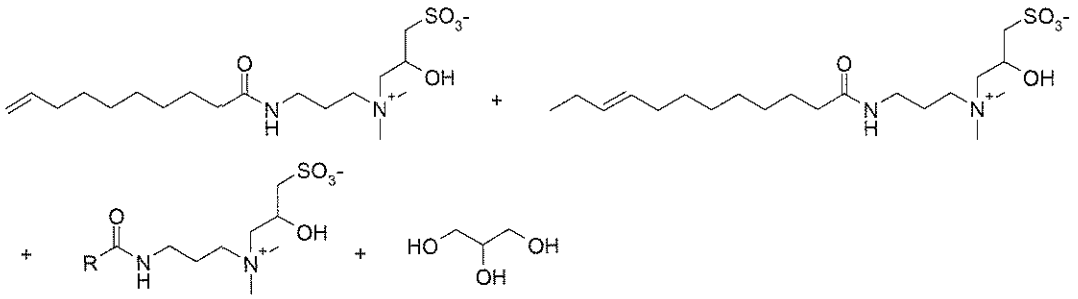
(i) an amidoamine oxide derived from cross-metathesis of palm or soybean oil having the structure:



R = C16, C18 Sat.

and

(j) a sulfobetaine derived from cross-metathesis of palm or soybean oil having the structure:



R = C16, C18 Sat.

The ~~invention~~ present disclosure includes a boosted bargain laundry detergent. This detergent comprises an anionic surfactant, a nonionic surfactant, and a performance booster derived from a metathesis-derived C_{10}-C_{17} monounsaturated acid, octadecene-1,18-dioic acid, or their ester derivatives and selected from the group consisting of C_{12} low-EO fatty ester alkoxylate sulfonates, C_{18} amidoamine oxide esters, C_{18} amidoamine

oxide carboxylates, and amidoamine sulfobetaines made from self-metathesized palm or soybean oil.

The inventive compositions can take many forms, including liquid, powder, paste, granule, tablet, molded solid, water-soluble sheet, or water-soluble sachet. In another aspect, there is provided a liquid, powder, paste, granule, tablet, molded solid, water-soluble sheet, or water-soluble sachet comprising the detergent of the first aspect. In another aspect, there is provided a storage-stable liquid detergent of the first aspect further comprising water. We surprisingly found that the particular classes of surfactant compositions and performance boosters identified above, all derived from renewable resources, rival or outperform commercial standards when tested as either a complement to an alkyl ester sulfonate for cold-water detergents or as a booster for a bargain detergent formula.

DETAILED DESCRIPTION OF THE INVENTION

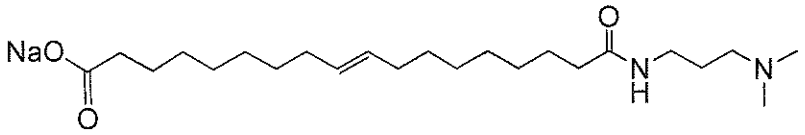
Detergent compositions useful for cold-water cleaning comprise an anionic surfactant, a nonionic surfactant, a fatty alkyl ester sulfonate, and a surfactant composition derived from a metathesis-derived C_{10}-C_{17} monounsaturated acid, octadecene-1,18-dioic acid, or their ester derivatives. The metathesis-derived surfactant composition is selected from C_{10} betaines, C_{12} or C_{16} amidoamines, C_{12} ethanolamine amides, C_{16} amidoamine sulfonates, C_{18} diamidoamine dioxides, quaternized C_{18} diamidoamine betaines, sulfonated C_{18} low-EO fatty ester alkoxylates, C_{18} amidoamine carboxylates, and amidoamine oxides and sulfobetaines derived from cross-metathesis of palm or soybean oil.

The detergent composition can take any of a number of forms. For example, it can be an isotropic liquid, a surfactant-structured liquid, a granular, spray-dried or dry-blended powder, a tablet, a paste, a molded solid, or any other laundry detergent form known to those skilled in the art. Water soluble sheets or sachets, such as those described in U.S. Pat. Appl. Publ. No. 2002/0187909, which is incorporated herein by reference, are also suitable.

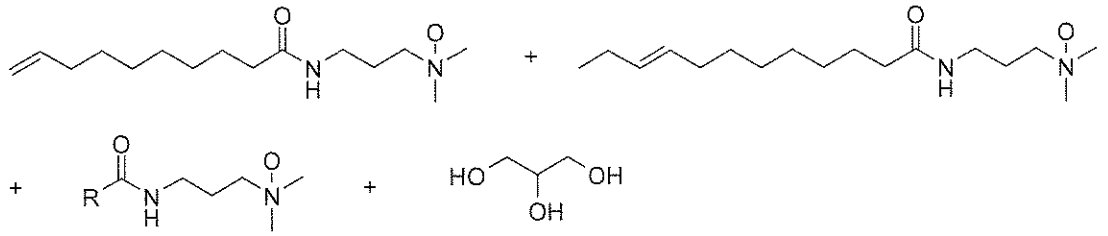
Suitable anionic surfactants are well known in the art. Anionic surfactants generally have a molecular weight below 10,000 and comprise one or more functional

groups that exhibit a net anionic charge when in aqueous solution at the normal wash pH, which typically ranges from 6 to 11. Suitable anionic surfactants include C_4-C_{30} carboxylates, fatty alkyl sulfates (alcohol sulfates, "AS"), fatty alkyl ether sulfates (alcohol ether sulfates, "AES"), paraffin sulfonates, olefin sulfonates, alkyl aryl

(h) a C_{18} amidoamine carboxylate having the structure:



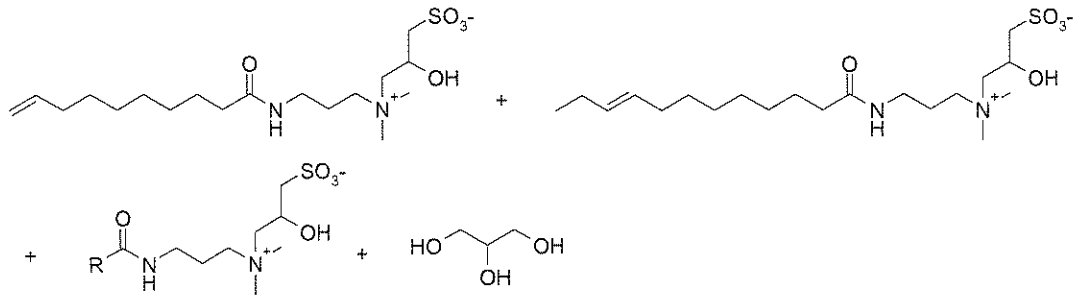
(i) an amidoamine oxide derived from cross-metathesis of palm or soybean oil having the structure:



R = C16, C18 Sat.

and

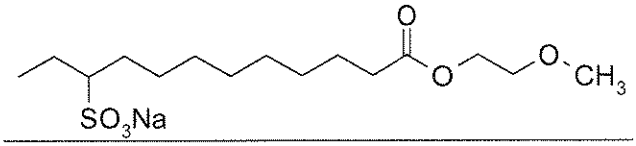
(j) a sulfobetaine derived from cross-metathesis of palm or soybean oil having the structure:



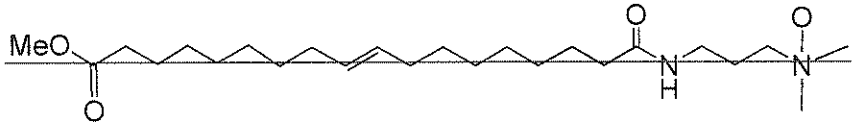
R = C16, C18 Sat.

~~2. A boosted bargain laundry detergent, comprising 1 to 70 wt.% of an anionic surfactant, 5 to 70 wt.% of a nonionic surfactant, and 0.1 to 5 wt.% of a metathesis-based performance booster selected from the group consisting of:~~

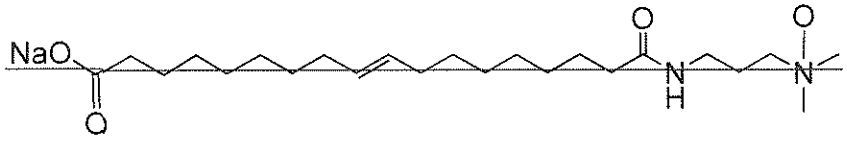
~~(a) a C_{42} low-EO fatty ester alkoxylate sulfonate having the structure:~~



~~(b) a C_{18} amidoamine oxide ester having the structure:~~

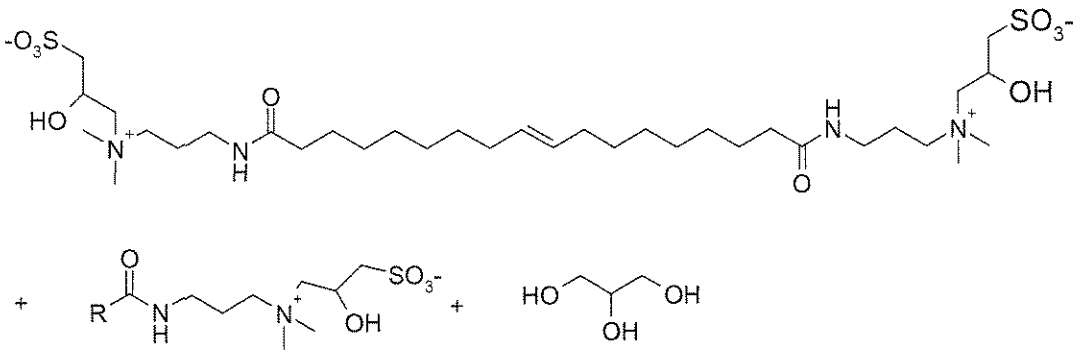


~~(c) a C_{18} amidoamine oxide carboxylate having the structure:~~



~~and~~

~~(d) an amidoamine sulfobetaine made from self-metathesized palm or soybean oil having the structure:~~



~~R = C16, C18 Sat. + Unsat.~~

~~32~~. The detergent of claim **1** wherein the nonionic surfactant is a fatty alcohol ethoxylate.

~~34~~. The detergent of claim **1** ~~or 2~~ wherein the acid or ester metathesis-based surfactant composition has at least 1 mole % of *trans*-Δ^9 unsaturation.

~~45~~. A liquid, powder, paste, granule, tablet, molded solid, water-soluble sheet, or water-soluble sachet comprising the detergent of claim **1** ~~or 2~~.

~~56~~. The detergent of claim **1** further comprising ~~30 to 80 wt.% of~~ water.

~~67~~. A storage-stable liquid detergent of claim ~~65~~.

~~78~~. The detergent of claim **1** that is a liquid at 20°C and exhibits a phase transition below 5°C.

~~9. The detergent of claim 2 further comprising 40 to 90 wt.% of water.~~