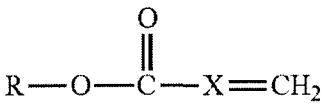
Claims:

1. A method of refining a natural oil, comprising:
providing a feedstock comprising a natural oil;
reacting the feedstock in a metathesis reactor in the presence of a first metathesis catalyst to form a metathesized product comprising olefins and esters;
separating the olefins in the metathesized product from the esters in the metathesized product;
transesterifying the esters in the presence of an alcohol to form a transesterified product comprising a terminal olefin ester having the following structure:



wherein X is a C_3-C_{18} saturated or unsaturated alkyl chain, and R is an alkyl group;
and
reacting the terminal olefin ester with an internal olefin ester in the presence of a second metathesis catalyst to form a dibasic ester.

2. The method of claim 1, wherein R is methyl.

3. The method of claim 1, wherein the weight ratio of the terminal olefin ester to the internal olefin ester is between 5:1 and 1:5.

4. The method of claim 1, wherein the weight ratio of the terminal olefin ester to the internal olefin ester is 1:1.

5. The method of claim 1, wherein the terminal olefin ester is selected from the group consisting of: 4-pentenoic acid ester, 5-hexenoic acid ester, 6-heptenoic acid ester, 7-octenoic acid ester, 8-nonenoic acid ester, 9-decenoic acid ester, 10-undecenoic acid ester, 11-dodecenoic acid ester, 12-tridecenoic acid ester, 13-tetradecenoic acid ester, 14-pentadecenoic acid ester, 15-hexadecenoic acid ester, 16-heptadecenoic acid ester, 17-octadecenoic acid ester, and mixtures thereof.

6. The method of claim 1, wherein the terminal olefin ester is 9-decenoic acid ester.

7. The method of claim 1, wherein the internal olefin ester is selected from the group consisting of: pentenoic acid esters, hexenoic acid esters, heptenoic acid esters, octenoic acid esters, nonenoic acid esters, decenoic acid esters, undecenoic acid esters, dodecenoic acid esters, tridecenoic acid esters, tetradecenoic acid esters, pentadecenoic acid esters, hexadecenoic acid esters, heptadecenoic acid esters, octadecenoic acid esters, and mixtures thereof.

8. The method of claim 1, wherein the internal olefin ester is 9-dodecenoic acid ester.

9. The method of claim 1, further comprising providing a low-molecular-weight olefin or a mid-weight olefin, wherein the reacting step comprises a cross-metathesis reaction between the feedstock and the low-molecular-weight olefin or mid-weight olefin.

10. The method of claim 9, wherein the low-molecular-weight olefin comprises at least one low-molecular-weight olefin selected from the group consisting of propylene, 1-butene, 2-butene, 3-hexene, and mixtures thereof.

11. The method of claim 1, wherein the internal olefin ester is formed by reacting a portion of the terminal olefin ester with a low-molecular-weight internal olefin in the presence of a third metathesis catalyst.

12. The method of claim 11, wherein the low-molecular-weight internal olefin is selected from the group consisting of: 2-butene, 2-pentene, 2-hexene, 3-hexene, 2-heptene, 3-heptene, 2-octene, 3-octene, 2-nonene, 3-nonene, and mixtures thereof.

13. The method of claim 11, wherein the low-molecular-weight internal olefin is 3-hexene.

14. The method of claim 1, wherein the dibasic ester is 9-octadecene dioic acid dimethyl ester.

15. The method of claim 1, further comprising hydrolyzing the dibasic ester.

16. The method of claim 1, wherein the olefin byproduct is removed from the metathesis product during the reaction of the terminal olefin and internal olefin, improving the yield of the dibasic ester and/or dibasic acid.

17. The method of claim 1, wherein at least 70 wt % dibasic ester and/or dibasic acid is formed in the presence of less than 150 ppm.

18. A method of refining a natural oil, comprising:
providing a feedstock comprising a natural oil;
reacting the feedstock in a metathesis reactor in the presence of a first metathesis catalyst to form a metathesized product comprising olefins and esters;
separating the olefins in the metathesized product from the esters in the metathesized product;
transesterifying the esters in the presence of an alcohol to form a transesterified product comprising 9-decenoic acid ester; and
reacting the 9-decenoic acid ester with 9-dodecenoic acid ester in the presence of a second metathesis catalyst to form 9-octadecene dioic acid ester.

19. The method of claim 18, wherein the 9-dodecenoic acid ester is formed by reacting a portion of the 9-decenoic acid ester with a low-molecular-weight internal olefin or a mid-weight internal olefin in the presence of a third metathesis catalyst.

20. The method of claim 19, wherein the low-molecular-weight internal olefin is 3-hexene.

21. The method of claim 18, further comprising hydrolyzing the 9-octadecene dioic acid ester to form 9-octadecene dioic acid.