FOOD PRODUCT COATINGS

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of the earlier filing date of U.S. Provisional Patent Application No. 62/452,897, filed on January 31, 2017, which is incorporated herein by reference in its entirety.

FIELD

[0002] Disclosed herein are embodiments of coating compositions and films for foodstuffs and methods of making and using the same.

BACKGROUND

[0003] Cavendish banana (Musa acuminate) is a rich source of vitamins and bioactive compounds (e.g. dietary fiber and phenolic compounds), and one of mostly consumed fruit worldwide. As a climacteric fruit, however, bananas have a relatively short shelf-life, regarding physiological disorder, postharvest diseases, and senescence. Bananas are just one example of foods that typically require an external modification to preserve shelf-life of the food. There remains a need in the art for improved compositions and coatings that can improve self-life and/or pre-harvest integrity of various food items, such as perishable foods, plants and plant parts.

SUMMARY

[0004] Disclosed herein are examples of a coating composition, comprising a cellulose nanomaterial and an emulsion system, comprising a hydrophobic agent (e.g., a fatty acid) and a surfactant. The coating compositions can further comprise a functional agent, a plasticizer, or any combination thereof. In some examples, the cellulose nanomaterial can comprise cellulose nanocrystals or cellulose nanofibrils.

[0004a] In one aspect, the present disclosure refers to a coating composition, comprising: cellulose nanofibrils or cellulose nanocrystals in an amount ranging from 0.1% w/w wet basis to 1% w/w wet basis; and an emulsion system, comprising a fatty acid and a surfactant that forms hydrophobic droplets and promotes placement of the emulsion system into a matrix comprising the cellulose nanofibrils or the cellulose nanocrystals, wherein the fatty acid is a medium-chain fatty acid having an aliphatic tail comprising 6 to 12 carbon atoms or a long-chain fatty acid having an aliphatic tail comprising 13 to 21 carbon atoms and the fatty acid is present in an amount ranging from 0.1% w/w wet basis to 5% w/w wet basis and the surfactant is selected from a sucrose ester of a fatty acid, a polysorbate, a sorbitan, or any combination thereof and the surfactant is present in an amount ranging from 0.1% w/w wet basis to 2% w/w wet basis.

[0004b] In another aspect, the present disclosure refers to a coating composition, comprising: cellulose nanofibrils or cellulose nanocrystals in an amount ranging from 0.1% w/w wet basis to 1% w/w wet basis; and an emulsion system, comprising oleic acid and a sucrose ester of a fatty acid, that forms hydrophobic droplets and promotes placement of the emulsion system into a matrix comprising the cellulose nanofibrils or the cellulose nanocrystals, wherein the oleic acid is present in an amount ranging from 0.1% w/w wet basis to 5% w/w wet basis and the sucrose ester of a fatty acid is

present in an amount ranging from 0.1% w/w wet basis to 2% w/w wet basis; wherein the cellulose nanofibrils or cellulose nanocrystals and the emulsion system are present at a ratio ranging from 1:1 to 1:20.

[0004c] ~~In another aspect, the present disclosure refers to~~Disclosed herein is a coating composition, comprising: a cellulose nanomaterial consisting of cellulose nanocrystals in an amount ranging from 0.1% w/w wet basis to 1% w/w wet basis; and an emulsion system, comprising a fatty acid that is a medium-chain fatty acid having an aliphatic tail comprising 6 to 12 carbon atoms or a long-chain fatty acid having an aliphatic tail comprising 13 to 21 carbon atoms and is present in an amount ranging from 0.1% w/w wet basis to 3% w/w wet basis; and chitosan.

[0005] Also disclosed herein are examples of a dried (or substantially dried) coating comprising a cellulose nanomaterial and an emulsion system, comprising a hydrophobic agent and a surfactant and substantially free of moisture. In some examples, the coating composition or the dried (or substantially) dried coating can be used to coat a foodstuff, such as a plant or plant part.

[0005a] In another aspect, the present disclosure refers to a dried coating, comprising a matrix comprising cellulose nanofibrils or cellulose nanocrystals and an emulsion system dispersed within the ~~cellulose nanomaterial~~matrix, wherein the emulsion system comprises (i) a fatty acid that is a medium-chain fatty acid having an aliphatic tail comprising 6 to 12 carbon atoms or a long-chain fatty acid having an aliphatic tail comprising 13 to 21 carbon atoms; and (ii) a surfactant ~~that forms hydrophobic droplets and promotes placement of the emulsion system into a matrix comprising the cellulose nanofibrils or the cellulose nanocrystals and that is~~ selected from a sucrose ester of a fatty acid, a polysorbate, a sorbitan, or any combination thereof, optionally wherein the dried coating comprises greater than 0% to 10% moisture.

[0005b] In another aspect, the present disclosure refers to a plant part, comprising a coating formed from the coating composition as disclosed herein.

[0005c] In another aspect, the present disclosure refers to a plant part, comprising the dried coating as disclosed herein.

[0006] Also disclosed herein are examples of a method, comprising coating or substantially coating a plant or plant part with a coating composition example described herein.

[0006a] In another aspect, the present disclosure refers to a method, comprising coating, optionally completely coating, a plant or a plant part with a coating composition comprising cellulose nanofibrils or cellulose nanocrystals in an amount ranging from 0.1% w/w wet basis to 1% w/w wet basis; and an emulsion system comprising a fatty acid and a surfactant that forms hydrophobic droplets and promotes placement of the emulsion system into a matrix comprising the cellulose nanofibrils or the cellulose nanocrystal, wherein the fatty acid is a medium-chain fatty acid having an aliphatic tail comprising 6 to 12 carbon atoms or a long-chain fatty acid having an aliphatic tail comprising 13 to 21 carbon atoms and the fatty acid is present in an amount ranging from 0.1% w/w wet basis to 5% w/w wet basis and the surfactant is selected from a sucrose ester of a fatty acid, a polysorbate, a sorbitan, or any combination thereof and the surfactant is present in an amount ranging from 0.1% w/w wet basis to 2% w/w wet basis.

[0007] The foregoing and other objects, features, and advantages of the present disclosure will become more apparent from the following detailed description, which proceeds with reference to the accompanying figures.

CLAIMS

1. A coating composition, comprising:

cellulose nanofibrils or cellulose nanocrystals in an amount ranging from 0.1% w/w wet basis to 1% w/w wet basis; and

an emulsion system, comprising a fatty acid and a surfactant that forms hydrophobic droplets and promotes placement of the emulsion system into a matrix comprising the cellulose nanofibrils or the cellulose nanocrystals, wherein the fatty acid is a medium-chain fatty acid having an aliphatic tail comprising 6 to 12 carbon atoms or a long-chain fatty acid having an aliphatic tail comprising 13 to 21 carbon atoms and the fatty acid is present in an amount ranging from 0.1% w/w wet basis to 5% w/w wet basis and the surfactant is selected from a sucrose ester of a fatty acid, a polysorbate, a sorbitan, or any combination thereof and the surfactant is present in an amount ranging from 0.1% w/w wet basis to 2% w/w wet basis.

2. The coating composition of claim 1, comprising cellulose nanofibrils.

3. The coating composition of claim 2, wherein the cellulose nanofibrils are present in an amount ranging from 0.1% w/w wet basis to 0.5% w/w wet basis.

4. The coating composition of claim 1, comprising cellulose nanocrystals.

5. The coating composition of claim 4, wherein the cellulose nanocrystals are present in an amount ranging from 0.1% w/w wet basis to 1% w/w wet basis.

6. The coating composition of any one of claims 1 to 5, wherein the fatty acid is oleic acid, capric acid, lauric acid, linoleic acid, α-Linolenic acid, palmitic acid, stearic acid, arachidic acid, and any combinations thereof.

7. The coating composition of any one of claims 1 to 6, wherein the surfactant is a sucrose ester of a fatty acid or a polysorbate surfactant.

8. The coating composition of any one of claims 1 to 7, further comprising a chitosan, a plasticizer, or a combination thereof.

9. The coating composition of claim 8, wherein the plasticizer is glycerol.

10. The coating composition of claim 8, wherein the composition comprises chitosan and a plasticizer, wherein the chitosan is present in an amount ranging from 0.1% w/w wet basis to 2% w/w wet basis and the plasticizer is present in an amount ranging from 0.02% w/w wet basis to 1% w/w wet basis.

11. A coating composition, comprising:

cellulose nanofibrils or cellulose nanocrystals in an amount ranging from 0.1% w/w wet basis to 1% w/w wet basis; and

an emulsion system, comprising oleic acid and a sucrose ester of a fatty acid, that forms hydrophobic droplets and promotes placement of the emulsion system into a matrix comprising the cellulose nanofibrils or the cellulose nanocrystals, wherein the oleic acid is present in an amount ranging from 0.1% w/w wet basis to 5% w/w wet basis and the sucrose ester of a fatty acid is present in an amount ranging from 0.1% w/w wet basis to 2% w/w wet basis;
wherein the cellulose nanofibrils or cellulose nanocrystals and the emulsion system are present at a ratio ranging from 1:1 to 1:20.

12. The coating composition of claim 11, comprising cellulose nanofibrils.

~~13. A coating composition, comprising:~~
~~a cellulose nanomaterial consisting of cellulose nanocrystals in an amount ranging from 0.1% w/w wet basis to 1% w/w wet basis; and~~
~~an emulsion system, comprising a fatty acid that is a medium-chain fatty acid having an aliphatic tail comprising 6 to 12 carbon atoms or a long-chain fatty acid having an aliphatic tail comprising 13 to 21 carbon atoms and is present in an amount ranging from 0.1% w/w wet basis to 3% w/w wet basis; and~~
~~chitosan.~~

~~14~~13. A dried coating, comprising a matrix comprising cellulose nanofibrils or cellulose nanocrystals and an emulsion system dispersed within the ~~cellulose nanomaterial~~matrix, wherein the emulsion system comprises (i) a fatty acid that is a medium-chain fatty acid having an aliphatic tail comprising 6 to 12 carbon atoms or a long-chain fatty acid having an aliphatic tail comprising 13 to 21 carbon atoms; and (ii) a surfactant ~~that forms hydrophobic droplets and promotes placement of the emulsion system into a matrix comprising the cellulose nanofibrils or the cellulose nanocrystals and that is~~ selected from a sucrose ester of a fatty acid, a polysorbate, a sorbitan, or any combination thereof, optionally wherein the dried coating comprises greater than 0% to 10% moisture.

~~15~~14. The dried coating of claim ~~14~~13, wherein the cellulose nanofibrils or the cellulose nanocrystals are present in an amount ranging from 4.5% w/w dry basis to 9.8% w/w dry basis.

~~16~~15. The dried coating of claim ~~14~~13 or claim ~~15~~14, wherein the fatty acid is present in an amount ranging from 9.5% w/w dry basis to 23% w/w dry basis.

~~17~~16. The dried coating of any one of claims ~~14~~13 to ~~16~~15, wherein the surfactant is present in an amount ranging from 9.5% w/w dry basis to 9.8% w/w dry basis.

~~18~~17. The dried coating of any one of claims ~~14~~ 13 to ~~17~~16, comprising cellulose nanofibrils.

~~19~~18. The dried coating of any one of claims ~~14~~ 13 to ~~17~~16, comprising cellulose nanocrystals.

~~20~~19. The dried coating of claim ~~19~~18, further comprising chitosan in an amount ranging from 9.5% w/w dry basis to 9.8% w/w dry basis.

~~21~~20. The dried coating of claim ~~19~~ 18 or claim ~~20~~19, further comprising glycerol in an amount ranging from 2% w/w dry basis to 4.7% w/w dry basis.

~~22~~21. A plant part, comprising a coating formed from the coating composition of any one of claims 1 to ~~13~~12.

~~23~~22. A plant part, comprising the dried coating of any one of claims ~~14~~ 13 to ~~21~~20.

~~24~~23. The plant part of claim ~~23~~22, wherein the plant part is a tropical fruit.

~~25~~24. The plant part of claim ~~23~~22, wherein the plant part is a banana, a papaya, an avocado, a melon, or a mango.

~~26~~25. A method, comprising coating, optionally completely coating, a plant or a plant part with a coating composition comprising cellulose nanofibrils or cellulose nanocrystals in an amount ranging from 0.1% w/w wet basis to 1% w/w wet basis; and an emulsion system comprising a fatty acid and a surfactant that forms hydrophobic droplets and promotes placement of the emulsion system into a matrix comprising the cellulose nanofibrils or the cellulose nanocrystals, wherein the fatty acid is a medium-chain fatty acid having an aliphatic tail comprising 6 to 12 carbon atoms or a long-chain fatty acid having an aliphatic tail comprising 13 to 21 carbon atoms and the fatty acid is present in an amount ranging from 0.1% w/w wet basis to 5% w/w wet basis and the surfactant is selected from a sucrose ester of a fatty acid, a polysorbate, a sorbitan, or any combination thereof and the surfactant is present in an amount ranging from 0.1% w/w wet basis to 2% w/w wet basis.