Claims

What is claimed is:

1. A biodegradable food material comprising:

a composite material with fibrillated cellulose, wherein the fibrillated cellulose having independently derived from plant fibers, wherein the composite material comprises dry strength, enhanced oil resistance, gas and/or liquid impermeability, dry tensile modulus, or dry tensile index, wherein said composite material being generally free from toxic chemical additives, wherein the toxic chemical additives aim to enhance properties of the composite material by at least one of the following: strength enhancers, oligomers, carboxylic acids, plasticizers, antimicrobial agents, or waterproofing agents;

said chemical additives adapted for improving dry tensile strength, enhanced oil barrier, gas and/or liquid impermeability, a dry tensile modulus, or a dry tensile index;

wherein the composite material comprises properties of:

an oxygen transmission rate of 8000 cm^3 $m^{-2}24$ h^{-1} or less,

a water vapor transmission rate of 3000 g m^{-2} 24 h^{-1} or less,

a dry tensile strength of 30 MPa or higher,

a dry tensile modulus of 4 GPa or higher, and

a dry tensile index of 45 Nm g^{-1} or higher.

2. The biodegradable food material of claim 1, wherein the composite material comprises the fibrillated cellulose with different diameters having a weight ratio of 1: 100 or 1: 1.

3. The biodegradable food material of claim 1, wherein the composite material comprises the fibrillated cellulose having a length 0.1 – 1000 micrometers, 10 – 500 micrometers, 1 – 25 micrometers, or 0.2 – 100 micrometers.

4. The biodegradable food material of claim 1, wherein the composite material further comprises additional properties of:

a wet tensile strength of 5 MPa or higher,

a wet tensile modulus of 0.4 MPa or higher, and

a wet tensile index of 5 Nm g-1 or higher.

5. The biodegradable food material of claim 1, wherein the composite material is a planar sheet.

6. The biodegradable food material of claim 1, wherein the composite material comprises a container for edible items.

7. The biodegradable food material of claim 1, wherein the composite material comprises a fibrillated cellulose mixture.

8 The biodegradable food material of claim 1, wherein the composite material comprises a film with a thickness of 0.01 – 3.0 millimeter (mm).

9. The biodegradable food material of claim 5, wherein the planar sheet comprises a length ranging from 0.01 mm to 10000 mm.

10. A biodegradable material comprising:

a composite material with fibrillated cellulose having independently derived from plant fibers, wherein the composite material comprises dry strength, enhanced oil resistance, gas and/or liquid impermeability, dry tensile modulus, or dry tensile index, wherein said composite material being generally free from toxic chemical additives; wherein the toxic chemical additives aim to enhance properties of the composite material by at least one of the following: strength enhancers, oligomers, carboxylic acids, plasticizers, antimicrobial agents, or waterproofing agents; said chemical additives adapted for improving dry tensile strength, enhanced oil barrier, gas and/or liquid impermeability, a dry tensile modulus, or a dry tensile index;

wherein the composite material comprises properties of:

an oxygen transmission rate of 8000 cm3 m-224 h-1 or less,

a water vapor transmission rate of 3000 g m-2 24 h-1 or less,

a wet tensile strength of 5 MPa or higher,

a wet tensile modulus of 0.4 MPa or higher, and

a wet tensile index of 5 Nm g-1 or higher.

11. The biodegradable material of claim 10, wherein the composite material further comprises additional properties of:
a dry tensile strength of 30 MPa or higher,
a dry tensile modulus of 4 GPa or higher, and
a dry tensile index of 45 Nm g-1 or higher.

12. The biodegradable material of claim 10, wherein the composite material comprises the fibrillated cellulose with different diameters having a weight ratio of 1: 100 or 1: 1.

13. The biodegradable material of claim 10, wherein the composite material comprises the fibrillated cellulose having a length 0.1 – 1000 micrometers, 10 – 500 micrometers, 1 – 25 micrometers, or 0.2 – 100 micrometers.

14. The biodegradable material of claim 10, wherein the composite material comprises a planar sheet.

15. The biodegradable material of claim 14, wherein the planar sheet comprises a length ranging from 0.01 mm to 10000 mm.

16. The biodegradable material of claim 10, wherein the composite material comprises a fibrillated cellulose mixture.

17. The biodegradable material of claim 10, wherein the composite material comprises a film with a thickness of 0.01 – 3.0 millimeter (mm).

18. The biodegradable material of claim 10, wherein the composite material comprises a container for edible items.