CLAIMS

1. A thermally reactive thermoplastic intermediate product in the form of a shaped body consisting essentially of a melt-extrudable composition,

wherein the composition consists of a mixture of a purified or an unpurified softwood lignin dry powder, a lignin solvent capable of opening up the lignin structure, a reactive blocking agent, and optionally an alignment agent,

wherein the lignin solvent is ethylene glycol, di-ethylene glycol or a low-molecular-weight poly ethylene glycol (PEG) having a molecular weight between 150 to 20,000 g/mol, and

wherein the lignin solvent is added in an amount of 1 to 10% by weight of the lignin powder so that after the addition of the lignin solvent, the lignin powder remains undissolved and a powder in a substantially solid state,

where the reactive blocking agent is selected from the group consisting of anhydrides, and

wherein the optional alignment agent is selected from the group consisting of high-molecular-weight poly ethylene glycol (PEG) having a molecular weight above 20,000 g/mol, or polyethylene oxide (PEO), or combinations thereof.

2. The intermediate product as claimed in claim 1, wherein the lignin solvent further comprises one or more of an aliphatic amide, dimethylformamide (DMF), dimethylacetamide (DMAc), a tertiary amine oxide, N-methylmorpholine-N-oxide (NMMO), dimethylsulfoxide (DMSO), or ionic liquids or any combination of said solvents and liquids.

3. The intermediate product as claimed in claim 1, wherein the alignment agent is the high-molecular-weight poly ethylene glycol (PEG) having a molecular weight above 20,000 g/mol.

4. The intermediate product as claimed in claim 1, wherein the product is re-meltable.

5. The intermediate product as claimed in claim 1, wherein at least 50% of free hydroxyl groups present in the purified softwood lignin remain unreacted.

6. The intermediate product as claimed in claim 1, wherein after addition of the lignin solvent, the lignin is solvent-impregnated.

7. The intermediate product as claimed in claim 1 wherein the lignin solvent is the low-molecular-weight poly ethylene glycol.

8. The intermediate product as claimed in claim 1, wherein the lignin solvent is added in an amount of 1 to 7% by weight of the lignin powder.

9. A thermally reactive thermoplastic intermediate product, in the form of a shaped body, wherein the intermediate product comprises a melt-extrudable composition,

wherein the composition comprises a mixture of a purified or an unpurified softwood lignin dry powder and at least one additive,

wherein the at least one additive is a lignin solvent capable of opening up the lignin structure,

wherein the lignin solvent is selected from the group consisting of an aprotic polar solvent, an aliphatic amide, dimethylformamide (DMF), dimethylacetamide (DMAc), a tertiary amine oxide, N-methylmorpholine-N-oxide (NMMO), dimethylsulfoxide (DMSO), or ionic liquids or any combination of said solvents and liquids, and

wherein the lignin powder remains in a substantially solid state.

10. The intermediate product as claimed in claim 9, wherein the lignin solvent is added in an amount of 1 to 20% by weight of the lignin powder.

11. A thermoplastic intermediate product in the form of a shaped body wherein the intermediate product consists essentially of a composition,

wherein the composition consists essentially of a purified softwood lignin, the lignin structure of the intermediate product comprising free hydroxyl groups, a first additive, and a second additive,

wherein the first additive is an aprotic polar solvent, selected from a group consisting of (i) an aliphatic amide including dimethylformamide (DMF) or dimethylacetamide (DMAc), (ii) a tertiary amine oxide including N-methylmorpholine-N-oxide (NMMNO), (iii) dimethylsulfoxide (DMSO), (iv) ethylene glycol, (v) di-ethylene glycol and (vi) a low-

molecular-weight poly ethylene glycol (PEG) having a molecular weight between 150 to 20,000 g/mol,

wherein the amount of the first additive is an amount of 1-20% by weight of dry powder lignin, and

wherein the second additive is a reactive blocking reagent including an acid anhydride.

12. The intermediate product as claimed in claim 11, wherein the lignin solvent is the low-molecular-weight poly ethylene glycol (PEG) having the molecular weight between 150 to 20,000 g/mol.

13. The intermediate product as claimed in claim 11, wherein the lignin solvent is added in an amount of 1 to 7% by weight of the lignin powder.

14. A method for producing a thermoplastic intermediate product being thermally reactive, comprising the steps of:

providing a purified softwood lignin as a dry powder or an unpurified softwood lignin as a dry powder;

adding a lignin solvent, a reactive blocking agent, and optionally an alignment agent, to the purified of unpurified softwood lignin powder to form a composition consisting essentially of the lignin solvent, the reactive blocking agent, and optionally the alignment agent;

wherein the lignin solvent is capable of opening up the lignin structure,

wherein the lignin solvent is ethylene glycol, di-ethylene glycol or a low-molecular-weight poly ethylene glycol (PEG) having a molecular weight between 150 to 20,000 g/mol, and

wherein the lignin solvent is added in an amount of 1 to 10% by weight of the lignin powder so that after the addition of the lignin solvent, the lignin powder remains undissolved and a powder in a substantially solid state,

where the reactive blocking agent is selected from the group consisting of anhydrides, and

wherein the optional alignment agent is selected from the group consisting of high-molecular-weight poly ethylene glycol (PEG) having a molecular weight above 20,000 g/mol, or polyethylene oxide (PEO), or combinations thereof.

15. The method as claimed in claim 14, wherein the lignin solvent further comprises one or more of an aliphatic amide, dimethylformamide (DMF), dimethylacetamide (DMAc), a tertiary amine oxide, N-methylmorpholine-N-oxide (NMMO), dimethylsulfoxid (DMSO), or ionic liquids, or any combination of said solvents and liquids.

16. The method as claimed in claim 15, wherein the lignin solvent is the low-molecular-weight poly ethylene glycol (PEG) having the molecular weight between 150 to 20,000 g/mol.

17. The method as claimed in claim 14, wherein the alignment agent is present.

18. The method as claimed in claim 17, wherein the reactive blocking agent is added after a treatment period from the addition of the lignin solvent.

19. The method as claimed in claim 17, wherein the reactive blocking agent is able to react in-situ with the lignin during melt-extrusion.

20. A thermally reactive thermoplastic intermediate product obtainable by the method as claimed in claim 14.