

TECH OFFER

Lignin-Essential Oil Polymer Composites



KEY INFORMATION

TECHNOLOGY CATEGORY:

Foods - Packaging & Storage

Manufacturing - Chemical Processes

Materials - Bio Materials

Materials - Composites

TECHNOLOGY READINESS LEVEL (TRL): **TRL7**

COUNTRY: **THAILAND**

ID NUMBER: **TO175434**

OVERVIEW

Lignin polymer composites represent a class of sustainable materials that combine eco-friendliness, cost-effectiveness, mechanical reinforcement, with intrinsic functional properties such as UV protection, antioxidant activity, barrier performance, and antimicrobial effects. While conventional production methods often rely on solvents or require separate lignin modification steps—leading to higher costs and loss of functionalities—this technology introduces a one-step process to efficiently produce lignin biopolymer composites by efficiently blending lignin and essential oils into a polymer.

The technology works by directly dissolving lignin in essential oils and then feeding this solution, along with a biopolymer like PLA, PBS, PBAT, or PP, into a twin-screw extruder. This method ensures an even dispersion of the mixture throughout the material without the need for additional solvents or complex pre-processing. The resulting material has enhanced properties, including antimicrobial, UV-resistant, and antioxidant capabilities, as well as controlled release of active ingredients. The final

materials can be manufactured into various products, including 3D printing filaments, films, or molded items.

The technology owner is seeking collaborations with partners in Singapore, particularly those involved in medical materials (e.g., wound dressings), active food packaging, biodegradable agricultural films, and 3D printing materials, to co-develop innovative solutions that support a circular economy.

TECHNOLOGY FEATURES & SPECIFICATIONS

The technology is a single-step process to efficiently produce lignin biopolymer composites by efficiently blending lignin and essential oils into a polymer.

Key features of the lignin biopolymer include:

- Manufacturing
 - One-step solvent-free process using a twin-screw extruder
 - Direct dissolution of lignin in essential oils prior to compounding with biopolymers, eliminating the need for separate lignin preparation or additional solvents
 - Compatible with standard industrial extrusion machinery, enabling continuous and scalable production.
- Suitable for blending with a range of biopolymers such as PLA, PBAT, or PBS
- Exhibits antimicrobial, UV-resistant, and antioxidant properties
- Preserves essential oil functionality for controlled prolonged effectiveness
- Can be manufactured into various products, including 3D printing filaments, films, or molded items

POTENTIAL APPLICATIONS

Potential applications include (but not limited to):

- Bio-based food films or bags with antimicrobial properties to prevent contamination
- Medical materials or devices, such as antiseptic wound dressings
- 3D printing filaments for producing safe, functional components
- Biodegradable agricultural films, like mulch films that protect against soil pathogens

UNIQUE VALUE PROPOSITION

- One-step, solvent-free production process – eliminates the need for lignin pre-treatment or additional solvents, enabling cost-efficient, continuous manufacturing on existing industrial machinery.
- Enhanced functional performance – biocomposites retain lignin's natural UV and antioxidant properties while integrating essential oils for antimicrobial activity and controlled release of active agents.
- Sustainable and versatile materials – transforms low-value lignin into high-performance biocomposites for various applications