

# RDTI General Approval Application (Draft) - v1.61

## Project Details

Project Identifier: PRJ-003

Objective (limit 1000 chars): Research and develop a novel, high-strength, fully compostable polymer composite derived from algae biomass to replace petroleum-based plastics in single-use packaging, targeting a shelf-life stability of 12 months and full degradation within 90 days in industrial composting facilities. [Intentional brevity to respect the 1000 character limit.]

Start Date: 2025-08-01

End Date: 2027-03-31

ANZSRC: 080399

Project Owner (technical contact)

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## Core Activity 1

Name: Optimization of Algae Biopolymer Extraction and Modification

Activity dates: 2025-09-01 -> 2026-04-30

Uncertainty (~500 words): The core scientific uncertainty is determining the precise chemical modification (e.g., cross-linking agents, graft copolymerization ratio) required to achieve the necessary mechanical strength and water barrier properties for packaging, while simultaneously ensuring the resulting polymer remains fully biodegradable within the specified timeframe. There is no existing method that successfully balances these three constraints for this novel biopolymer source.

Systematic approach (~250 words): We will use a systematic factorial experimental design ( $3^3$ ) to test three key variables: modification agent concentration, reaction time, and temperature. Samples will be characterized using `\text{FTIR}` and `\text{GPC}` to confirm chemical structure. Mechanical testing (tensile strength, Young's modulus) will follow `\text{ASTM D638}` standards, iteratively refining the process parameters based on the results.

Intentions (~200 words): This activity aims to generate New Knowledge regarding the structure-property relationships of chemically modified algae biopolymers. It will also create a New Process—the optimized, scalable, and cost-effective method for producing the modified biopolymer intermediate.

## Core Activity 2

Name: Composite Formulation and Accelerated Degradation Testing

Activity dates: 2026-05-01 -> 2027-01-31

Uncertainty (~500 words): The main technological uncertainty is finding the optimum ratio of reinforcing filler and processing conditions (e.g., melt-blending temperature/shear rate) that achieves the required 12-month shelf stability against moisture ingress while guaranteeing 90% degradation within 90 days under controlled composting conditions

### Supporting Activity 1

Name: Algae Strain Cultivation and Harvesting for Biomass Supply

Activity dates: 2025-08-01 -> 2025-10-31

Description (~250 words): Establishing controlled growth and harvesting protocols for the selected, high-yield algae strain to ensure a consistent and high-quality biomass supply for the Core R&D extraction activities.

Definition (~250 words): This satisfies the Supporting R&D activity definition because it involves the routine work to maintain the R&D environment and supply (raw materials) that is necessary for the execution of Core Activity 1 (Extraction and Modification). Consistent biomass quality is crucial for reliable experimentation.

### Supporting Activity 2

Name: Installation and Commissioning of Polymer Processing Equipment

Activity dates: 2025-11-01 -> 2026-01-31

Description (~250 words): Installing and validating the operational parameters of key pilot-scale equipment, including the twin-screw extruder and thin-film casting machine, to ensure they can meet the specific processing requirements of the novel composite material.

Definition (~250 words): This satisfies the Supporting R&D activity definition as it is an activity in support of R&D that involves the preparation and maintenance of the specialized equipment. Accurate and consistent material processing is a prerequisite for reliable testing in Core Activity 2.

### Supporting Activity 3

Name: Cost Analysis and Preliminary Scale-Up Assessment

Activity dates: 2026-02-01 -> 2027-03-31

Description (~250 words): Conducting preliminary engineering and economic assessment of the proposed optimized processes to estimate the potential industrial manufacturing costs and necessary scale-up investments.

Definition (~250 words): This satisfies the Supporting R&D activity definition because it involves the documentation and analysis of R&D results in terms of commercial viability. This work informs whether the technologically successful R&D can be transitioned into a practical, marketable process or product.