

Biodegradable plastics from natural materials

Abstract

Plastic pollution is a major environmental problem because conventional plastics take hundreds of years to decompose. In this project, biodegradable plastics were prepared using natural materials such as cornstarch and agar. The plastics were tested for flexibility, strength, and biodegradability in soil. Results showed that starch and agar plastics degraded significantly within weeks, while conventional plastic showed no change. This study demonstrates that natural materials can be used to make eco-friendly alternatives to conventional plastics.

Statement of the Problem

Conventional plastics made from petroleum are durable but cause serious environmental pollution because they do not decompose easily. There is a need to develop plastics from natural, biodegradable sources. This study investigates whether cornstarch and agar can be used to make biodegradable plastics and how their properties compare.

Hypothesis

Bioplastics made from natural materials (cornstarch and agar) will biodegrade faster than conventional plastic, while glycerol will increase flexibility of the films.

Design of the Study

Independent variable: Type of plastic (cornstarch-based, agar-based, and commercial plastic control).

Dependent variables: Flexibility, strength, and biodegradability (measured as % mass loss over time).

Control variables: Size and thickness of samples, soil type, moisture, and burial depth.

Control sample: A strip of polyethylene (conventional plastic).

Method: Prepare plastic samples, measure initial properties, bury in soil, and observe mass loss and changes over 4–6 weeks.

Materials

Cornstarch (20 g)

Agar powder (7 g)

Water (200 mL)

Glycerol (10–15 mL)

Vinegar (5 mL)

Saucepan and stirring spoon

Measuring spoons / cups

Molds or flat tray

Oven or warm drying area

Soil and small pots (for burial test)

Ruler / caliper

Digital kitchen scale

Plastic sheet (polyethylene) for control

Labels, marker, and notebook

Procedure

Part A – Preparation of Bioplastics

1. Cornstarch Plastic

Mix 20 g cornstarch with 100 mL water.

Add 10 mL glycerol and 5 mL vinegar.

Heat with stirring until mixture thickens and turns translucent.

Pour onto a tray, spread evenly, and dry for 24–48 hours.

Cut into strips of equal size.

2. Agar Plastic

Dissolve 7 g agar powder in 200 mL water.

Add 10–15 mL glycerol.

Heat and stir until completely dissolved.

Pour into molds, let cool and dry.

Cut into strips of equal size.

3. Control

Cut equal-sized strips of commercial plastic.

Part B – Testing

1. Physical properties

Measure thickness and mass of each sample.

Test flexibility by bending or adding small weights until breaking.

2. Biodegradability

Bury each strip 5 cm deep in moist soil (in pots or bags).

At weekly intervals (e.g., 7, 14, 21, 28 days), remove one sample, wash off soil, dry, and reweigh.

Record mass loss and visual changes.

3. Control check

Ensure commercial plastic sample shows little to no change.