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**CLASS**

**GRADE 5**

**PROJECT TITLE**

**COMPARATIVE STUDY OF  
DECOMPOSITION OF DIFFERENT  
BIODEGRADABLE PRODUCTS**

## TITLE OF THE PROJECT

### **Comparative Study of Decomposition of Different Biodegradable Products**

## INTRODUCTION

This research focuses on studying how different biodegradable products decompose under similar environmental conditions. Biodegradable items break down naturally with the help of microorganisms, sunlight, and moisture, turning into simpler compounds such as carbon dioxide, water, and humus. Understanding the decomposition rates of different products helps us manage waste more effectively and encourages sustainable practices like composting.

## SELECTION OF PROBLEM AND BACKGROUND INFORMATION

Every day, large amounts of biodegradable waste are generated in the form of food scraps, paper, and natural fibers. However, not all biodegradable products decompose at the same rate. Some break down quickly, while others take months or years. This difference impacts waste management and composting efficiency. By comparing decomposition rates, we can identify which materials are most suitable for quick composting and which ones require longer treatment.

## OBJECTIVES

The main purpose of this project is to **compare the decomposition rates of different biodegradable materials** in order to understand which items break down faster and why. The detailed objectives are:

1. **To study and compare the decomposition process** of different biodegradable products such as fruit peels, paper, cardboard, and natural fabrics when placed under similar soil conditions.
2. **To identify the effect of material composition** (sugars, fibers, lignin, oils, acids) on the speed of decomposition.
3. **To analyze physical and chemical changes** (color, texture, odor, fungal growth, fragmentation, weight loss) that occur during the decomposition process.
4. **To find which biodegradable products are most suitable for composting** because they decompose quickly and enrich the soil.
5. **To highlight the limitations of slow-decomposing materials**, which require longer time periods and special conditions for proper breakdown.

6. **To promote awareness of eco-friendly waste disposal** by showing how common household biodegradable items behave differently when returned to the soil.

## GUIDING PRINCIPLE

Decomposition is a **natural biological process** in which organic matter is broken down into simpler substances by the action of microorganisms such as bacteria and fungi. These microorganisms consume the biodegradable material as food, using enzymes to break down complex compounds like carbohydrates, proteins, fats, cellulose, and lignin into simpler molecules such as carbon dioxide, water, and humus (organic matter that enriches the soil).

The rate of decomposition depends on several key factors:

### 1. **Moisture Content**

- Water is essential for microbial activity. Materials with high moisture content (like banana peels) decompose quickly because they provide an ideal environment for microbes.
- Dry materials (like cardboard or jute) require extra moisture before microbes can act on them.

### 2. **Temperature**

- Warm temperatures accelerate microbial growth, speeding up decomposition.
- In colder climates, decomposition is slower because microbial activity is reduced.

### **Composition of Material**

- **Sugars and starches** in fruit peels are easy for microbes to digest, leading to rapid decomposition.
- **Cellulose and lignin**, found in paper, cardboard, and jute, are tougher compounds that require specialized microbes and more time.
- **Natural oils and acids**, like those in orange peels, act as preservatives and slow down microbial action.

### **Surface Area**

- Smaller or shredded pieces decompose faster because they expose more surface area for microbes.
- Larger, thick pieces (like whole cardboard or fabric) take longer.

## Oxygen Availability

- In well-aerated soil, aerobic decomposition dominates, which is faster and less foul-smelling.
- Lack of oxygen may cause anaerobic decomposition, which is slower and produces bad odors.

## HYPOTHESES

1. Cellulose-based natural materials (banana peel, cotton, paper) will decompose faster than polymer-based biodegradable plastics (PLA, starch-blend) in aerobic compost and vermicompost.
2. Anaerobic conditions will slow visible mass loss for many materials but increase methane production for carbon-rich items.
3. Higher temperature and adequate moisture in composting accelerate decomposition for all materials.
4. Vermicomposting will outperform plain soil burial in reducing mass of organic, easily accessible substrates (fruit peels) but may show smaller differences for industrially processed biodegradable plastics.

## MATERIALS

- Banana peel
- Orange peel
- Newspaper
- Cardboard
- Cotton cloth (small piece)
- Jute (small piece)
- 6 soil-filled containers/pots
- Weighing scale
- Spray bottle for water
- Gloves

## PROCEDURE

1. Prepare six containers with equal amounts of garden soil.
2. Place 50 g of each biodegradable material (banana peel, orange peel, newspaper, cardboard, cotton cloth, jute) into separate containers.
3. Cover lightly with soil.
4. Sprinkle water to keep moisture consistent.
5. Keep all containers in the same environment (temperature, sunlight exposure).
6. Record observations weekly (weight loss, physical appearance, fungal growth, odor changes).
7. Continue for 8–12 weeks until significant decomposition occurs.



## SINDEPENDENT VARIABLES

- Type of biodegradable material.

## DEPENDENT VARIABLES

- Rate and extent of decomposition (time, weight loss, appearance).

## RISK FACTORS

1. **Handling Soil and Compost**
  - Soil and compost may contain bacteria, fungi, or insects that can cause infection or skin irritation.
2. **Bad Odors and Gases**
  - Decomposition releases gases like carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>). If containers are airtight, pressure may build up.
3. **Use of Sharp Tools**
  - Scissors, cutters, or knives used to cut materials may cause cuts or injuries.
4. **Moisture and Mold Growth**
  - Too much moisture can lead to mold growth, which may cause allergies or breathing problems.
5. **Heat in Compost Piles**
  - Active compost can become hot (up to 50–60 °C), which may cause burns if touched directly.
6. **Improper Disposal**
  - If decomposed materials are not disposed of properly, they may attract flies, insects, or create foul smells.

## SAFETY MEASURES

1. **Personal Protection**
  - Wear gloves while handling soil or compost.
  - Wash hands thoroughly after the experiment.
  - Wear a mask if mold is visible.
2. **Working Environment**
  - Keep containers in a well-ventilated area.
  - Do not keep jars completely airtight; allow gases to escape safely.
3. **Tool Handling**
  - Use scissors carefully under adult supervision.

- Cut materials on a flat surface to avoid injuries.
- 4. **Compost Handling**
  - Measure compost temperature with a thermometer instead of touching it directly.
  - Do not dig hands deep into compost piles.
- 5. **Hygiene and Disposal**
  - Dispose of decomposed materials in a proper compost pit or waste bin.
  - Clean all containers, tools, and work surfaces after the project.

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