National Science FairSynopsis

Project ID	**NSF-SCH2025-184**
Project Title	**Hybrid Soil Boosters: Testing Eco-Additives to hybrid soil for Faster Plastic Breakdown**
Level	**Middle level**
Category	**Environmental Science**
Participant Name	**R. SARA FARIHA**
School	***i*MAX Global School, Royapettah**
City	**Chennai – 600 014**
State	**Tamil Nadu.**

ABSTRACT:

Plastic pollution is one of the biggest environmental problems today because plastics take hundreds of years to break down naturally. This study investigates an eco-friendly way to speed up plastic degradation using hybrid soils enriched with natural household waste materials. Three types of hybrid soils were prepared — Hybrid Soil A (garden and pond soil + compost + orange peel powder), Hybrid Soil B (garden and pond soil + compost + eggshell powder), and Hybrid Soil C (garden and pond soil + compost + orange peel + eggshell powder) — and compared with plain soils and air control. Plastic strips were buried in each soil type and observed over several weeks for changes in mass, color, texture, brittleness, and visible surface damage. The results are expected to show that hybrid soils, especially those containing both orange peel and eggshell powder, promote greater microbial activity and faster plastic breakdown than ordinary soils. This experiment demonstrates a simple, low-cost, and sustainable method to reduce plastic waste using every day biodegradable materials.

INTRODUCTION:

Plastic is widely used but takes hundreds of years to break down, causing serious pollution. Ordinary soil and compost can slowly degrade plastics, but the process is very slow. Adding natural household waste like orange peel, eggshell powder may make a hybrid soil that boosts microbial activity and weakens plastics. This project explores whether such hybrid soils enriched with kitchen waste can help plastics degrade faster than ordinary soil. By comparing plastic strips buried in plain soils, compost soils and hybrid soils with different natural additives, this study aims to find a simple, eco-friendly method that could reduce plastic pollution.

STATEMENT OF THE PROBLEM:

Although scientists have studied composting and microbial breakdown of plastics, there has been little exploration of how hybrid soils enriched with natural, safe household waste additives (like fruit peels, eggshells) might boost microbial activity and physical wear to accelerate plastic degradation.

Plastics do not degrade effectively in ordinary soil, and there is a need to test simple, eco-friendly methods (such as hybrid soils with natural boosters) that may enhance plastic degradation in safe and sustainable ways.

HYPOTHESIS

Hybrid soils enriched with natural additives (like orange peel or eggshell powder) will cause plastics to show greater visible changes (damage, brittleness, weight loss) than plastics buried in plain garden soil.

DESIGN OF STUDY:

Variables

- Independent variable: type of soil/treatment.
- Dependent variables: percentage by mass change of plastic strip, visible damage (scoring), flexibility/brittleness score, appearance photos.
- Controlled variables: same size/type of plastic, same burial depth (~5 cm), same temperature/location, same moisture schedule, same duration.

PROCEDURE

1. Cut plastic strips (5 × 3 cm). Weigh each and record before treatment.
2. Prepare containers with treatments as below.
3. Bury strips at ~5 cm depth.
4. Keep moist (spray bottle every 3–4 days).
5. Every 2 weeks, remove one strip from each container. Wash gently, dry, weigh, photograph.
6. Score visible damage (0–5 scale) and brittleness (0–2 scale).
7. Continue for 7–8 weeks.

Treatments:

1. Air control – plastic strip not buried (just in box)
2. Plain soil- pond soil and garden soil.
3. Hybrid soil=garden Soil + compost + pond soil = richer
4. Hybrid soil A – garden soil + pond soil + compost + orange peel powder.
5. Hybrid soil B – garden soil +pond soil+ compost + crushed eggshells.
6. Hybrid soil C - garden soil+ pond soil + compost + crushed egg shells + orange peel

DATA ANALYSIS TABLE:

BIODEGRADATION OF PLASTIC STRIPS IN HYBRID SOILS
pond and garden soils (vs) hybrid soils

Treatment	Week	Initial Mass (g)	Final Mass (g)	% Mass Remaining	Damage score (0-5)	Brittleness score (0-2)
Air control (no soil)	14/09/25 Week 1	2g	2g	100	2	1
Air control	28/09/25 Week 2	2g	2g	100	2	1
Air control	12/10/25 Week 3	2g	2g	100	2	1
Air control	26/10/25 Week 4	2g	2g	100	2	1
Air control	09/11/25 Week 5	2g	2g	100	2	1
Pond soil	14/09/25 Week 1	2g	2g	100	2	1
Pond soil	28/09/25 Week 2	2g	2g	100	2	1
Pond soil	12/10/25 Week 3	2g	2g	100	2	1
Pond soil	26/10/25 Week 4	2g	2g	100	2	1
Pond soil	04/11/25 Week 5	2g	2g	100	2	1
Garden soil	14/09/25 Week 1	2g	2g	100	2	1
Garden soil	28/09/25 Week 2	2g	2g	100	2	1
Garden soil	12/10/25 Week 3	2g	2g	100	2	1
Garden soil	26/10/25 Week 4	2g	2g	100	2	1
Garden soil	04/11/25 Week 5	2g	2g	100	2	1
Hybrid Soil (pond + Garden + Compost)	14/09/25 Week 1	2g	2g	100	2	1
Hybrid Soil (pond + Garden + Compost)	28/09/25 Week 2	2g	2g	100	2	1
Hybrid Soil (pond + Garden + Compost)	12/10/25 Week 3	2g	2g	100	2	1
Hybrid Soil (pond + Garden + Compost)	26/10/25 Week 4	2g	2g	100	2	1
Hybrid Soil (pond + Garden + Compost)	04/11/25 Week 5	2g	2g	100	2	1

Hybrid soil A, hybrid soil B, hybrid soil C (with natural additives)

Treatment	Week	Initial Mass (g)	Final Mass (g)	% Mass Remaining	Damage score (0-5)	Brittleness score (0-2)
Hybrid soil A (pond soil + Garden soil + Compost + Orange peel)						
Hybrid soil A						
Hybrid soil A						
Hybrid soil A						
Hybrid soil A						
Hybrid soil B (pond soil + Garden soil + Compost +Egg shells)						
Hybrid soil B						
Hybrid soil B						
Hybrid soil B						
Hybrid soil B						
Hybrid soil C (pond soil + Garden soil + Compost + Orange peel + Egg shells)						
Hybrid soil C						
Hybrid soil C						
Hybrid soil C						
Hybrid soil C						

Orange Peel Dry it in the Sun Light

Grind it Orage Peel

OrangePeel Power

Egg Shell Dry it in the Sun Light

Egg Shell Powder

18 Clay Pots and
One Air Control Box.

Cut the Plastic Cup in Small Pieces

Breadth in 1cm

Height in 2.7cm

Collection of the Pond Soil

Pond Soil

Garden Soil

Compost

Names labelled on all types of pots

Pond Soil Filled in 3 Pots

Garden Soil Filled in 3 pots

Hybrid Soil

Making of the Hybrid Soil : Pond Soil, Garden Soil and Composed. Measure the **2 : 2 :1** Ratios in the Measuring Cup Mix it and Fill the Three Pots.

Hybrid Soil A

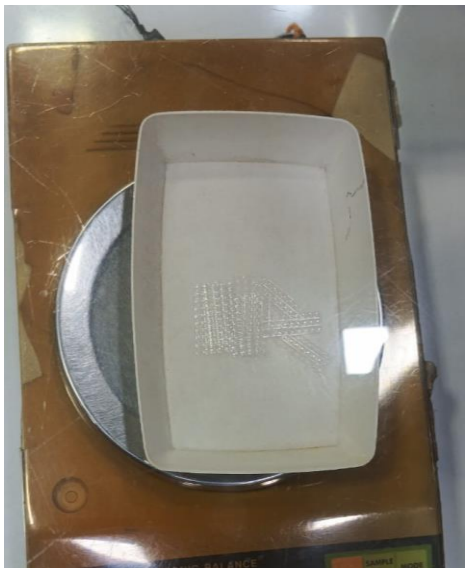
Making of the Hybrid Soil A : Pond Soil, Garden Soil, Composed and Orange Peel Powder. Measure the **2 : 2 : 1 : 0.5** Ratios in the Measuring Cup Mix it and Fill in the Three Pots.

Hybrid Soil B

Making of the Hybrid Soil B : Pond Soil, Garden Soil, Composed and Egg Shell Powder. Measure the **2 : 2 : 1 : 0.5** Ratios in the Measuring Cup Mix it and Fill in the Three Pots.

Hybrid Soil C

Making the Hybrid Soil C : Pond Soil, Garden Soil, Composed ,Orange Peel Powder and Egg Shell Powder. Measure the **2: 2: 1 : 0.5 : 0.5** Ratios in the Measuring Cup Mix it and Fill in the Three Pots.



weighing of plastic strips – 2g

Plastic pieces added in all Types of Pots.

3 Days Once Spray water in the all Pots.

Check the Weight all the Types of First Pots

the Weight was measured Weekly Once in all the types of Pots

RESULTS, CONCLUSION AND DISCUSSION:

Certain reports are yet to come and will be published during final report