

Testing the durability of bioplastics as a future material of choice

Leytonstone school

Samuel Mason-Carroll, Nikol Panayotova, Rowan Comins, Martha Dean, Fariya Islam

A growing world and depleting resources



Aim



The aim of the experiment is to create a biological alternative to LDPE plastic bags and to test its properties.

The strength, the water resistance, the and the UV resistance were tested

Potato, chia seed and pineapple were selected to be the base of our bioplastics.

Hypothesis



The prediction is that the potato bioplastic would be strong and uv resistant due to its high starch content. The chia seed bioplastic would be strong because of the gelatinous substance they secrete but may not be water resistant. The pineapple bioplastic may be strong because of the insoluble fibres in the skin.

Risk Assessment

RISK MANAGEMENT

Risk	Hazard	
Bunsen burner	Burning yourself / objects	● Safety flame ● Heat proof mats ● Keep away from edge ● Make sure gas tap is securely attached to bunsen burner tube
Knife	Cutting yourself	● Be careful when handling knife ● We were supervised by a teacher

Method

Potato bioplastic



- Peel the potatoes
- Blend the potato peel with water
- Heat over a bunsen burner until around $\frac{1}{2}$ the solution has evaporated
- Stir in $\frac{1}{2}$ a tablespoon of vinegar, 8 grams of cinnamon, 1 tablespoons of honey, 1 tablespoon of glycerine and 1 gram of thyme.
- Heat over a bunsen burner until $\frac{2}{3}$ of the solution has evaporated
- Pour the mixture into a baking tray and leave to cool and set for 2 weeks



Chia seed bioplastic



- Soak the chia seeds in water for 15 minutes
- Mix in 2 tablespoons of glycerine, 2 tablespoons of aloe vera and 8 grams of cinnamon
- Thinly spread the mixture evenly on a flat surface
- Leave to set for 2 weeks



Pineapple bioplastic



- Cut the skin off of a pineapple
- Blend the skin with water
- Heat over a bunsen burner until around $\frac{1}{2}$ the solution has evaporated
- Stir in $\frac{1}{2}$ a tablespoon of vinegar, 20 grams of cinnamon, 1 tablespoons of honey, 1 tablespoon of glycerine, 1 gram of thyme and $8\frac{1}{2}$ tablespoons of cornstarch.
- Heat over a bunsen burner until $\frac{2}{3}$ of the solution has evaporated
- Pour the mixture into a baking tray and leave to cool and set for 2 weeks



Bioplastic Results

The chia seed bioplastic was successful. It formed a solid, more brittle sheet with similar properties to Polypropylene.



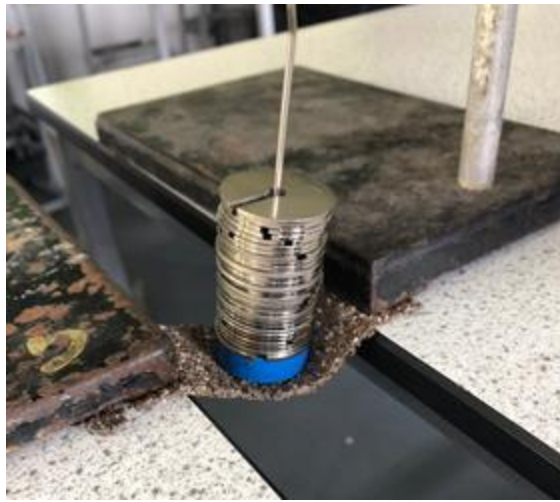
The pineapple bioplastic was unsuccessful, failing to form a solid sheet. One of the reasons that could have led to this result was that the pH of the pineapple skin may have interfered with the polymerisation.



The potato bioplastic was very successful. It formed a thin, translucent sheet. It is very flexible and had similar properties to clingfilm.



Tests



Strength Test

Strength

The plastics were suspended between two surfaces and progressing weights were added until the plastics broke.

A mean weight was calculated.

	Potato Bioplastic	Chia Seed Bioplastic	LDPE Plastic Bag
Mean Weight (Kg)	0.16	0.253	10
Mean Force withstood (N)	1.568	3.448	95

The plastic that performed best in the strength test was the LDPE plastic bag.



Water Resistance Test

Water Resistance

The plastics were left in a beaker of 50 ml of water for one hour

Potato Bioplastic	Chia Seed Bioplastic	LDPE Plastic Bag
- Kept shape - Being submerged in water for a long time made it weaker but it still maintains structural integrity	- Not water resistant - Breaks down when submerged in water	- Water resistant

The plastic that performed in the water resistance LDPE plastic bag



UV Test

UV Resistance

The bioplastics were left under a window for two weeks, with uniform exposure to the sun and UV.

Mean UV index for the two weeks=

Potato Bioplastic	Chia Seed Bioplastic	LDPE Plastic Bag
- UV rays did not impact the structural properties of the bioplastic	- UV rays did not impact the structural properties of the bioplastic	- UV rays did not impact the structural properties of the plastic

All plastics performed well in the UV test

Conclusion

Conclusion

- The three bioplastics did not outperform the standard plastic bag...yet!
 - This is a preliminary test, adding other materials to reinforce the bioplastic and increasing its water resistance should improve their durability.
-



A New and Unexpected Discovery!

- The potato and chia seeds bioplastics can conduct electricity, without the addition of graphene or carbon.
- Potential use in electronics and energy storage as a cheaper alternative.



Thank you for listening.
