



**Prize Winner**

# **Science Investigation**

## **Year R-2**

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# Title: Investigating Microplastic Pollution

## 1. Background Work

1. A plastic is a string of molecules KNOWN as polymers which are man-made. They are liquid or soft when first made. They can be moulded then hardened into shape. Examples of plastics include: Bicycle helmets, toy rackets and toy blocks.
2. There are two different types of fabrics - natural fibres and synthetic ones. Synthetic fibres are a type of plastic. Leather and wool are types of natural fibres.
3. Microplastics are small plastic particles that have broken down through water erosion and are polluting our waterways. They can get into fish-yes! The fish that we eat and can poison or even kill them! And once they get caught then we eat them...fish eats microplastics → fish dies → humans eat fish → Result-HUMANS EAT MICROPLASTICS! Microplastics are defined as less 5 millimetres in length.
4. Many people are aware of microplastics degrading from large plastics such as cutlery, plastic bags and straws. This is why many companies and governments no longer allow plastic versions of these. However not many people realise that 60 to 70% of our clothes are made from synthetic materials containing plastics such as: Polyester, Lycra and Nylon.
5. This is very important because of fast fashion. Fast fashion is the constant cycle of people buying clothes which contain plastics, wearing them for a short period of time before disposing of them then - buying clothes that are in fashion. As we buy new synthetic clothes, they will release microplastic fibres into the ocean!
6. Synthetic material characteristics are:
  - **POLYESTER** -durable, wrinkle / shrinking /stretching resistant
  - **LYCRA** -Highly elastic
  - **RAYON** -Semi synthetic mimics cotton /silk, light weight, highly breathable
  - **POLYESTER FLEECE** – lightweight, moisture resistant, durable.

Synthetic fibres are chemically engineered to provide strength and durability.

## My research question

Which synthetic material releases the most micro plastics during washing?

## Hypothesis

I think Polyester Fleece fabric will release the most micro plastics when it is put in the washer because its fibres are weak and can easily escape and break off when spun around at a high speed. When we bought the fabric at the shop it also shed lots of fibres.

## Variables

**Changed variable:** Synthetic material type (Polyester Fleece, Polyester, Lycra and Rayon)

**Controlled variable:** Place/location of photograph, Temperature of water, capacity of water, size of jar, iPhone camera, size of material, speed and range of shaking, and time of shaking.

## Equipment

- Pieces of fabric
- Ruler
- Scissors
- Jar with lid
- Water
- Coffee machine
- Paper filters to capture fibres
- Funnel to pour water
- Beaker
- Petri dish
- iPhone 16 pro:
  - For camera to take photos of filter paper
  - Timer to measure the time
  - Metronome app to pace shaking
- AI program (Copilot)

## Methodology

1. Measure the fabric using a ruler to make a 10x10cm square.
2. Cut the fabric to the specific size using scissors.
3. Turn on the coffee machine.
4. Pour water into a jug until the volume is 250 ml
5. Using the coffee machine, heat water to 53°C (the thermometer was always 3 degrees lower than the coffee machine in our pilot tests)
6. Pour water into a jar until the water is at the top of the arc - this would make it 175 millilitres
7. Place selected fabric into jar with water and put on the lid tightly
8. Using a metronome, shake jar at a rate of one beat per second for two minutes (range of shake was from my chin to my waist).
9. Fold the filter paper into quarters by folding them in half then folding them in half again
10. Put filter paper on the funnel and put the funnel in a beaker.
11. Slowly pour water from the jar into the funnel until all the water is in (Do this carefully so that the fibres don't escape over a saturated filter paper).
12. Take the filter paper and the funnel out then place the filter paper onto a Petri dish and wait to dry.
13. Using an iPhone, take a photo of the fibres on the filter paper (remember to take them from the same height to make it a fair test).

14. Upload the photo into AI then ask AI to count fibres. (we asked AI to count the fibres for us because we couldn't see them properly and count them accurately).

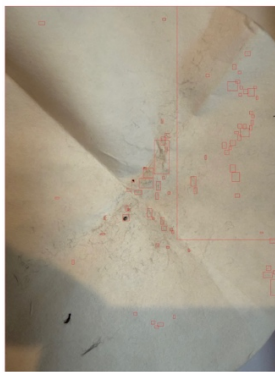
## Results

Because it is inefficient and inaccurate to count fibres manually under a microscope, I decided to use an automatic process. My daddy helped in this experiment by creating an AI agent using copilot. This was trained to count any fibres on the filter paper that were 100 or more pixels. Below is the table showing the fibres counted and the photos outlining fibres counted.

| Material         | Test 1 | Test 2 | Average             |
|------------------|--------|--------|---------------------|
| Polyester Fleece | 79     | 153    | $(79+153)/2= 116$   |
| Lycra            | 196    | 157    | $(196+157)/2=176.5$ |
| Rayon            | 97     | 279    | $(97+279)/2=188$    |
| Polyester        | 201    | 230    | $(201+230)/2=215.5$ |

### Test 1 photos

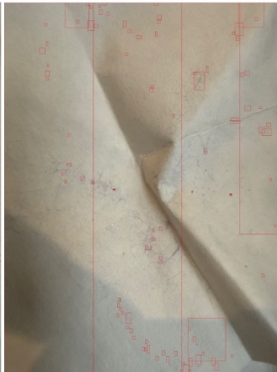
• Photo 1 (Polyester fleece):



• Photo 2 (Lycra):



• Photo 3 (Rayon):



• Photo 4 (Polyester):

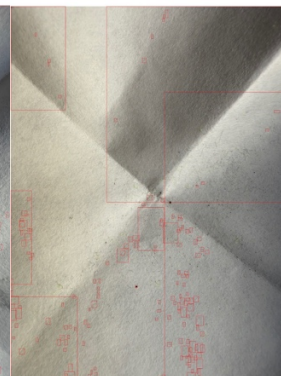


### Test 2 photos

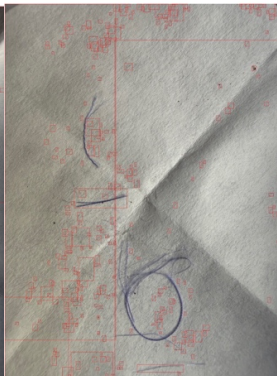
✓ Photo 1 – Polyester fleece (153)



✓ Photo 2 – Lycra (157)



✓ Photo 3 – Rayon (279)

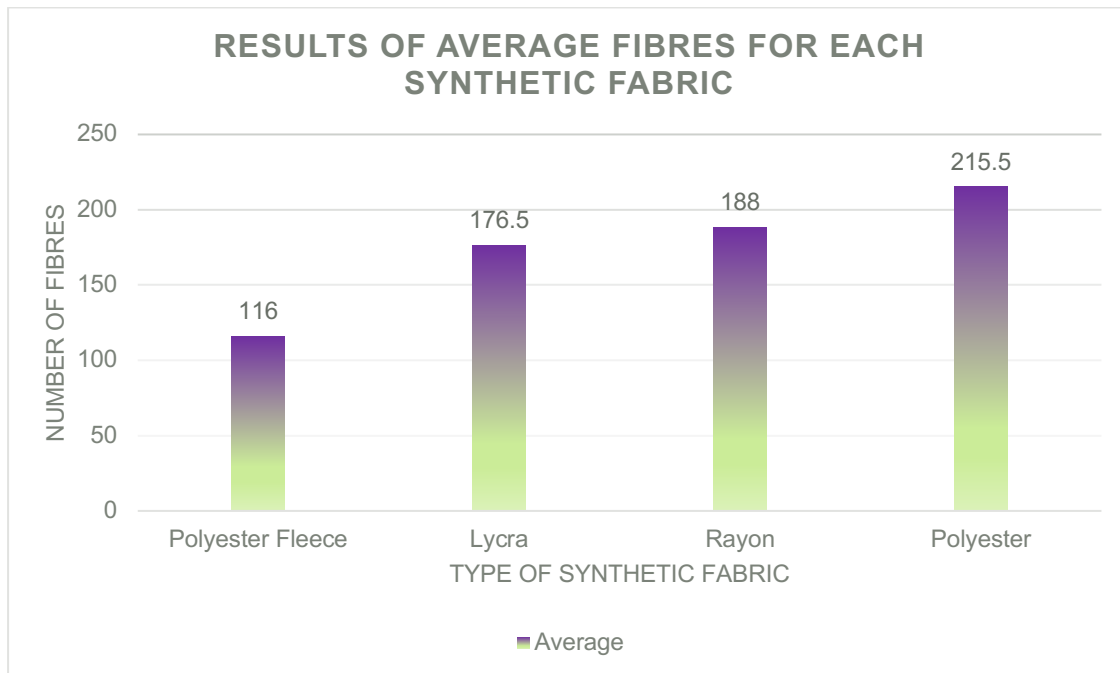


✓ Photo 4 – Polyester (230)



I entered the data into Excel and created a graph showing the results.





From the graph and table, I can see:

1. Polyester released the 4 most fibres with an average of 215.5 fibres!
2. The fleece equivalent of polyester has released the fewest fibres at 116 compared to 215.5 - 99.5 less fibres!
3. I've noticed that Test 2 gave off the most fibres overall.
4. The maximum number of fibres was 279 fibres (Rayon)
5. The minimum was 79 fibres (Fleece).

The photos show that even though polyester fleece released only 116 fibres, it has extremely thick fibres!

## Conclusions

My hypothesis was incorrect as polyester fleece only released 116 fibres when polyester in fact released the most at a jaw dropping 215.5 fibres. The reason for this result is unknown and I recommend more testing and more investigation.

My conclusion is that polyester released the most fibres and even though it is the most popular fabric we must take action and stop using (or in some cases stop making it) then we can make Australia a better and brighter place along with the oceans! A good alternative to polyester is Lycra which is very light and comfortable. Further research is required to make sure that the manufacturing processes are not as harmful to the environment as polyester in which case we can then use rayon or Lycra.

### Further ways to improve my test results are:

- Have multiple test results so we have a better average.
- Do the test with old fabrics to be more realistic of when people are washing their clothes again and again.
- Test with more synthetic materials such as acrylic and nylon to test whether we would get the same result again.
- Have a robot to do the manual labour for you so then it improves your morale and helps you work better.

## References

These are the books that I read for my background work and I would like to pay my respects to the creators of these books and to the **END OF POLLUTION!**

ABC, BTN. 2022. Microplastics in our Oceans. <https://www.abc.net.au/education/btn-microplastics-in-our-oceans/13971452>, accessed 16 May 2026

Comfort World. 2026. What is Fleece? What is Fleece material and how to care for it. <https://www.comfortworld.co.uk/long-live-clothes/what-is-fleece-material-and-how-to-care-for-it.html>, accessed 24 June 2026

FlexFeng Textile Technology. 2025. How do Synthetic Fibers Improve Fabric Durability? <https://www.flexfeng.com/blog/how-do-synthetic-fibers-improve-fabric-durability247>, accessed 24 June 2026

French, J . 2019. What a waste - Rubbish, recycling and protecting our planet.

Gray, T. 2022. Oceans of Plastic, understanding and solving a pollution problem.

Herculite. 2023. Complete Guide to Synthetic Fashions. <https://www.herculite.com/blog/the-history-of-synthetic-fabrics>, accessed 16 May 2026

History of simple things. 2025. What exactly is Polyester? The plastic in our clothes. 4 October 2025, <https://youtu.be/ErKKOVv7IHE?si=pZLpOy8Ns6WAolcc> , accessed 17 May 2026

Merriam-Webster. 2019. Children's Dictionary. DK Publishing.

NSFScience. 2024. What are Microplastics? Science for Kids. 15 April 2024. <https://youtu.be/fyYy58aTs7U?si=vSJQVMk9svboanc3>, accessed 17 May 2026

Scales, H. The Great Barrier Reef. 2021

Sky news. Plastics from our clothing is polluting oceans. 13 March 2017, [https://youtu.be/h7dclG1rj\\_l?si=7XxVwZB6pLuutmnT](https://youtu.be/h7dclG1rj_l?si=7XxVwZB6pLuutmnT) , accessed 17 May 2026

## Appendices

### A1. Pilot test notes

The reason I conducted this pilot test was to make sure I had a full understanding of my equipment and so I knew the process and to test to see if it would work. I also did it to figure out if there was anything I needed to change. These are the things I noticed:

- Have assistance cutting fabric
- The red scissor was the most efficient at cutting the polyester fleece.
- I used a 10x10 cm square paper templet to cut the squares of fabric.
- Heat water using the coffee machine to get the correct temperature at 50°C. Using the coffee machine meant that I didn't need the thermometer or the kettle.
- Make sure all equipment is clean before use otherwise fabrics and dirt will get caught and make it an unfair test therefore meaning I would have to restart and wouldn't finish in time to go to my England trip.
- Pour the water carefully to not saturate the filter paper so then fibres don't escape and make it an unfair test.
- When I used the magnetic stirrer, I noticed the magnetic pieces weren't hitting the fabric. The water was just swirling! So, I started shaking the fabric instead in a jam jar to one shake per second. I noticed that when we shook the fabric more fibres were released. We want more fibres to be collected otherwise the experiment would be for nothing.
- The microscope wouldn't work properly so I decided to take a photo and uploaded it into AI (my dad did this for me). AI is better because it counted the fibres for me and if I counted it would be inefficient and inaccurate but AI is *accurate* and *efficient*.





13. Upload photo into AI then ask AI to count fibres then record number of fibres on a record table

\* When I used the Magna stirrer the magnets were hitting the fabric so I started shaking the fabric in a jar for two mins

### Practice test notes

1. have assistance cutting fabric
2. Heat water in coffee machine to get correct temp at  $50^{\circ}\text{C}$ . ~~Thermometer is  $3^{\circ}\text{C}$  higher.~~ So set coffee machine  $3^{\circ}\text{C}$  higher.
3. ~~Make~~ Make sure all equipment is clean before use otherwise fabrics and dirt will get mixed up.
4. Pour the water carefully to not saturate the filter paper so then fibres don't escape
5. ~~Ino~~ I noticed that when we shook it ~~was~~ more fibres were released.

- \* ~~the~~ pour water into ~~it~~ until the ~~water~~ is at the top of the ~~can~~ ~~this~~ This would make it ~~10~~
- \* 5. Place soaked fabric into jar with water and put on the lid tightly.
- \* Using a metronome, shake jar at a rate of 1 per second for 2 mins

1. Polyester has released the most ~~fibres~~ <sup>Fibres</sup> with an average of 215.5 fibres.
2. The fleece equivalent of Polyester has released the fewest fibres at 116 compared to 215.5 + 40.5 ~~more~~ fibres!
3. I've noticed that test 2 gave the most fibres overall ~~probably because some of the fibres got stuck and added to the total~~
4. The maximum amount of fibres was 279 fibres
5. The minimum was 79 fibres.

\* 99.5



### A3. Experiment Photographs



Photo 1 Looking for the types of synthetic fabric



Photo 2 Found the four types of synthetic fabric



Photo 3 Polyester, Polyester Fleece, Lycra & Rayon (top to bottom)



Photo 4 Pilot Test - Stirred and Shaken





Photo 5 Using the template to cut the fabric

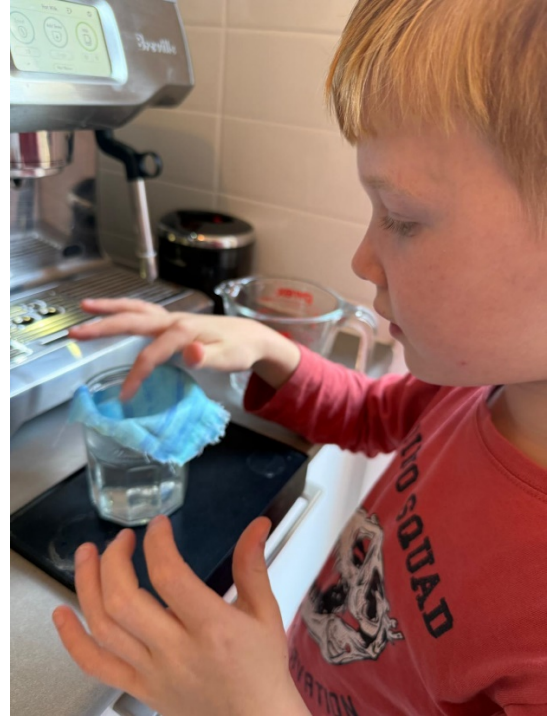


Photo 6 Placing fabric into jam jar with hot warm water

## OSA RISK ASSESSMENT FORM

for all entries in ☒ Models & Inventions and ☒ Scientific Inquiry

This must be included with your report, log book or entry. One form per entry.

STUDENT(S) NAME: Finn Gelsthorpe

ID: 0526-004

SCHOOL: Prince Alfred College

Activity: Give a brief outline of what you are planning to do.

Heating water with the coffee machine heating wand. Shake a glass jar. Filter water and fabrics.

Are there possible risks? Consider the following:

- Chemical risks: Are you using chemicals? If so, check with your teacher that any chemicals to be used are on the approved list for schools. Check the safety requirements for their use, such as eye protection and eyewash facilities, availability of running water, use of gloves, a well-ventilated area or fume cupboard.
- Thermal risks: Are you heating things? Could you be burnt?
- Biological risks: Are you working with micro-organisms such as mould and bacteria?
- Sharps risks: Are you cutting things, and is there a risk of injury from sharp objects?
- Electrical risks: Are you using mains (240 volt) electricity? How will you make sure that this is safe? Could you use a battery instead? *\*Only batteries can be used for Models & Inventions entries*
- Radiation risks: Does your entry use potentially harmful radiation such as UV or lasers?
- Other hazards.

Also, if you are using other people as subjects in an investigation you must get them to sign a note consenting to be part of your experiment.

| Risks                                                                                                                                                                                                               | How I will control/manage the risk                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Coffee machine using mains electric.<br>2. Burning my body on the steam wand.<br>3. Spilling hot water on myself.<br>4. Dropping the glass jar while shaking.<br>5. Spilling hot water when pouring into funnel. | 1. My parents will turn on the coffee machine.<br>2. The wand will be placed in the jug of water before heating and turned off automatically when it reaches the desired temperature.<br>3. When pouring hot water, I'm using a heat resistant jug and my parents will hold the jar to stop it slipping.<br>4. I will hold the top and the bottom, rather than the sides.<br>5. This will be done in the sink so any spilt water will do the drain. |

(Attach another sheet if needed.)

**Risk Assessment indicates that this activity can be safely carried out**

RISK ASSESSMENT COMPLETED BY (student name(s)): Finn Gelsthorpe

SIGNATURE(S):

Finn Gelsthorpe

☒ By ticking this box, I/we state that my/our project adheres to the listed criteria for this Category.

TEACHER'S NAME:

Christopher Richards

SIGNATURE:

[Signature]

DATE:

25-6-26