

Microplastics Inquiry Report

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Task 1

Read the articles “Plastic From Tyres” and “Plastics In the Ocean”. Make your own notes of the key points with the macroconcepts—Interactions and Systems, as a guide.

- Large amounts of microplastics are produced by many objects around us
- Around 30% of plastics in seas come from microplastics and not the breaking down of larger ones.
- These microplastics enter the sea and the food chain, posing potentially disastrous effects on the rich diversity of life within them, and on human health
- These microplastics are produced by us humans, but they enter the sea and cause harm to the marine creatures like fishes [interactions] and since we consume them in the end as consumers, we will be consuming these microplastics too [systems]. These may ultimately cause harm to us too.
- Debris from tyre abrasion and synthetic fabrics are the main sources of microplastics pollution
- Solutions need to be made by considering plastics and products over their whole lifecycle [systems] to reduce plastic losses during each step of its way — production, use, maintenance or end of life of products and releases to the world ocean.
- It may be possible to make synthetic clothes and textiles to help reduce the rate of this pollution.

Task 2

Scientific Investigation: Compare the amount of microplastics from car tyres with the amount from shoe wear.

What are some questions you have about the inquiry question? What are your answers to those questions?

Questions	Answers
How do microplastics form from rubber products?	Through friction, washing, and abrasions.
What is the difference in the amount of microplastics produced by car tyres and shoe wear? How significant is it?	Car tyres are one of the most prevalent causes of microplastics.
What kind of materials can contain microplastics?	Many, from water, laundry, to cosmetic products. A huge concern is that animals and humans alike consume these microplastics from water, and cause serious health harm.

Experimental Set-up

Title: Comparing the amount of microplastics from car tyres with the amount from shoe wear.											
Hypothesis: If sandpaper is used to rub against the soles of shoes and tyres, more microplastics will be collected from the tyres.											
Independent Variable: The type of rubber product.											
<table border="1"> <tbody> <tr> <td>Test</td> <td>Sole of Shoe</td> <td>Tyre</td> <td>Sandpaper (control)</td> </tr> <tr> <td>Sample Size</td> <td>3 shoes</td> <td>3 tyres</td> <td>3 pieces of sandpaper</td> </tr> </tbody> </table>				Test	Sole of Shoe	Tyre	Sandpaper (control)	Sample Size	3 shoes	3 tyres	3 pieces of sandpaper
Test	Sole of Shoe	Tyre	Sandpaper (control)								
Sample Size	3 shoes	3 tyres	3 pieces of sandpaper								
Dependent Variable: The amount of microplastics produced.											
Constants: Amount of sandpaper used, Surface Area of sandpaper used, Force used to scrub the samples, Time taken to scrub samples											
Materials:											

Sandpaper	Tyre	Shoe
Paper	Coffee Filter	Funnel
Bowl	Water	Cloth
Pencil	Ruler	

Method:

1. Wipe clean tyre and sole of shoe with cloth and water, ensuring that no debris is left on them. Dry.
2. Scrub tyre with a 5cm x 5cm square of sandpaper with a constant force for 1min. Ensure the entire surface area of sandpaper is in contact with object during scrubbing.
3. Collect residue with paper.
4. Transfer the residue to a bowl.
5. Add 500ml of water to the bowl. Mix well.
6. Draw a 15 x 15 grid on a piece of coffee filter.
7. Pour the mixture through a funnel over the piece of coffee filter.
8. Collect and dry residue. Count the number of pieces of granules. The granules are microplastics. Use the grid to aid in counting.
9. Scrub sole of shoe with a similar size of sandpaper, and with the same amount of constant force in step 2 for 1min. Ensure the entire surface area of sandpaper is in contact with object during scrubbing.
10. Repeat steps 3-8 for the sole of the shoe.
11. Scrub two pieces of 5cm x 5cm of sandpaper together with the same amount of constant force in step 2 for 1min.
12. Repeat steps 3-8 for the sandpaper.
13. Repeat two more times Steps 1-12 with a different tyre, a different sole of a shoe, and more sandpaper.

Conditions of Experiment:

The steps with regards to scrubbing the tyre was conducted in a carpark, and traffic was looked out for. The rest of the steps were conducted in a house. Wind was ensured to not be present, or else the experiment would be repeated on a different tyre, as it could blow some of the microplastics away.

Results:

Independent Variable	Tyre	Sole of Shoe	Sandpaper (control)
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No. of Granules												
	1st	2nd	3rd	Avg	1st	2nd	3rd	Avg	1st	2nd	3rd	Avg
	182	193	177	184	78	82	70	77	0	0	0	0

Analysis:

By taking the average of the three replicates, it is evident that the tyre had a significantly larger amount of granules of 184, as compared to that of the sole of the shoe, 77. The control showed that the sandpaper did not produce any microplastics, hence it is certain that all the microplastics were produced by the sample themselves.

Therefore, tyres produce much more granules and hence more microplastics than shoe wear.

Limitations:

This experiment does have some limitations.

Firstly, the number of granules can be subjective, as the size of each granule was not taken into consideration when comparing the amount of microplastics. However, the difference of number of granules (107) is statistically significant enough to ascertain that there is much more microplastics in tyres than in soles of shoes, but it is unclear to what exact extent.

Furthermore, some of the granules may not be of microplastics but simply dirt. However, attempts were made to decrease this likelihood by wiping down and cleaning the tyres and soles of shoes, as they are expected to have much dirt.

In addition, some microplastics cannot be visible by the naked eye, and can also pass through the filter and not be collected as residue. However, we assume that the difference in the number of microplastics that cannot be seen is similar to those that can be seen. Therefore, the experiment is still reliable in comparing the extent.

Under the conditions and equipment in a home, it is unrealistic to be able to view these invisible microplastics without a microscope, let alone compare their abundances.

Therefore, while this experiment has some limitations, it is still relatively reliable and accurate considering the circumstances and equipment usable.

Conclusion: There is significantly more microplastics in car tyres than in shoe wear.

Appendix (Task 2)

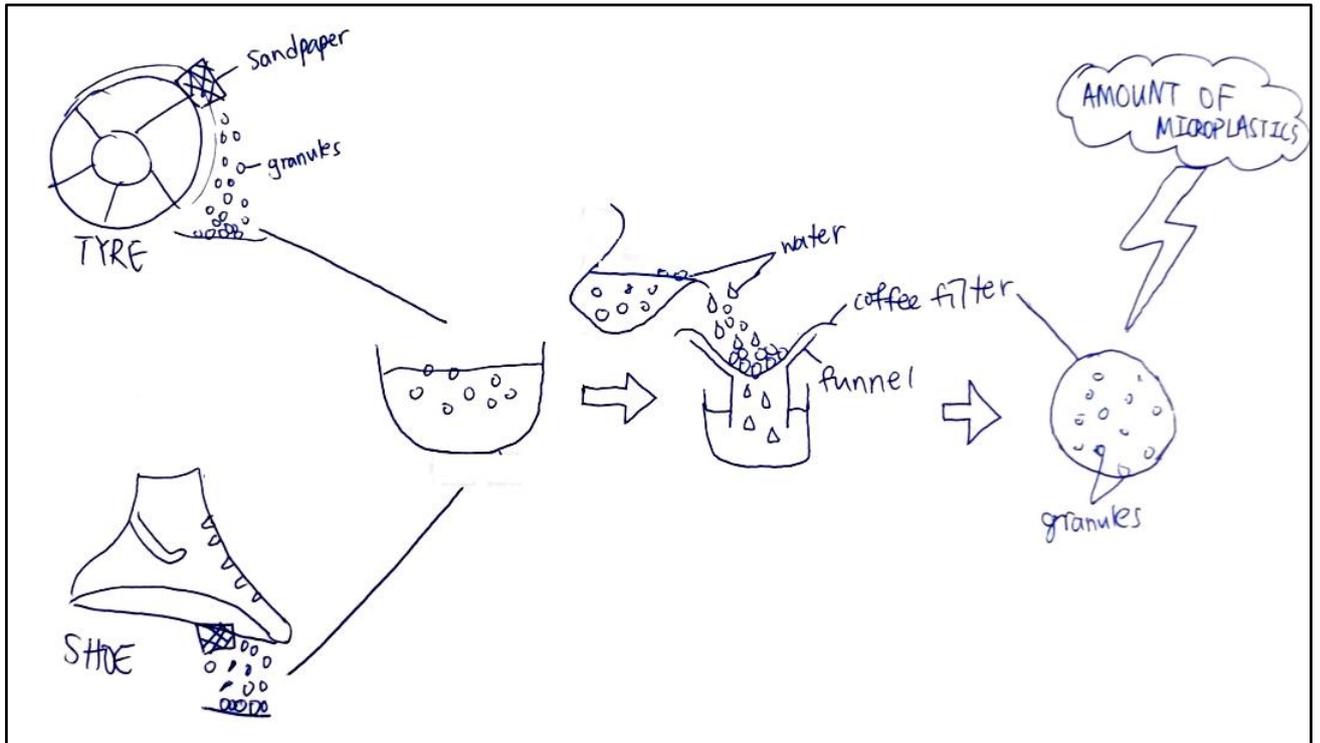


Figure 1. Steps for collecting granules of microplastics in tyres and soles of shoes.