Project Notes:

Project Title: Filtering Microplastic
Name: Neena Xiang

Note Well: There are NO SHORT-cuts to reading journal articles and taking notes from them. Comprehension is paramount. You will most likely need to read it several times so set aside enough time in your schedule.

Contents:

Knowledge Gaps:

This list provides a brief overview of the major knowledge gaps for this project, how they were resolved and where to find the information.

Knowledge Gap	Resolved By	Information is located	Date resolved
What is the composition of microplastics			
How can microplastic be detected?	Reading article	Notes in Article 2	October 16, 2019
What are the most common types of plastics?	Reading article	Notes in Article 2	October 16, 2019
Properties of common plastic			

Literature Search Parameters:

These searches were performed between (Start Date of reading) and XX/XX/2019.
List of keywords and databases used during this project.

Database/search engine	Keywords	Summary of search
Engineering Village	Microplastic and filter	Found filters used on seawater
Engineering Village	Microplastic and filter	Found ways to detect microplastic
ScienceDirect	Common plastics and properties	Found a chapter of a book that explained the properties of common plastics

Article #1 Notes: Title

Article notes should be on separate sheets

Source Title	
Source Author	
Source citation	
Original URL	
Source type	
Keywords	
Summary of key points	
Important Figures	
Reason for interest	
Notes	
Follow up Questions	

Article #1 Notes: Microplastic pollution in deep-sea sediments

Article notes should be on separate sheets

Source Title	Environmental Science
Source Author	Lisbeth Van Cauwenberghe
Source citation	Van Cauwenberghe, L., Vanreusel, A., Mees, J., & Janssen, C. R. (2013). Microplastic pollution in deep-sea sediments. *Environmental Pollution*. Retrieved from http://onemoregeneration.org/wp-content/uploads/2012/07/Microplastic-pollution-in-deep-sea-sediments.pdf
Original URL	http://onemoregeneration.org/wp-content/uploads/2012/07/Microplastic-pollution-in-deep-sea-sediments.pdf
Source type	Online journal
Keywords	Microplastics, Deep sea, Sediment, Pollution
Summary of key points	- Microplastics are found in deeper depths than initially thought - Samples were taken from deeper in the ocean and microplastics were found

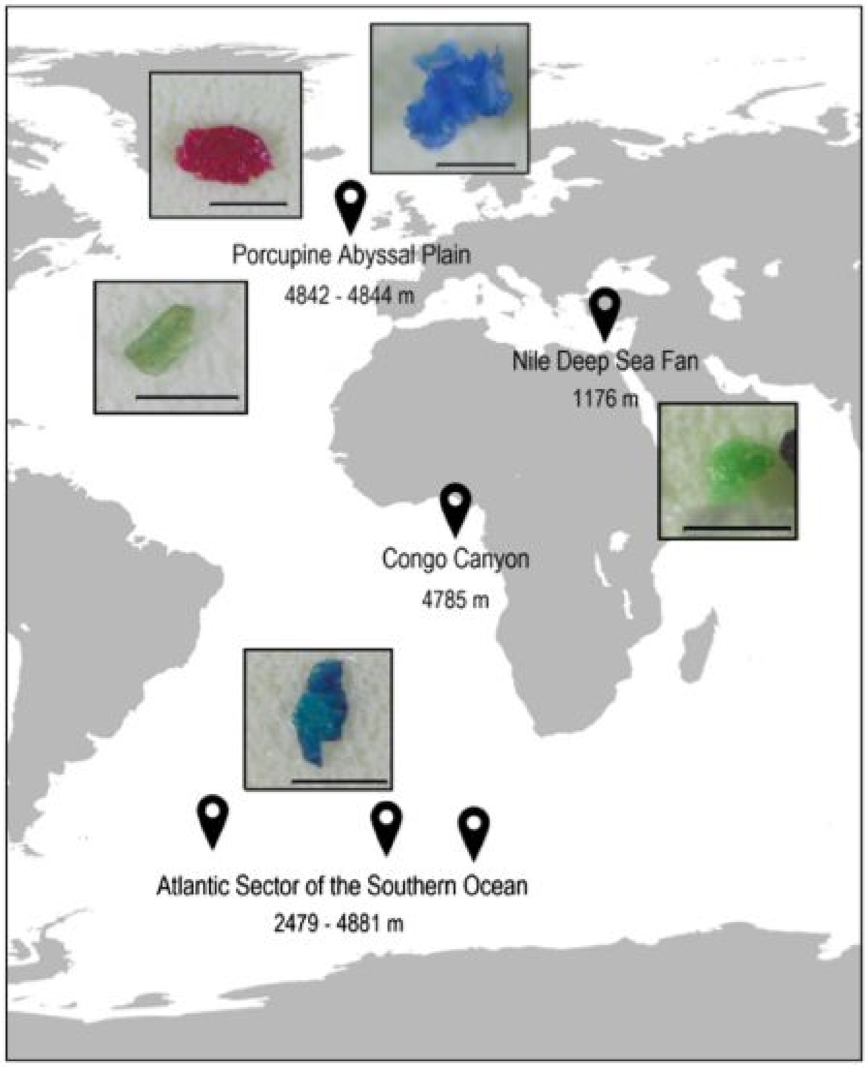
<table>
<tr>
<td>Important Figures</td>
<td>


Fig. 1. Locations of the sites sampled and microplastics recovered from the deep sea sediments. Three locations in the Atlantic Ocean (Porcupine Abyssal Plain, Lobe of Congo Canyon and Atlantic sector of the Southern ocean) and one location in the Mediterranean Sea (Nile Deep Sea Fan) were sampled. Microplastics (see inserted photos) were detected in the top centimetre of sediments from three of the four sampled locations (Scale bar represents 100 μm).

L. Van Cauwenberghe et al. / Environmental Pollution 182 (2013) 495–499 497

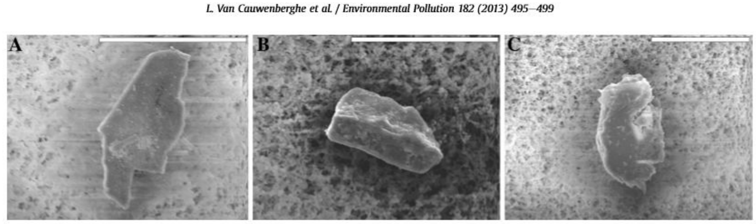


Fig. 2. Scanning electron microscopy images of microplastics. A. Blue particle extracted from sediment from the Southern ocean (2749 m). B. Green particle originating from the Porcupine Abyssal Pain (4842 m). C. Red particle extracted from sediment from the Porcupine Abyssal Plain (4843 m) (Scale bar represent 100 μm).
</td>
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<tr>
<td>Reason for interest</td>
<td>There may be microplastic found in more places than the surface waters of the ocean.</td>
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</table>

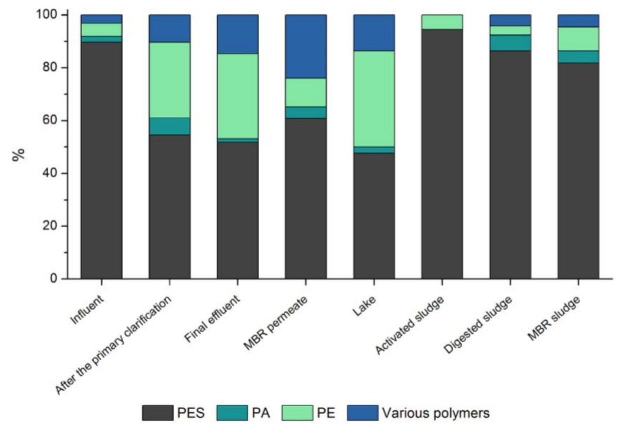
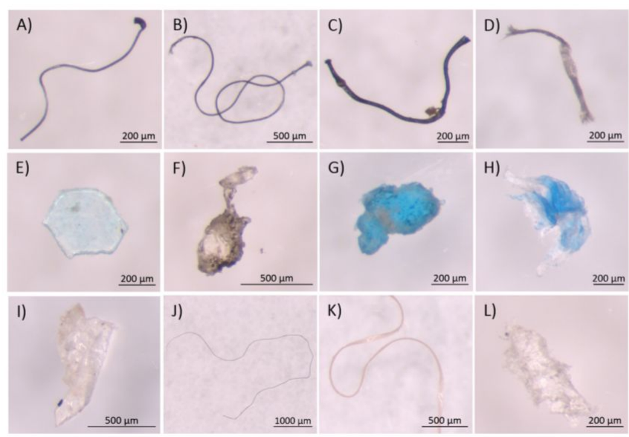
Notes	- Improper plastic disposal leads to the breakdown of those plastics in the ocean - Sewage treatments don’t keep microplastic, so it is released into aquatic environments - “ plastic particles <1mm accounted for 65% of all marine debris items collected on beaches in the Tamar Estuary (U.K.)” - Marine animals will eat the plastics, and it will either exit the animal as defecation or stay in the tissues of the animal. - There is plastic found in water columns and sediment in the ocean
Follow up Questions	Could there be micro plastic in the sediment on land?

Microplastics are small particles of plastic which have broken down from bigger plastic items. There has been a build up for decades, but it wasn’t until recently that people have wondered how far the pollution has gotten. There have been microplastics found on the surface of the ocean, but there may be more microplastics at the bottom of the ocean. The study was conducted to prove that microplastic has indeed permeated to the bottom of the ocean.

Article #2 Notes: Occurrence, identification and removal of microplastic particles and fibers in conventional activated sludge process and advanced MBR technology

Article notes should be on separate sheets

Source Title	Water Research
Source Author	Mirka Lares
Source citation	Lares, M., Ncibi, M. C., & Sillanpaa, M. (2018). Occurrence, identification and removal of microplastic particles and fibers in conventional activated sludge process and advanced MBR technology. *Water Research*, *133*, 236–246. doi: https://doi.org/10.1016/j.watres.2018.01.049
Original URL	https://www.sciencedirect.com/science/article/pii/S0043135418300630
Source type	Online Journal
Keywords	Microplastics, WWTP (wastewater treatment plants), Wastewater, Sludge, Identification
Summary of key points	- Sludge samples were collected for 3 months - The two methods of filtration used were conventional activated sludge and membrane bioreactor. - Activated sludge was more efficient.

Important Figures	240 M. Lares et al. / Water Research 133 (2018) 236–246  **Fig. 1.** The proportion of different polymers in different stages of the WWTP and a nearby lake. Various polymers include e.g. PE, PP and PES fragments with similar kind of appearance. M. Lares et al. / Water Research 133 (2018) 236–246 241  **Fig. 2.** Typical appearance of different polymers detected in different stages of the WWTP and recipient lake and identified by micro-FTIR and/or micro-Raman. (A–E) Polyester, (F–I) polyethylene, (J–K) polyamide and (L) polypropylene.
Reason for interest	This article presented some methods of filtration of microplastics
Notes	- Plastic gets into the environment through the disposal of plastic products and the wear and tear of other frequently used products. - There are fluctuations between studies of the size of microplastic - Most particles are removed from wastewater and end up in treatment plants - Sludge may end up in the environment which also releases the microplastic in it - There may be even smaller nanoplastics - Possible means of filtration include infrared spectroscopy, Raman spectroscopy, and visually looking at it - Great caution was taken to avoid contamination - Polyester, polyethylene, polyamide, and polypropylene are common plastics

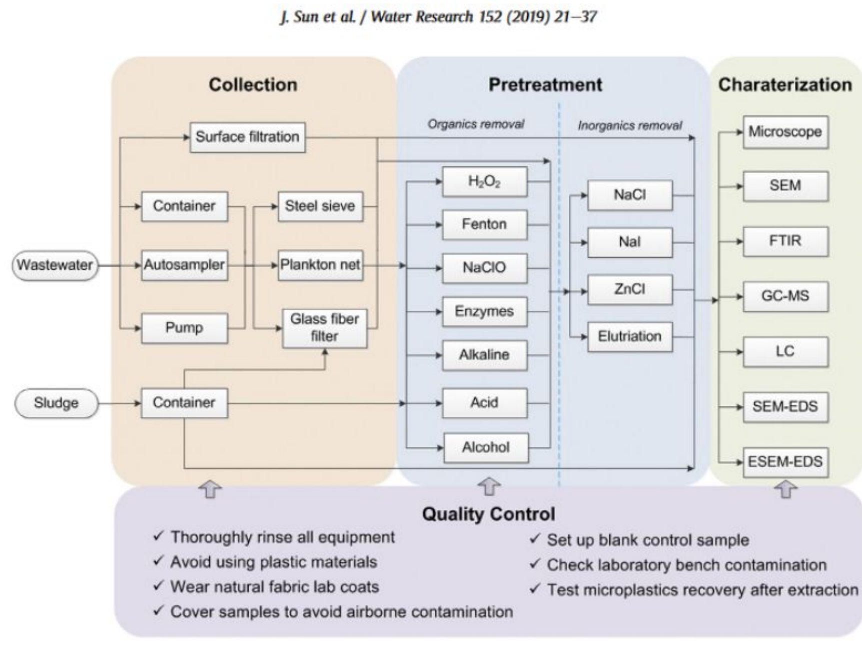
	- Polyester fibers were the most common plastics in the samples - Polyethylene was the most common polymer in the samples - Cosmetics give off microplastics - Microplastic fibers are more common than microplastic particles in wastewater sludge - If a mesh smaller than 250 nanometers is used, small sized MPs are lost
Follow up Questions	What other methods are there to filter out microplastic? What problems do different types of plastics create when being collected? How many different types of plastics are there?

Microplastic has found its way to wastewater treatment plants. The goal of the study was to find a way to efficiently filter the microplastic from the collected sewage. Researchers used the conventional activated sludge and membrane bioreactor to filter the microplastic, and identified any pieces with a microscope. The conventional activated sludge was found to be more efficient, and the collected microplastics were released into bodies of water.

Article #3 Notes: Microplastics in wastewater treatment plants: Detection, occurrence and removal

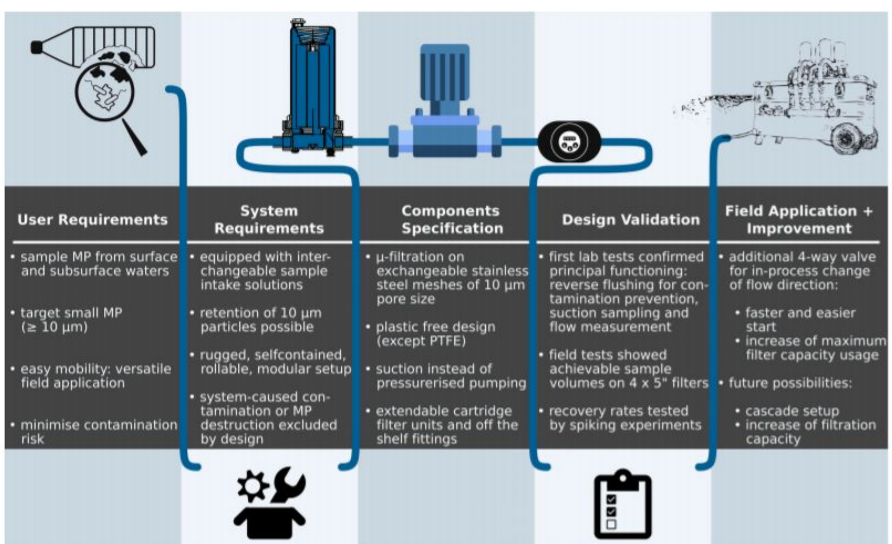
Article notes should be on separate sheets

Source Title	Water Research
Source Author	Jing Sun
Source citation	Sun, J., Dai, X., Wang, Q., van Loosdrecht, M. C. M., & Ni, B.-jie. (n.d.). Microplastics in wastewater treatment plants: Detection, occurrence and removal. *Water Research*, *152*, 21–37. Retrieved from Microplastics in wastewater treatment plants: Detection, occurrence and removal
Original URL	https://www.sciencedirect.com/science/article/pii/S0043135418310686
Source type	Online Journal
Keywords	Microplastics Wastewater treatment plant detection Occurrence Sewage sludge Treatment technologies
Summary of key points	- There is no immediate danger in consuming microplastic, but the toxins can build up -

Important Figures	 **Fig. 1.** Flow chart summarizing steps and techniques used for microplastics detection in WWTPs.
Reason for interest	The article gives insights into the methods that are already being used
Notes	- Microplastics are mainly identified by size but it is subject to bias because of the color -
Follow up Questions	- What are the most common types of plastic? - Is there a way to use wastewater treatment methods in the ocean? - How can the treatment plants be improved to collect all traces of microplastic?

Article #4 Notes: Small Microplastic Sampling in Water: Development of an Encapsulated Filtration Device

Article notes should be on separate sheets

Source Title	Small Microplastic Sampling in Water: Development of an Encapsulated Filtration Device
Source Author	Robin Lenz and Matthias Labrenz
Source citation	Lenz, R., & Labrenz, M. (2018). Small Microplastic Sampling in Water: Development of an Encapsulated Filtration Device. *Water*, *10*(8). doi: https://doi.org/10.3390/w10081055
Original URL	https://www.mdpi.com/2073-4441/10/8/1055/htm
Source type	Journal Article
Keywords	Microplastics, field work, pollution monitoring, engineering design
Summary of key points	- Microplastics that are less than 10 nanometers become too hard for flow through filtration to work
Important Figures	
Reason for interest	This journal talk about some of the filtration methods that area

	already being used
Notes	- Most filtration methods just skim the surface of the water and need water to flow through it to work - Centrifuges have also been used to separate microplastics by density - When trying to collect really small microplastics, the filter material and air will contaminate the sample. - Really fine sieves are easily clogged -
Follow up Questions	- How can I get around flow through filtration? - Is there a need for me to attempt to filter these smaller sized plastics?

Article #5 Notes: Size and shape matter: A preliminary analysis of microplastic sampling technique in seawater studies with implications for ecological risk assessment

Article notes should be on separate sheets

Source Title	Size and shape matter: A preliminary analysis of microplastic sampling technique in seawater studies with implications for ecological risk assessment
Source Author	Garth A Coverton, Christopher M Pearce, Helen J Gurney-Smith, Stephen G Chastain, Peter S. Ross, John F. Dower, Sarah E Dudas
Source citation	Covernton, G. A., Pearce, C. M., Gurney-Smith, H. J., Chastain, S. G., Ross, P. S., Dower, J. F., & Dudas, S. E. (2019). Size and shape matter: A preliminary analysis of microplastic sampling technique in seawater studies with implications for ecological risk assessment. *Science of the Total Environment*, *667*, 124–132. Retrieved from https://www-sciencedirect-com.ezproxy.wpi.edu/science/article/pii/S004896971930854X
Original URL	https://www-sciencedirect-com.ezproxy.wpi.edu/science/article/pii/S004896971930854X
Source type	Journal
Keywords	Aquaculture, Discrete, Filtration, Mesh, Methodology, Microplastics
Summary of key points	- Microfibers are the most common shape of microplastic - They can pass through mesh due to their thickness - Mesh may not be the best method of filtration since it measures 1 - 4 times less

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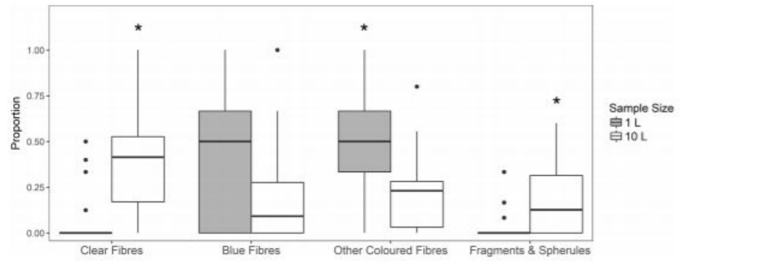
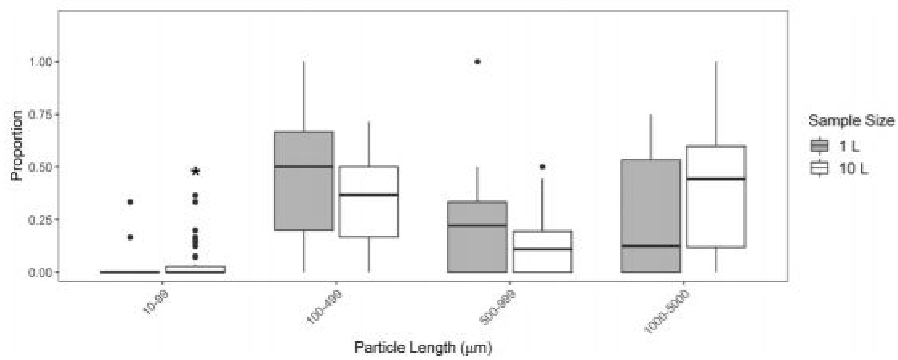
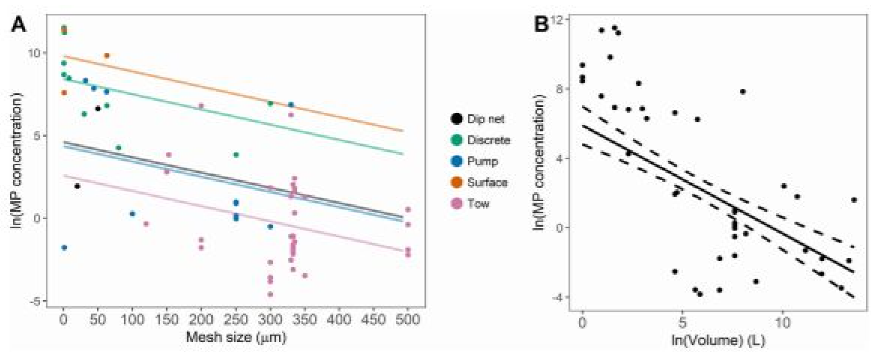


Fig. 3. Boxplots of proportions of potential microplastic particle types in 36 samples, separated by sampling method (1-L jar sample and 10-L filtered bucket sampling). Asterisks indicate significant differences between methods as determined by two-sample Mann-Whitney U tests. Coloured fibres (aside from blue) are grouped together, as well as fragments and spherules. Box limits and whiskers show first and third quartiles, respectively, with outliers (>1.5 times the distance between the first and third quartiles away from the median) shown as points.

G.A. Covernton et al. / Science of the Total Environment 667 (2019) 124–132





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<tr><td>Reason for interest</td><td>
- Talks about sampling methods and possible environmental risks
- Shows the types of particles that were in samples
</td></tr>
<tr><td>Notes</td><td>
- Larger meshes underestimate the amount of microplastic found in water
</td></tr>
<tr><td>Follow up Questions</td><td>How can I implement other filtration methods that aren’t mesh?</td></tr>
</table>

Article #6 Notes: Development of an optimal filter substrate for the identification of small microplastic particles in food by micro-Raman spectroscopy

Article notes should be on separate sheets

Source Title	Development of an optimal filter substrate for the identification of small microplastic particles in food by micro-Raman spectroscopy
Source Author	Barbara E Obmann, George Sarau, Sebastian W Schmitt, Heinrich Holtmannspötter, Silke H Christiansen Wilhem Dicke
Source citation	Oßmann, B.E., Sarau, G., Schmitt, S.W. et al. Anal Bioanal Chem (2017) 409: 4099. https://doi-org.ezproxy.wpi.edu/10.1007/s00216-017-0358-y
Original URL	https://link-springer-com.ezproxy.wpi.edu/article/10.1007/s00216-017-0358-y#cities
Source type	Journal
Keywords	Microplastics . Food . Micro-Raman spectroscopy . Aluminium . Polycarbonate membrane filter . Substrate
Summary of key points	- Analysis of filtration usually happens on surface of filter - Membrane filters are helpful filters
Important Figures	(see tables below)

Table 1 Material, manufacturer, pore size and diameter of all tested, commercially available membrane filters

Material	Manufacturer	Pore size (μm)	Diameter (mm)
Regenerated cellulose	GE Healthcare Life Sciences Whatman™	0.45	50
Nitrocellulose	Macherey-Nagel	0.45	47
Cellulose acetate	Macherey-Nagel	0.45	47
Aluminium oxide	GE Healthcare Life Sciences Whatman™	0.2	25/47
Silver	Pieper Filter GmbH	0.45	47
PC white	Merck Millipore Ltd.	0.4	25
PC black	Merck Millipore Ltd.	0.4	25
PC coated with gold	Nuclepore GmbH Costar	0.8	37
	GE Healthcare Life Sciences Whatman™	0.4	25
		0.8	13
	APC	0.4	25
		0.8	25

Table 2 Material, type, manufacturer and size of all used plastic particle standards

Material	Type	Manufacturer	Size (μm)
Polystyrene	Polybead micron microspheres, 2.5% solids in water	Polysciences Inc.	1
Polyethylene	Clear microspheres, powder	Cospheric	1–10
			10–106
Polypropylene	Chromatographic grade, powder	Polysciences Inc.	25–85
Polyamide–Nylon 6	Powder	GoodFellow	15–20 (average particle size)
Poly(vinyl chloride)	Powder	Pyropowders.de	<50

Reason for interest	It explores the concept of micro-Raman spectroscopy
Notes	- There is microplastic even in food. - Microplastics can get into organs through food consumption - Using a metal coating will help material be detected by Raman spectroscopy - Regenerated cellulose, nitrocellulose and cellulose acetate are some good materials.
Follow up Questions	Are there other more effective methods of analyzing collected plastic?

Article #7 Notes: Effect of microplastic size on the adsorption behavior and mechanism of triclosan on polyvinyl chloride

Article notes should be on separate sheets

Source Title	Effect of microplastic size on the adsorption behavior and mechanism of triclosan on polyvinyl chloride
Source Author	Jie Ma, Jinghua Zhao, Zhilin Zhu, Liquing Li, Yu Fei
Source citation	Ma, J., Zhao, J., Zhu, Z., Li, L., & Yu, F. (2019). Effect of microplastic size on the adsorption behavior and mechanism of triclosan on polyvinyl chloride. *Environmental Pollution, 254* Retrieved from https://www.sciencedirect.com/science/article/pii/S0269749119336310
Original URL	https://www.sciencedirect.com/science/article/pii/S0269749119336310
Source type	Journal article
Keywords	Microplastics, Polyvinyl chloride, Triclosan, Size, Adsorption behavior

<table>
<tr><td>Summary of key points</td><td>
- Particle sizes affected absorption capacity
- Salinity and pH also changed the amount of pollutant that could be absorbed.
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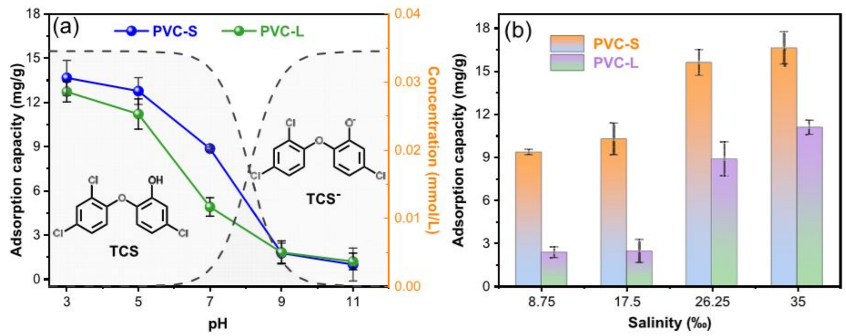
<tr><td>Important Figures</td><td>


Fig. 4. The influences of pH (a) and salinity (b) on adsorption of TCS on PVC-S and PVC-L.

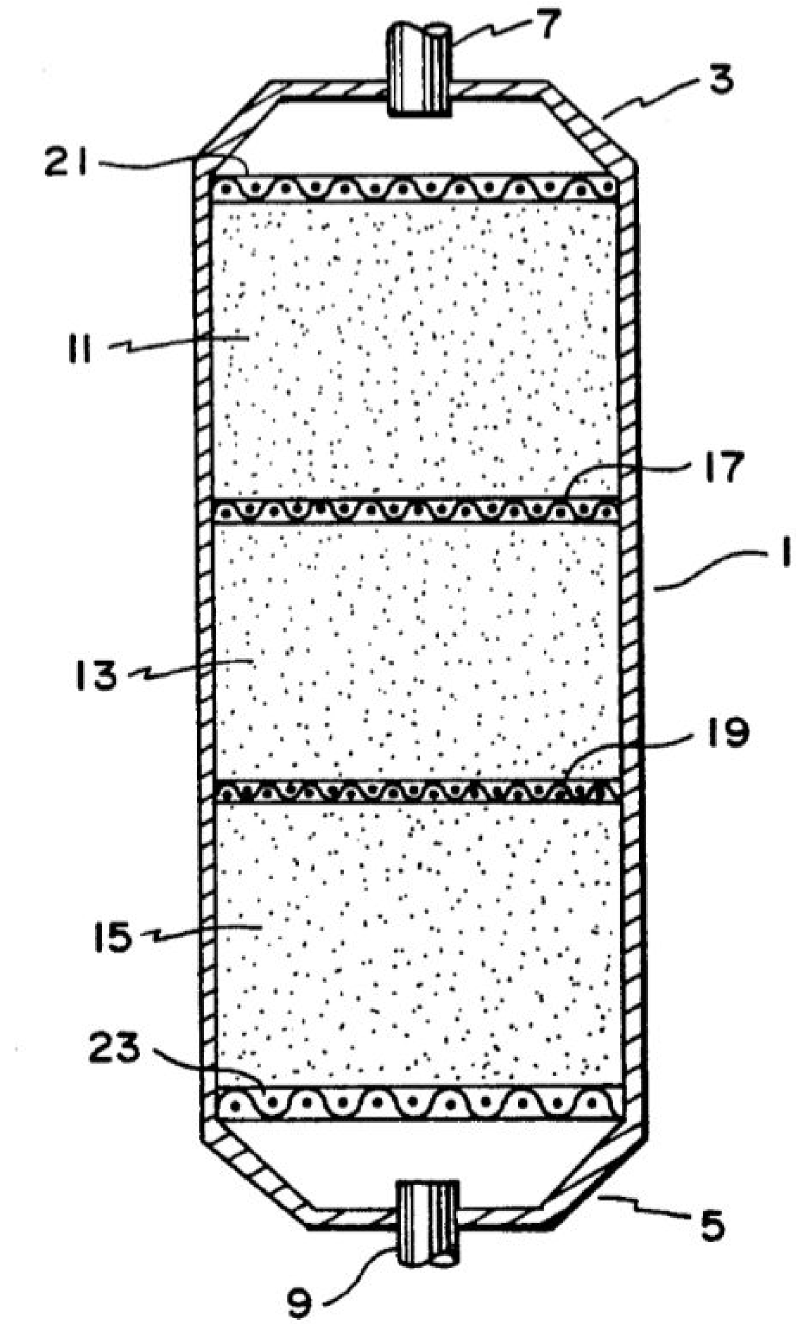
Table 2
Adsorption isotherm parameters of TCS on PVC-S and PVC-L (PVC: 10 mg, T = 298 K).

<table>
<tr><td></td><td colspan="3">Linear</td><td colspan="4">Langmuir</td></tr>
<tr><td></td><td>k_d</td><td>R^2</td><td>P</td><td>q_e</td><td>k_L</td><td>R^2</td><td>P</td></tr>
<tr><td>PVC-S</td><td>1.35</td><td>0.856</td><td>0.0028</td><td>42.1</td><td>0.061</td><td>0.915</td><td>6.00E-4</td></tr>
<tr><td>PVC-L</td><td>1.05</td><td>0.865</td><td>0.0024</td><td>40.2</td><td>0.044</td><td>0.909</td><td>7.52E-4</td></tr>
<tr><td></td><td colspan="4">Freundlich</td><td colspan="4">Temkin</td></tr>
<tr><td></td><td>k_F</td><td>n</td><td>R^2</td><td>P</td><td>B_T</td><td>k_T</td><td>R^2</td><td>P</td></tr>
<tr><td>PVC-S</td><td>3.01</td><td>1.38</td><td>0.892</td><td>1.17E-4</td><td>6.77</td><td>0.974</td><td>0.878</td><td>1.59E-4</td></tr>
<tr><td>PVC-L</td><td>2.05</td><td>1.30</td><td>0.890</td><td>1.34E-4</td><td>5.77</td><td>0.803</td><td>0.866</td><td>2.19E-4</td></tr>
<tr><td></td><td colspan="5">D-R</td></tr>
<tr><td></td><td>q_e</td><td>β</td><td>E_{D-R}</td><td>R^2</td><td>P</td></tr>
<tr><td>PVC-S</td><td>20.4</td><td>3.55E-6</td><td>0.376</td><td>0.949</td><td>1.84E-5</td></tr>
<tr><td>PVC-L</td><td>17.1</td><td>4.69E-6</td><td>0.327</td><td>0.951</td><td>1.83E-5</td></tr>
</table>
</td></tr>
<tr><td>Reason for interest</td><td>Contained information about the interaction of microplastics with other types of pollution</td></tr>
<tr><td>Notes</td><td>
- Microplastics can absorb other pollutants which is more toxic to the environment
- When salinity increased, adsorption also increased
- Salting out and electrostatic interaction allowed for the increase adsorption
</td></tr>
<tr><td>Follow up Questions</td><td>To what extent does this trend apply to other pollutants and microplastics?
Is there any combination of microplastic and pollutant that will do more damage to the environment or people than others?</td></tr>
</table>

Article #8 Notes: Water Filter

Article notes should be on separate sheets

Source Title	Water Filter
Source Author	Theodore L Wilkinson and Frank J Sork
Source citation	Wilkinson, T. L., & Sork, F. J. (n.d.).
Original URL	https://patentimages.storage.googleapis.com/03/7b/45/d9954e68f49052/US5149437.pdf
Source type	patent
Keywords	
Summary of key points	- One end for water to enter, the other end for filtered water to come out - 3 layer of purification - Layer one: metallic particles - Layer two: activated carbon - Layer three: weak acid

Important Figures	

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Contaminant	Max. Allowed	Influent	Effluent
Selenium	<0.01	0.09	0.007
Mercury	<0.002	0.008	<0.0005
Endrin	<0.0002	0.0008	<0.0002
Lindane	<0.004	0.013	0.0014
Methoxychlor	<0.1	0.12	0.008
Toxaphene	<0.005	0.02	<0.005
2,4-D	<0.1	0.19	0.017
Silvex (2,4,5-TP)	<0.01	0.02	0.008
TEST B (150% OF CAPACITY)			
Chloroform	<0.1	0.440	0.042
Lead	<0.025	0.141	0.005
Fluoride	<1.4	7.82	0.72
Nitrate	<10.0	27.8	9.48
Barium	<1.0	8.7	0.88
Arsenic	<0.05	0.25	0.011
Cadmium	<0.01	0.03	0.009
Chromium VI	<0.05	0.14	0.024
Chromium III	<0.05	0.162	0.013
Selenium	<0.01	0.11	0.012
Mercury	<0.002	0.005	<0.0005
Endrin	<0.0002	0.0006	0.0002
Lindane	<0.004	0.015	0.002
Methoxychlor	<0.1	0.34	0.031
Toxaphene	<0.005	0.018	<0.005
2,4-D	<0.1	0.24	0.028
Silvex (2,4,5-TP)	<0.01	0.016	0.008

Reason for interest	Gives insight into how other filters are already filtering water
Notes	- Drinking water can contain various microorganisms and other suspended particles - Activated carbon can become ineffective quickly - Anions and cations have been used in filters along with activated carbon
Follow up Questions	What would be the average amount of usage one could get out of a water filter? What can cause that number to change?

Article #9 Notes: 3 - Review of Characteristics of Common Plastics for Thermoforming

Article notes should be on separate sheets

Source Title	Thermoforming of Single and Multiplayer laminates
Source Author	Seyd Ali Ashter
Source citation	Ashter, S. A. (2014). 3 - Review of Characteristics of Common Plastics for Thermoforming. In *Thermoforming of Single and Multilayer Laminates* (pp. 39–63). doi: https://doi.org/10.1016/B978-1-4557-3172-5.00003-7
Original URL	https://pdf.sciencedirectassets.com/305821/3-s2.0-C20120028219/3-s2.0-B9781455731725000037/main.pdf?X-Amz-Date=20191020T225051Z&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Signature=124b9ed3add37329dae9f64d422b12a8e5f090591bf26a53619ed53befaa1b7c&X-Amz-Credential=ASIAQ3PHCVTY45H3HCQO%2F20191020%2Fus-east-1%2Fs3%2Faws4_request&type=client&tid=prr-49591a56-fe70-4982-809f-d51eaaae6fe7&sid=dc4681ab9d1df844e88bb535fc5534831d2agxrqa&pii=B9781455731725000037&X-Amz-SignedHeaders=host&X-Amz-Security-Token=AgoJb3JpZ2luX2VjEM7%2F%2F%2F%2F%2F%2F%2F%2F%2F%2FwEaCXVzLWVhc3QtMSJGMEQCIEX1WHF7UYUm4KmU16MfrR%2FxtyUj1SZ%2FycvOx%2BWFnhY3AiBqLNbPtpf4R7Xp5c2DWj6jaS46SZYBXQWWWjCVr55zSirjAwjH%2F%2F%2F%2F%2F%2F%2F%2F%2F%2F8BEAIaDDA1OTAwMzU0Njg2NSIM%2FjOLPXy3GFGLjI3VKrcD2NXaMjNJf0JzBKOvsvHcHr2I5aK5KtkQPIvt644rQgnD9ZwtsNJvEA%2BmZ5ViCEAHaYKo%2F5s3Bu%2BJBzMNuUX7ARdZ8%2FjCUzR0j7E7f4cgJwZWZO9kJpO1BFAdiv7X1OiAwzFkaxFiO3SVCSCTUasVOtSVYKvMSJ5mRxk30DyQUIczfKNKz6DYE%2Bt6z22uyhItaRyw6z1tmZ6TrSrvIPpd4uZUhx5YmucoNNaIr9pQHS6jIWtbwKFWjeA1hJCtq31qmHQJI000McQV0pu7nSSVHiKxQEwaME%2B6f4NTJCer2iJxccUx7bo9SYf4KqF0H%2Fog9dhjm0rYoFy0nrb8WwsOu4VDR%2FzbT2YGimbkaMQm1LWqCZIbp0R5zw5Sj3hhUc8medRzthi02GDQIpXhJmqiCupdiKh5iJYqsGyzzIvQPLQ8edGC21yggrzp8t0GLEdInZ2PUEFQSjTCYwUY1%2B%2FTK9XGhiX%2F6IP6BX9YswpWp5DWk7izCkAJo8%2Bd96MMjSMmuO9qN6Cqf6djr3IBuQxg98zF1q439Q%2BtCp%2FeAdhSIS2BNpM3kgYuZnJfUAm%2BrHnx9mu42w4I%2BzCzpbPtBTq1AZLtTBx3NnYN%2B5IvEpod2wCLELYCY6Y9XJCIh0LYqf4sjcGeMjiBxFbi6BtQMJoZb7LzL3rxfjvXunIO0Bctc5Gm7m3G44fOuVX3aZIbpp7BVgBKxovI4LgpTkoCfL6JKfPqa2biPB3ItMRtma5tTGJnRV6K4jSFVTaC0Xnzs04bFZZeLwvyD%2FEJfw2krHsdLsF1kiUej%2F7aw1xFj76qo

%2BNqskvbdaUDBKXAMWxyGDESy1Ia%2FEo%3D&host=68042c943591013ac2b2430a89b270f6af2c76d8dfd086a07176afe7c76c2c61&X-Amz-Expires=300&hash=c1d73a84f0a7fe25dfe905e0c98cd8c659959acf350c0943012a4e7af3f180be

Source type

Book Chapter

Keywords

Crystallinity, glass transition, temperature viscosity, molecular weight, molecular weight, distribution, electrical resistance, chemical resistance, mechanical properties

Summary of key points

- Some plastics are tough and don't break easily
- Some are very tough but are brittle
- Different plastics will have different properties and will come with advantages and disadvantages

Important Figures

Table 3.2 Comparison of Mechanical Properties of Polyamide Family [16]

Polyamide Type	Specific gravity (g/cm^3)	Tensile Strength (MPa)	Tensile Modulus (MPa)	Flexural Modulus (MPa)	Elongation at break (%)	Izod impact strength (kJ/m^2)
Nylon 6	1.13	70	2.8	2.2	15	45–65
Nylon 6, 6	1.14	85	3.0	2.8	5	40–60
Nylon 6, 10	1.07	55	2.1	–	70	50
Nylon 11	1.03	38	1.4	1.2	250	100

Table 3.3 Mechanical Properties of PTFE [27]

Property	Value
Tensile strength, MPa	20–35
Elongation at break, %	300–550
Tensile modulus, MPa	550
Flexural strength, MPa	No break
Flexural modulus at 23 C, MPa	340–620
Impact strength, Izod, notched, J/m	188
Compressive strength, MPa	34.5

Reason for interest

It talks about the properties of the most common plastics which may help in the filtering process.

Notes

- Polyester is used in the production of film and fibers
- Polyethylene terephthalate is hard, strong and extremely tough, has high abrasion resistant, and chemical resistant with low moisture absorption. It is used in special areas like electronics components, film and drinking bottles.
- Polyethylene has a density less than that of water.
- It is tough but has moderate tensile strength

	- The molecular weight can range from 10,000 to 40,000
Follow up Questions	Which plastics would pose the most issue with filtering?

Article #10 Notes: A simple method for detecting and quantifying microplastics utilizing fluorescent dyes - Safranine T, fluorescein isophosphate, Nile red based on thermal expansion and contraction property

Article notes should be on separate sheets

Source Title	Environmental pollution
Source Author	Lulu Lv, Junhao Qu, Zihua Yu, Daihuan Chen, Pengzhi Hong, Shengli Sun, Chenyong Li
Source citation	Lv, L., Qu, J., Yu, Z., Chen, D., Hong, P., Sun, S., & Li, C. (n.d.). A simple method for detecting and quantifying microplastics utilizing fluorescent dyes - Safranine T, fluorescein isophosphate, Nile red based on thermal expansion and contraction property. *Environmental Pollution*, *225*. doi: https://doi.org/10.1016/j.envpol.2019.113283
Original URL	https://www.sciencedirect.com/science/article/pii/S0269749119329562
Source type	Journal
Keywords	Microplastics, Staining, Thermal expansion and contraction, Identification, Quantification
Summary of key points	- The method of staining was good for detecting polyethylene, polystyrene, polyvinyl chloride, and polyethylene terephthalate.

Important Figures

Table 2
The recovery data of four polymers stained with Nile red, FITC and Safranine T under different heating conditions (The numerator indicates the number of microplastics fluorescent particles under fluorescence field, and the denominator represents the number of microplastics particles in the bright field).

Microplastics		Dyes								
		Nile red Time (min)			FITC Time (min)			Safranine T Time (min)		
		10	20	30	10	20	30	10	20	30
PE	25	18/20	21/22	21/22	18/32	22/26	27/34	0/24	0/25	0/28
Temperature (°C)	50	30/30	25/25	24/24	22/22	24/24	31/31	28/28	29/29	23/23
	75	25/25	23/23	26/26	20/21	20/21	22/24	20/20	24/24	28/28
PVC	25	35/35	31/31	34/34	29/35	26/26	25/25	0/28	0/30	0/28
Temperature (°C)	50	28/28	32/32	29/29	27/29	26/30	32/34	26/27	31/31	28/28
	75	21/21	25/25	37/37	27/28	26/28	25/25	32/32	25/25	33/33
PET	25	19/24	29/31	26/32	20/26	22/26	20/20	0/30	0/28	0/21
Temperature (°C)	50	24/24	24/24	30/30	20/27	23/26	19/26	28/39	23/28	18/21
	75	21/21	24/24	32/32	20/23	20/23	21/24	25/29	25/31	24/33
PS	25	8/31	8/30	11/27	19/22	26/30	20/23	0/21	0/23	0/20
Temperature (°C)	50	30/30	29/29	26/26	26/26	29/29	27/27	21/23	30/31	21/23
	75	23/23	30/30	32/32	25/27	21/23	29/31	20/22	22/26	23/23

Table 3
Recovery rates of four microplastics stained with three dyes (in triplicate and based on weight calculations). Staining conditions are 50 °C for 30 min.

Microplastics	Dyes		
	Nile red Recovery rates (%)	FITC Recovery rates (%)	Safranine T Recovery rates (%)
PE	96 ± 2	98 ± 0.2	96 ± 0.2
PVC	93 ± 1	95 ± 0.5	98 ± 3
PET	96 ± 0.5	97 ± 0.5	99 ± 0.5
PS	96 ± 0.4	98 ± 0.3	99 ± 0.2

Reason for interest

There may be some properties more specific to microplastics due to their size.

Notes

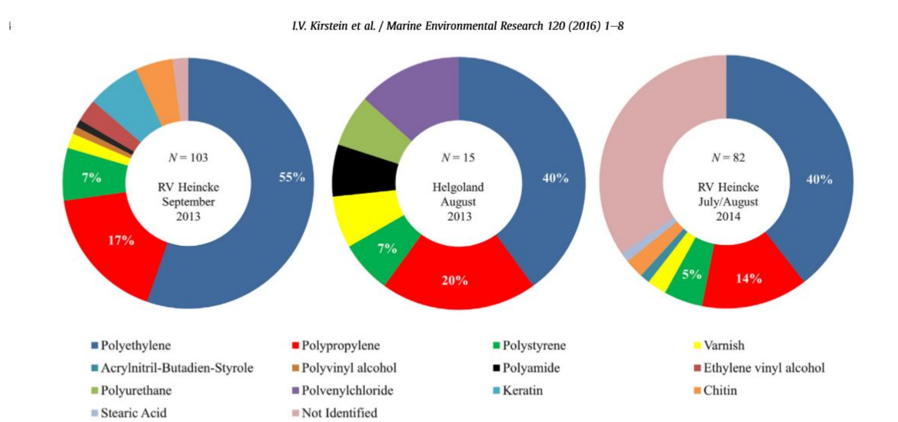
- Visually identifying microplastics is not a good way to observe them.
- Certain dyes can only be absorbed by certain microplastics.
- Red Nile could only stain polyethylene, polystyrene, polypropylene, and nylon 6.

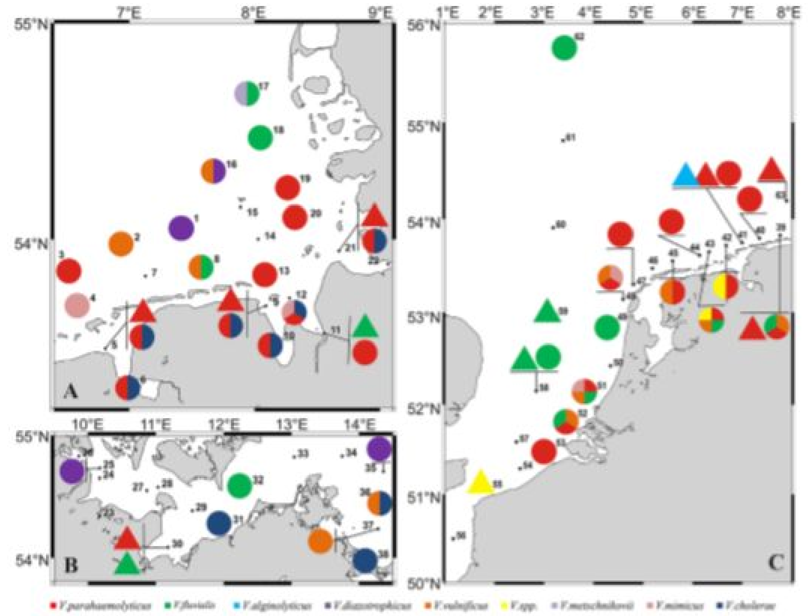
Follow up Questions

Can I use this method in my experiments?
Is it costly to procure these materials.

Article #11 Notes: Dangerous hitchhikers? Evidence for potentially pathogenic *Vibrio* spp. on microplastic particles

Article notes should be on separate sheets

Source Title	Dangerous hitchhikers? Evidence for potentially pathogenic *Vibrio* spp. on microplastic particles
Source Author	Igna V. Kristein, Sidika Kirmizi, Antje Wichels, Alexa Garin-Fernandez, Rene Erler, Martin Loder, Gunnar Gerdts
Source citation	Kirstein, I. V., Kirmizi, S., Wichels, A., Garin-Fernandez, A., Erler, R., Loder, M., & Gerdts, G. (2016). Dangerous hitchhikers? Evidence for potentially pathogenic Vibrio spp. on microplastic particles. *Marine Environmental Research*, *120*, 1–8. doi: https://doi.org/10.1016/j.marenvres.2016.07.004
Original URL	https://www.sciencedirect.com/science/article/pii/S014111361630112X
Source type	Journal
Keywords	Synthetic polymers, Vector, Pathogens, North Sea, Baltic Sea
Summary of key points	
Important Figures	

	 Fig. 2. Geographical occurrence of *Vibrio* spp. On microplastics and surface water of a) the North Sea from research cruise HE409 on RV Heincke in September 2013 b) the Baltic Sea from research cruise HE409 on RV Heincke in September 2013 and c) North Sea from research cruise HE430 on RV Heincke in July/August 2014 and the drift line of Helgoland (station 63). (○) species detected from surrounding seawater (△) species detected on microplastic particles.
Reason for interest	This article lists some of the dangers of the microplastics in the environment.
Notes	
Follow up Questions	