4. Problem Identification:

What's hidden in our sand?

CIIMAR TEAM (PORTUGAL)

Topic: Natural Sciences and Biology

Description: This scenario is suitable for students aged between 10-18 years. The students have to reflect about the presence of microplastics in the environment

Aims: Present microplastics, their origin and the consequences of their presence in the marine environment.

Outcome: raise awareness of the need to reduce the production and consumption of plastics.

Title	Procedure	Time
Presentation	The topic is introduced to the students	
Workgroup	In groups students carried out the lab activities. Each student group should have their own sample	
Discussion	After the activities the student fill in the experimental log, registering data obtained and answering the questions	
Presentation	Students present their work to classmates and discuss the differences among samples	

Activities

Experimental Protocol

WHAT'S HIDDEN IN OUR SAND?

Background information

The multiple activities carried out daily in the coastal zones can lead to the presence of several pollutants in our sea.

Plastics account for 60-80% of marine litter and are currently considered one of the main pollutants responsible for marine pollution, together with petroleum hydrocarbons, ballast water and nutrients which, when at high levels, cause for instance eutrophication. Plastic can be carried by surface currents to sites far from the original ones having detrimental effects on both oceanic species and coastal ecosystems (US-EPA, 2002). Indeed, plastics pose a major threat to marine organisms such as fish, birds, turtles, mammals and zooplankton, mainly because of the risk of ingestion. About 400 marine species from around the world have already been found "stuck" to tons of plastic scattered across the ocean like plastic bags and fishing nets.

Microplastics are small particles (<5mm), that vary in composition (synthetic polymer), shape and colour. They are manufactured (primary microplastics) to fulfil certain functions, such as industrial abrasives, exfoliant micro-beads in personal care products or cosmetics, and pre-production plastic beads or pellets. They can also result from degradation or fragmentation of larger plastic particles (secondary microplastics) through mechanical, UV and microbial action which can result from larger plastic particles that have been degraded or from small dimensions purpose-built plastics. Since they have the capacity to absorb contaminants, namely Persistent Organic Pollutants (POPs), when ingested by marine species, they represent a route of entry of POPs to reach the marine food chain.

Target Audience

Curricular Areas: Natural Sciences and Biology

Age group: 10-18

Aims

This activity aims to present microplastics, their origin and the consequences of their presence in the marine environment. This activity aims to raise awareness of the need to reduce the production and consumption of plastics. This activity is related with The Ocean Literacy Principles, namely Principle 6 –The Ocean and Humans are inextricably interconnected[4].

[4] http://oceanliteracy.wp2.coexploration.org/

Material

- 1 Water bottle with a capacity of 5L or more
- 1 Bottle of 1,5L
- 1 Bottle of 0,5L
- Funnel
- Sieve
- 1 Kg of cooking salt
- Beach sand (1 bottle of 1,5L)
- Filtration glassware (i.e. Büchner flask, filtration glass, clamping device...)
- Vacuum pump with hose
- 2 filters ca. 0,2 µm porosity (1 for each 0,5L bottle)
- Stereomicroscope
- Petri dishes
- Tweezers

Procedure

14. Collect sand from the high tide line, on the shallow side, up to about 5-10cm depth and sieve it to a 1.5L bottle. Discard large debris, or plastics, found into adequate recycling bins; *Suggestion: students may be asked to collect and bring to the class sands from beaches under differing levels of human pressure and compare them*
15. In the lab, prepare a ultra-concentrated saline solution with a concentration of approximately 360 g / L. To do this, in a 5 L capacity bottle, add 3 L of water and 1 kg of cooking salt. if there is no material for measuring 3L of water, a 1.5L bottle filled twice can be used;
16. Shake in 3 sets of 1 minute each;
17. Place the collected sand (free of large debris / debris), which is in the 1.5 L bottle, into the 5 L water bottle;
18. Close it and shake vigorously in 5 sets of about 30 seconds each;
19. Allow the mixture to stand for about 15 minutes;
20. Pass the water with the suspended particles to the 0.5 L bottle;
21. Prepare the filtration system and (vacuum pump + filtration glassware) and place the membrane filter in place;

22. Decant 250 ml of the salted with the sand into the filtration cup and connect the pump
23. At the end of the filtration, transfer the filter to a Petri dish with the tweezer and observe at with the with the stereomicroscope (repeat step 8 with the water in other 0.5L bottle);
24. Proceed to the research and identification of microplastics. If desired, they may also be separated into a petri dish so as to facilitate their counting.

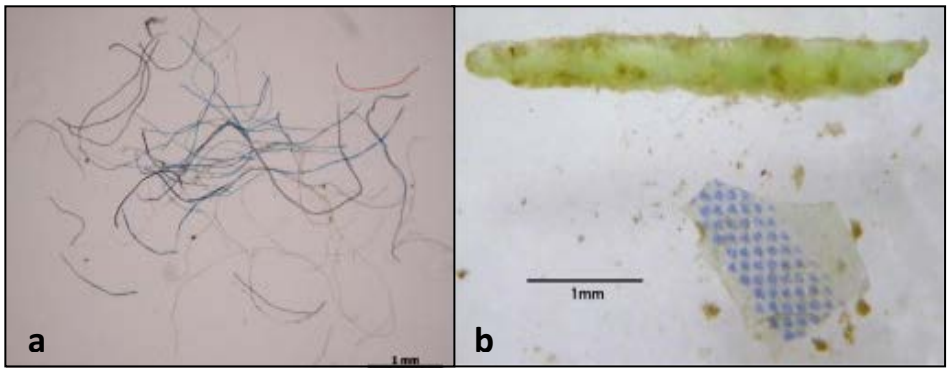

Figure 1: Examples of nylon fibres (**a**), rigid plastic (b)[5] and of different types of plastics (c)[6].

Experimental log

WHAT'S HIDDEN IN OUR SAND?

[5] Possatto, F.E.; Barletta, M.; Costa, M.F.; Ivar do Sul, J.; Dantas D.V. 2011. Plastic debris ingestion by marine catfish: an unexpected fisheries impact. Mar Poll Bull 62: 1098–1102.

[6] Lechner, A.; Keckeis, H.; Lamesberger-Loisl, F.; Zens, B.; Krusch, R.; Tritthart, M.; Glas, M.; Schludermann, E. 2014. The Danube so colourful: A potpourii of plastic litter outnumbers fish larvae in Europe's second largest river. Environmental Pollution 188: 177-181.

1. Indicates the hypothesis to be tested in this experiment.

2. What is the purpose of the NaCl used for in the experiment?

3. During the filtration of the sample where are the microplastics retained?

4. Is the sample analysed contaminated with microplastics? If yes, what kind of microplastics did you find (shape, colour, etc.)?

5. What measures should be taken in our daily life to avoid contamination of waters with microplastics?