BE A MICROSCIENTIST!

River exploration and scientific research for microscientists

Printer-friendly version.
The planet-friendly microscientist doesn't print every page, only what he absolutely needs.

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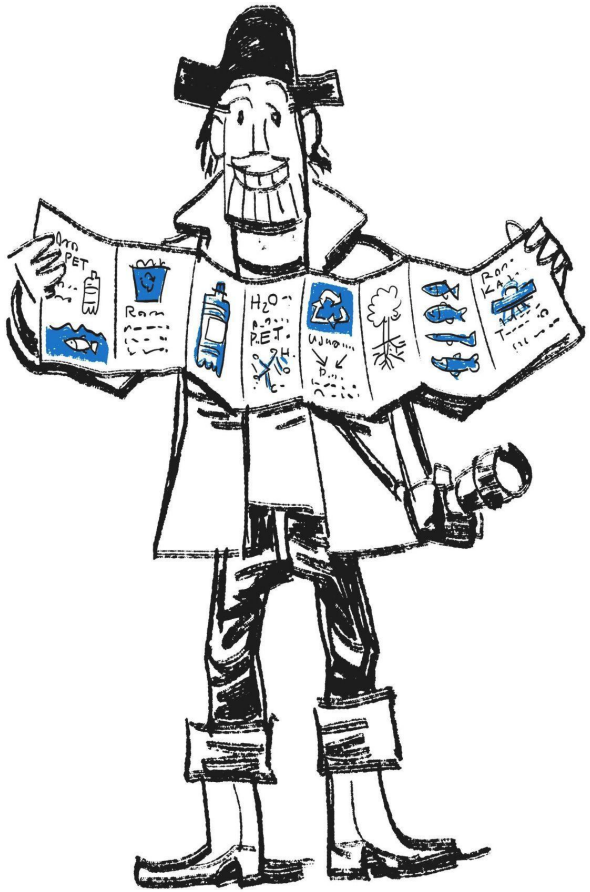
TABLE OF CONTENTS



TREASURE CHEST

TOOLS AND SUPPLIES

- ❑ YOURSELVES AND YOUR PRESENCE
- ❑ YOUR ATTENTION, YOUR SENSES
- ❑ BLANKETS TO SIT ON
- ❑ LOGBOOK

NAVIGATOR

1. Choose an outdoor location. It's best to find a nearby waterfront that's quiet, away from the noise of the city and traffic. But the location could be a secluded corner of the schoolyard or a nearby park.

2. Discuss what you expect from the experiment! What will you feel through your skin? What will you hear? What will you smell? What will you see?

3. When you arrive at your chosen location, form a circle, standing at a comfortable distance from each other. If the weather permits, take off your shoes so you can feel the ground and grass under your feet (only do this if it doesn't cause discomfort). But if the ground is not cold, you can sit down. The main thing: feel comfortable!

4. Before you begin the task, close your eyes, take a deep breath, and exhale slowly. Imagine that all noise and rushing disappear. It's just you, the environment, and what you are about to discover. There is no rush, your attention is complete. The task leader will guide this attention, and you can linger for a while at each station.

5. Let's start with touch. We experience touch not only through our palms and fingers, but with our entire body. The caress of the wind, the warmth of the sun, the feeling of the ground beneath our feet all belong to this sensation. Notice where you experience sensation through touch! What feelings does this evoke in you?

6. Next, smell. Pay attention to your nose, the wind, and the air that carry the scents and odors. Follow the path of the air in your mind and discover how the air connects you to distant lands, to nature, and to each other. Breathe slowly, deeply, and observe this flow. Become aware that the fresh air flowing into your lungs contains oxygen, which reaches all your cells. Pay attention to the smells. With your eyes closed, imagine where they come from, what colors and shapes can be associated with them. The moisture, tiny water droplets in the air, are also found in your body. Just as they are in the clouds above you, and in the river and sea. Everyone has a drop of the ocean in them, even if they have never been to its shores. Water molecules connect people to the universe through the water cycle.

7. Let's move on to hearing, but let's stay with air. Air is responsible for transporting not only smells, but also sounds. Direct your attention to your ears and how you perceive sounds. Sound is a vibration, and we hear it not only with our ears, but also with our whole body. Notice the intensity with which the stimulus comes to you. Which sound came from the closest, and which one you feel is the furthest. Remain in complete silence for 1-2 minutes, and while doing so, count how many different sounds you hear! Which sounds come from human activity, and which from the natural environment?

8. The last sense we use is the eyes, or vision. Open your eyes carefully, covering them with warmed, rubbed palms (so that the sunlight doesn't blind you) and open them slowly. Look into each other's eyes, and then look around. Observe the landscape and area around you again, and find out what the sounds and smells you heard before belong to. What special colors or shapes do you see that you hadn't noticed before?

LOGBOOK

Impact test

Compare how you felt going to the riverbank or into nature and how you felt when you finished the task.
Has anything changed?

.....

.....

Make Thanksgiving jam / gratitude compote!

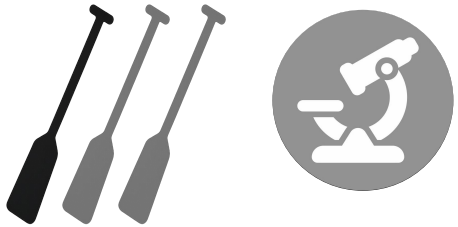
Gather some of the feelings you noted during the interviews. Also, describe how the river makes you feel and what feelings it evoked in you when you were on its banks.

Write these on small pieces of paper and put them in the jar!

Share the words collected in the gratitude potion with other microscientists at www.tisztatisza.hu page!

TREASURE CHEST

TOOLS AND SUPPLIES



- ❑ NOTEBOOK
- ❑ GOOD OBSERVATION SKILLS
- ❑ INTERNET ACCESS FOR RESEARCH
- ❑ SCHOOL LIBRARY
- ❑ LOGBOOK

NAVIGATOR

1. Form groups (max. 4 groups)! Each group should be given an ecosystem service with its corresponding examples.

2. Let's do some research! If you have the opportunity, use the internet to find out what you can find about the given service.

- Find an example of how a given service appears by following the path of a water molecule (from oceans to clouds to rivers).
- You can also use the school library if you don't have internet access.
- Discuss each person's thoughts and feelings on the topic.
- We need some movement! Bring the river into the room with a rain game! See how the petkalóz do it!

LOGBOOK

The path of the water molecule

Supply service:

.....

.....

Maintenance service:

.....

.....

Regulatory service:

.....

.....

Cultural service:

.....

.....

Don't forget to upload your results to the tisztatisza.eu website!

TREASURE CHEST

TOOLS AND SUPPLIES

- ❑ ATLAS, MAP
- ❑ INTERNET ACCESS
- ❑ LOGBOOK
- ❑ CREATIVE TOOLS FOR POSTERS
- ❑ (COLORED PENCILS, PAPER, GLUE, SCISSORS, ETC.)
- ❑ JAR

NAVIGATOR

1. Interview parents or local residents about the role the river plays in the life of the settlement. What do they know about its history and significance? Collect emotions related to the river. An emotion map can also help with this.

2. Use maps to determine the course of the river and make notes based on the following criteria, then create a table of the data you have collected. Each column of the table should contain the main sections of the river (e.g. upper, middle, lower sections). Each row should contain a characteristic feature of the river (e.g. tributaries, major settlements, protected areas, and sources of pollution).

3. Use the internet or library books to search! Look for literary works (e.g. poems, fairy tales and short stories) and artistic works (e.g. paintings, music, sculpture) that can show what other people think about the river!

4. Create a drawing, poster or digital illustration that shows the natural values and threats of the river, the settlements along the river and artistic inspirations.

5. Write a letter to the river, addressing it and expressing your thoughts about its protection!

LOGBOOK

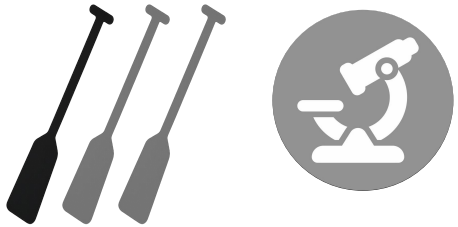
River name:..... Popular name or nickname, if any there is: .....

Source:..... Mouth:..... Length:.....Fkm

	Lower section	Middle section	Upper section
Tributaries			
Larger settlements			
Protected areas			
Sources of pollution			

TREASURE CHEST

TOOLS AND SUPPLIES



- ❑ PLASTIC OBJECTS FROM OUR ENVIRONMENT (E.G., WORN SLIPPERS, LINT AT THE BOTTOM OF A BAG)
- ❑ RULER
- ❑ MAGNIFIERS, MICROSCOPE
- ❑ UV LAMP
- ❑ MICROPLASTIC DEFINITION
- ❑ LOGBOOK

NAVIGATOR

1. Examine each other's clothes, your own clothes (e.g. sweatshirt, jacket), shoes or plastic items (e.g. bag, pen holder, ruler) with a magnifying glass, microscope and UV light. What is the difference between looking at them with a magnifying glass and looking at them under UV light? What is the structure of your clothes or other items? Are there any signs that these items are slowly wearing out? Are the plastic parts chipping? Based on the marks, can pieces smaller than 5 mm come off?

2. Look around the classroom! Have you found any suspicious microplastic particles? Use a magnifying glass, a UV lamp and a microscope to observe the details! Suggestion: look at the bottom of your bags, the hidden corners of the room and shelves!

3. Where could the identified microplastic particles come from? Measure the size of a few pieces using a ruler and a microscope! (e.g. place the plastic particle on graph paper and look at it under the microscope)

4. Note-taking and documentation in the logbook!
- Make notes and drawings of what you find!
- What types and sizes of particles did you identify? Are these microplastics? How did you distinguish microplastics from other pollutants?
- Where did you find them? Where could microplastics in your environment come from?

5. Discussion:
- How can microplastic particles get into our immediate environment?
- How can these particles get into living waters?
- What impact can they have on wildlife?
- What is the connection between your daily habits and microplastic pollution?
- Why is it important to test microplastics?

LOGBOOK

Microplastic identification data request

School code:	
Sampling location, date, time	

Number of microplastics found	
Size range	
Detected colors	
Detected shapes	
Assumed material	

TREASURE CHEST

TOOLS AND SUPPLIES

- ❑ MOP SET (BUCKET, MOP HANDLE WITH HEAD)
- ❑ TWEEZERS, SIEVE
- ❑ PETRI DISH
- ❑ MAGNIFIERS AND MICROSCOPES
- ❑ UV LAMP
- ❑ LOGBOOK

NAVIGATOR

1. Wash the floor of the room (not when you bring in a lot of mud). Collect the sample!

   - Make sure that the sample is not full of dirt (e.g. remove large hairs or lumps of dirt with tweezers). - Carefully pour the mop water onto the sieve (the water may run into the sink).
   - Transfer the sample from the sieve to a clean Petri dish using tweezers, or look at the sieve fabric itself.

2. Run your wet fingers along the windowsill and shelves. Wash the material from your hands (carefully, with a little water) into a petri dish, or if you use more water, wash your hands over the sieve and see what remains on the sieve cloth.

3. Observe the samples from the mop water and the windowsill with a magnifying glass!

   - What grains can you identify with the naked eye? Which ones come from where?
   - Record what you find in the logbook! Draw something interesting if you see it.

4. UV lamp magic: will we see more things this way?!
   - Turn off the lamp and shine a UV lamp on the samples.
   - Many microplastics glow in UV light, so they are revealed! Note in the logbook if you see anything interesting.

4. Microscopic super discovery!
   - Put the petri dish or the sieve under the microscope. What do you see?
   - Look for tiny threads, pieces, or even shiny particles! These could be microplastics.

Draw what you find in your logbook or make a short note about what you see!

NAVIGATOR

6. Find an explanation! Record your experiences in the logbook!

   - How did microplastics get into the water and onto the ledge or shelves?
   - Where could these particles come from? Could they come from the soles of shoes? Maybe from the school trash can or from plastic household items?
   - What plastic objects surround you? If you look at their surface (with the naked eye and under a microscope), do you see pieces breaking off?

7. Where does microplastic travel next?

   - Where do you usually pour the mop water at school? Where does the water used to wash the shelves and ledges go? Is there a sewage system?
   - If there is a sewage system, find out where the pipes carry the sewage water? Where is the nearest sewage treatment plant and how does it work?
   - Where does the water purified by the sewage treatment plant go?

8. Let's count!
   - How many classrooms are there in the school where microplastics, like yours, are released into the wastewater?
   - How many schools are there in the town where the same thing happens every day? Guess how much mop water goes into the sewer system and from there to the wastewater treatment plant in the town where you live.

This is a science mission, but don't forget: wash your hands afterwards and ask for adult help with the experiments!

Happy research, young scientists!
"The school may be clean, but the water is certainly mysterious!"

LOGBOOK

Use the microplastic limiter!

What can be seen under the magnifying glass and the microscope?

Identification of identified grain	Dimensions	Color	Quantity	Where can it come from?

TREASURE CHEST

TOOLS AND SUPPLIES

- ❑ SIEVE
- ❑ WATER FROM A WASHING MACHINE COLLECTED IN A MASON JAR

  (OR MATERIAL STUCK IN THE DRYER FILTER)
- ❑ MAGNIFIERS, MICROSCOPE
- ❑ UV LAMP
- ❑ PETRI DISH
- ❑ LOGBOOK

NAVIGATOR

1. Collect the sample!
   - Collect the water that runs out of the washing machine in a glass container (e.g. a mason jar)! This will be the sample we will work with. Ask your parents for help with the sample collection!
   - Make sure that the sample is not full of dirt (e.g. large hairs or pieces of tissue paper).
2. Place the sieve so that the water flowing out of it does not cause any problems (hold it over a bucket or sink). Strain the sample, the size of a mason jar, through the sieve! It is also worth rinsing it with a little tap water to wash away dirt and detergent. We will continue working with the parts that get stuck on the sieve, which should be placed in a Petri dish (but you can also leave it on the sieve and look for microplastics there).
3. Observe the pattern first with a magnifying glass!
   - What do you see with the magnifying glass? Write down what you find in your logbook! What color are the pieces? What shape are they? Are there any shiny pieces of clothing? Draw them if you discover anything interesting!
4. UV lamp magic!
   - Turn off the laboratory lights and shine a UV lamp on the sample.
   - Many microplastics glow under UV light, revealing themselves! Note down in your notebook if you see anything interesting! (Caution! Not all plastic fibers glow brightly!)
5. Microscopic super-inspection!
   - Put the sample under the microscope!
   - Look for tiny threads, pieces, or even shiny particles! These could be microplastics.
   - Draw what you found in your logbook or make a short note of what you saw.
6. Now look at the structure of your sweatshirt or jacket under a microscope or magnifying glass! Could the particles extracted from the wash water have come from clothes?

7. Come up with an explanation! Record your experiences in the logbook!
   - Why can there be microplastics in water?

   - What material are our clothes made of? (check the little note on the inside of your sweatshirt or jacket to see what material they are made of!

8. Where does microplastic travel with the water flowing out of the washing machine?
   - Where does the water from the washing machine go? Do you have a sewer system?

   - If there is a sewer system, check where the pipes that carry the wastewater bend.

9. Where is the nearest wastewater treatment plant and how does it work? What happens in water treatment plants?

   What river does the water purified by the sewage treatment plant flow into?

   Let's count further (using the logbook)!

   - How often do you wash clothes at home? Calculate how much water you use in a week and a year!

   - How many households are there in your town where the same thing happens every day, from which microplastics, like yours, end up in the wastewater?

   - Guess how much water from washing machines goes into the sewer system each week, and from there to the wastewater treatment plant in the town where you live.

   - Assuming that there are 500 microplastic particles in one liter of wastewater, how much microplastic reaches the water purifier? If 90% of this is filtered out, how many particles does the remaining 10% represent, i.e. how much ends up in nature?

LOGBOOK

Use the microplastic limiter!

What can be seen under the magnifying glass and the microscope?

Identification of identified grain	Dimensions	Color	Quantity	Where can it come from?

LOGBOOK

V = Weekly water consumption per household:

M = number of washes per week
F = water used per wash in liters

V = M × F

Z = Annual water consumption per household:

1 year = 52 weeks

Z = V x 52

T = Weekly water consumption in the settlement:

H = number of households in the settlement

T = Z x H

P = Weekly amount of microplastics:

C = number of detected pieces

P = C x T

TREASURE CHEST

TOOLS AND SUPPLIES

- ❑ FUNNEL
- ❑ PET BOTTLE (FOUND ON THE RIVERBANK IS BEST)
- ❑ PUTTY
- ❑ 1 KG OF TABLE SALT
- ❑ MAGNIFYING GLASS, MICROSCOPES
- ❑ SIEVE
- ❑ 1.5 METER PLASTIC PIPE
- ❑ UV LAMP
- ❑ LOGBOOK
- ❑ MICROPLASTICS DEFINITION

NAVIGATOR

Before we get started, it's important to clarify a few safety rules!
Safety is the primary consideration in all field work!

The physical safety of yourself and your companions is the most important thing when performing the task!

Please note the following:

1. Always work as a team! Look out for each other so that no one gets into a dangerous situation.
2. Approach the shore under adult supervision!
3. Do not draw water from deep water.
4. Use protective gloves when collecting waste.
5. If you find something dangerous (e.g. broken glass, chemicals, dead animals), call for adult help.
6. The quantity and quality of dissolved substances in the river are extremely important for the life of the river. Sodium chloride, i.e. common table salt, which we use in the experiment does not seem to be a dangerous substance, but its increased concentration causes problems for the life of the water. Therefore, do not pour the test substance, i.e. the salt solution, back into the river!!! The life of the river may be damaged due to the changed conditions. It is best to pour it into the toilet and leave the solution to the sewage treatment plant!

1. Waste collection:
- If possible, use a bottle found on the riverbank for the experiment so that you don't produce extra waste during the experiment. Choose a 1.5 liter PET bottle (you can also find one in your bag if there wasn't one among the beach litter). Make sure that the bottle is not punctured or dirty, and has a cap.

2. Filling a bottle from the river:
- First, put sediment into the PET bottle using a funnel: fill the bottom of the bottle with about 8-10 cm of sediment. Try to collect freshly deposited sediment (preferably sandy), as it was deposited by the last flood. This means that you should only collect the top few millimeters of sand using the spatula.

3. Making a saline solution:
- Add about 30 dkg of table salt to the bottle using the funnel (1 liter of water requires 30 dkg of salt, if the bottle is larger, you will need more salt).

- Fill the bottle completely with running water (using the funnel and another bottle).
- Close the bottle and shake vigorously until the salt is completely dissolved (this takes about 10-15 minutes).

4. Observation:

- Let the bottle stand for at least an hour.

- Observe what happens: heavier sediment sinks to the bottom, while lighter materials, such as organic debris and plastics, float to the surface.

5. Testing with UV light:
- After letting it stand for a while, carefully pick up the bottle (do not shake it)!
- Illuminate the substance on the surface of the solution with a UV lamp! What do you see?

6. Magnifying glass examination:
- Use a magnifying glass to take a closer look at the collected material. Did you find any microplastics in it?

7. Further microscopic examination of samples:

- Take the bottle with you to the classroom. Shake it vigorously and then let it stand for at least an hour, but if it stands for a day (or more), that's even better! This gives the microplastics more time to float to the surface of the solution.
- Use a plastic tube to suck the salt solution out of the bottle (not from the bottom, but always with the end of the tube just under the water), or very carefully pour the water out! Don't stir up the sediment, because we won't need it anymore!
- Pour the drained or sucked water onto the sieve. This will cause the suspended substances in the brine to settle on the sieve and become trapped.

Examine the material collected at the bottom of the sieve under a microscope and UV light.
What kind of materials do you see? Is there plant residue in it? Is there plastic fiber or shreds in it?

8. Recording the results in the logbook:
   - Take photos and drawings of the microplastics you find and describe their characteristics!

   - Note the types of microplastics you found and try to determine how they could have entered the environment.

9. We appreciate the results!

   - Why were microplastics successfully extracted from the sediment? How did the salt help separate the sediment and the plastic? (Explanation of the dissolution process.) Why did they float to the surface of the water? (Discussion of specific gravity and density.) Is all plastic light or are there plastics that sink to the bottom of the water? If a mussel settles on a floating piece of plastic, how do you think the plastic's ability to float or float changes? When can plastics settle to the bottom of the riverbed?

   - Is there water on Earth saltier than rivers? Where in the seas does a lot of plastic accumulate: near the surface or down deep? How do you think the presence of microplastics affects river life? How can we reduce plastic pollution? Where can plastic pollution from the river you are examining end up? Which sea is the final recipient?

LOGBOOK

Use the microplastic limiter!

What can be seen under the magnifying glass and the microscope?

Identification of identified grain	Dimensions	Color	Quantity	Where can it come from?

TREASURE CHEST

TOOLS AND SUPPLIES

- ❑ PUTTY
- ❑ MASON JAR
- ❑ MORTAR (OR SOMETHING TO CRUSH THE SAMPLE IN)
- ❑ SIEVE (FINE MESH, WITH 0.5-1 MM HOLES)
- ❑ UV LAMP, MAGNIFYING GLASS, MICROSCOPE
- ❑ PETRI DISH
- ❑ PLASTIC ADVERB
- ❑ LOGBOOK

TREASURE CHEST

TOOLS AND SUPPLIES

ADDITIONAL TOOLS FOR ADVANCED USERS

- ❑ ALCOHOL FELT
- ❑ GPS APPLICATION ON MOBILE PHONE
- ❑ WATER SPRAYER (YOU CAN ALSO USE A SIMPLE WINDOW WASHER FLUID BOTTLE)
- ❑ GRAM-ACCURATE SCALE
- ❑ GRAPH PAPER (THE SAME SIZE AS THE PETRI DISH)
  DRAW 1 CM VERTICAL LINES ON IT: ONE LINE IN RED AND THE NEXT ONE IN BLUE. THIS WILL HELP WITH THE MICROSCOPIC WORK.

NAVIGATOR

For BEGINNER microscientists

1. Sampling

- Plan where you will collect the sample! It is worth collecting a fine-sandy sample close to the water level. If you don't have one, a clay sample is also good (but harder to work with!).
- Use the spatula to take a sample from the top (1-2 mm) layer of sediment. This way you are sure to sample the sediment from the last flood wave. Collect material from several points and mix it together!
- Place the sample in a glass jar and seal it.

2. Laboratory sample preparation

- Cleaning the sample: The collected sample contains various particles that you need to examine carefully. Remove larger pieces (e.g. roots, leaves, other organic matter) from the sand, this will not be necessary.
- Cleaning the sieve: Rinse the sieve thoroughly in tap water before testing.
- Place a coffee cup-sized amount (approx. 5-10 dkg) of the sample on the sieve.
- Hold the sample under the tap and run water through the sieve, moving the sieve in small circular motions. This will wash out the clay and silt particles. You should wash the sample until the water running out is crystal clear!
- You can also examine the sample through the sieve, or you can carefully wash it into a Petri dish. In this case, cover the top at an angle and place it on a heating element (or in the oven) or in the sun to let the water evaporate!

3. Searching for microplastics with a UV lamp, magnifying glass and microscope

- We will continue to examine the material on the sieve or in the Petri dish!
- A UV lamp can help you identify microplastics, as some plastics fluoresce when exposed to ultraviolet light. Darken your lab and shine a light on the sample. If you see fluorescent light, it is likely microplastic.
- Use a magnifying glass or microscope to examine the sample in more detail. Look for small particles that resemble plastic (e.g. colored or transparent fibers, shreds). Use the microplastic identifier to identify the types present in the sediment.

4. Recording results in the logbook:

- Record the type of microplastics you identified, their color, and which one you found the most of.
- Take photos or drawings of the microplastics you find and describe their characteristics.
- Record the types of microplastics you find and try to determine how they may have entered the environment.

For ADVANCED microscientists

1. Sampling

- Plan which section of the river and exactly where you will take samples!
- When you arrive at the sampling location, use a mobile phone application to determine the GPS coordinates of the sampling location. (This way, the data can be entered into the database and can be an important element of an international research project). Give the sampling location a name (e.g. Szolnok-1, so your sample number will be Sz-1). Record it in the logbook!
- If you see plastic waste around the sampling site, note it in your logbook! (The more waste in the environment, the more likely we are to find microplastics in the sediment).
- Also write down whether you collected the sample at low tide or high tide, and whether the river is ebbing or flowing.
- Use the spatula to take a sample from the top (1-2 mm) layer of sediment. This way you are sure to sample the sediment from the last flood wave. Collect material from several points!
- Place the sample in a glass jar and seal it. Write the number of the mina on the jar with an alcohol marker (e.g. SZ-1). This allows you to collect samples from multiple locations and prevent them from getting mixed up.

2. Laboratory sample preparation:

- Cleaning the sample: The sample obtained in this way contains various particles that you need to examine carefully. Remove larger pieces (e.g. roots, leaves, other organic matter) from the sand, this will not be necessary.
- Cleaning the sieve: Rinse the sieve thoroughly in tap water before testing.
- Place 5 dkg of the (preferably) dry sample on the sieve (record the exact weight in the report).
- Hold it under the tap and run water through the sieve, moving the sieve in small circular motions. This will wash out the clay and silt particles. You should wash the sample until the water running out of the sieve is crystal clear!
- Wash the sample carefully (with a little water) into a Petri dish (use a water sprayer). First, write the sample number on the side of the Petri dish with an alcohol-based marker! Then, in both cases, cover the sample (e.g. with aluminum foil or the top of the Petri dish) and place it on a radiator or in the sun (in the oven) to let the water evaporate! Be careful! Plastics melt above 65 degrees C.
- ROOM MISCELLANEOUS (MSC): The air around us can also be full of microplastic fibers. These get into the sample from our clothes during sample preparation and increase the amount of microplastics there. If we include this in our results, we get a much higher level of contamination than the real value! Therefore, you need to go through the same steps with an empty sieve, for the same length as with the sample. Write the MSC on the side of the Petri dish, then wash in the apparent “nothing” from the sieve. Then the “room miscellaneous” result must be subtracted from the sample result. (But more on that later!)

3. Searching for microplastics with a UV lamp and microscope:

- Using a microscope, systematically go over the area of the Petri dish! It helps to place the dish on the graph paper, on which there are red and blue lines to help you progress. Move the sample in a meandering manner (up and down) under the microscope, from one edge of the dish to the other. Be careful! Don't miss a single grain! This takes practice, you don't always succeed the first time!
- Record each microplastic: what type it is (e.g. colored or colorless thread, shred, sphere) and exactly how many there are. Use the microplastic descriptor to determine what shape types occur in the sediment.
- Record the type, color, and number of microplastics identified in the report.
- A UV light can help you identify microplastics, as some plastics fluoresce when exposed to ultraviolet light. Darken your lab and shine a light on the sample! If you see fluorescent light, it's probably microplastics. (But there are many more types of microplastics!)
- Do the same with the SzH pattern!
- Calculate the microplastic content of 1 kg (=100 dkg) of sediment: First, subtract the plastic content of the Room Error from the microplastic content of the sample! This is the corrected value. Microplastic content = (100* corrected value)/weight of measured material

4. Recording results in the logbook:

- Take photos and drawings of the microplastics you find and describe their characteristics. Expand the definition of microplastics.
- Record the types of microplastics you find and try to determine how they got into the environment.
- Upload the minutes to the online interface: www.tisztatisza.eu

LOGBOOK

For BEGINNER microscientists

Use the microplastics identifier! What can you see under the magnifying glass and microscope?

Sampling location coordinates: .....

Date:

Identification of identified grain	Dimensions	Color	Quantity	Where can it come from?

Don't forget to upload your results to the tisztatisza.eu website!

LOGBOOK

For ADVANCED microscientists

Use the microplastics identifier! What can you see under the magnifying glass and microscope?

Sampling location coordinates: .....

Date:

Identification of identified grain	Dimensions	Color	Quantity	Where can it come from?

TREASURE CHEST

TOOLS AND SUPPLIES

- ❑ INTERNET ACCESS
- ❑ USED CHEWING GUM, OR CLEAN PIECES FOR MODELING
- ❑ A BOWL OR MASON JAR FILLED WITH WATER
- ❑ SAND OR EARTH
- ❑ PLANT LEAVES, SMALL PEBBLES
- ❑ PUTTY
- ❑ CHALK AND 1 PIECE OF 1 METER CORD
- ❑ LOGBOOK

NAVIGATOR

1. Find a place on the street or sidewalk that is contaminated with chewing gum!
2. Using a 1-meter cord, a little skill and cooperation, mark out a one-square-meter sample area (1x1 m). Draw the sample area with chalk! Count how many pieces of chewing gum are stuck there. Measure the number of chewing gums at other points as well! When mapping, start from the school and look around bus stops or any other place that seems interesting! The more sampling points you count the number of chewing gums, the more accurate a picture you will get of the “chewing gum pollution” of your settlement.
3. Collect at least three pieces of chewing gum for further testing using the spatula. Place them in a sealable glass container and bring them to the lab.
4. Look at the surface of a piece of chewing gum that has been stuck to the bench or floor for a while using a microscope or magnifying glass. What materials are stuck to it? Has any of it fallen off?
5. Put a piece of chewing gum in a bowl or mason jar filled with water. Observe how it behaves! Does it float? Does it sink? What happens to the chewing gum in the river or lake? What living things might this affect?
6. Sprinkle sand, dirt, or other materials found in the environment on one of the samples. Rub the two materials together, simulating the effect of chewing gum being washed across the ground by rain. Observe the effects: how does the surface of the chewing gum change? If you place this chewing gum in water, how does its behavior change in the water?
7. How can chewing gum get into rivers and lakes?
8. Let's see what the situation is with cigarette butts! In addition to chewing gum, let's count how many cigarette butts or other discarded plastic and packaging materials we find in the study area! What could be the harmful environmental impact of cigarette butts?
9. Record the steps of the experiment in the logbook!

LOGBOOK

Date: .....

Sampling location coordinates: .....

Type of settlement (city, countryside, etc.): .....

Location description (bus stop, school nearby, downtown, suburbs, park, etc.):

.....

Pedestrian traffic: rare / medium / high

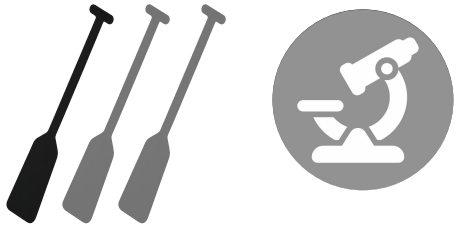
Number of chewing gums found in the sample area: ..... pcs

Number of chewing gums found in the sample area: ..... pcs

You can perform the test in multiple locations and compare the results.

TREASURE CHEST

TOOLS AND SUPPLIES



- ❑ THREE IDENTICAL GLASS JUGS:
  FILL ONE WITH TAP WATER (LET IT SIT FOR A WHILE TO LET THE CHLORINE DRAIN OUT)
  IN THE OTHER TWO JUGS, FILL TWO DIFFERENT BRANDS OF STILL MINERAL WATER AND STORE THEM AT ROOM TEMPERATURE FOR THREE DAYS.
- ❑ STILL MINERAL WATER (2 TYPES)
- ❑ GLASSES
- ❑ LOGBOOK

NAVIGATOR

One of the important scientific aspects of food - including water - is sensory testing. Let's examine the taste, smell and color of the water! In the next step, let's examine which type of water sample contains microplastics! Based on the comparison, we gain insight into the quality of tap water and PET-bottled mineral waters. As PET bottles age, transparent microplastic fragments can enter drinking water, or if the bottle is thrown away, they can pollute natural waters and endanger wildlife.
some research , bottled mineral waters often contain more microplastics than tap water. There are many chemicals found in and attached to plastics that are harmful to health.
UV light, heat, and refrigeration can accelerate the degradation of plastic, which can cause further pollution .

1. Sample collection and preparation:

- Collect the water samples! Put tap water in one jug, and bottled water in the other two. Only the experiment leader knows which jug contains what! (It is worth numbering the jugs and writing down the numbers!). Let the water stand for a few minutes!
- Make sure that all water samples are placed in a clean jug to avoid contamination!
- The experiment leader should pour the waters into glasses (only he/she knows which water comes from where). After that, the sensory test should come!

    - Does the color and transparency of the waters differ?
    - Is there a difference in their scent?
    - Which one tastes the best? Which one did you find the most delicious? Why?
    - Everyone guess which glass contained what kind of water! Justify your guesses!
    - Finally, the experiment leader explains where each water sample comes from. Is PET bottled mineral water better?
    - Tasting note

NAVIGATOR

2. Recording experiences in the logbook:

- Note any differences between the different samples in the experiment.
- How many of you regularly drink bottled water or soft drinks? Calculate how many bottles are needed in the classroom in a day?
- How many bottles do you use in a year? Is it worth it (how much does a liter of tap water cost and a liter of bottled water)?
- How much could be saved if the class drank tap water for a year (what would you spend this amount on)? What is the impact of drinking bottled water on the environment?

LOGBOOK

Fill in the table based on the different examination criteria!

	Fragrance	Color	Transparency	Taste
1. sample				
Sample 2				
Sample 3				

The head of the investigation can reveal the secret! The tap water was sample number .....

TREASURE CHEST

TOOLS AND SUPPLIES

- ❏ PAINT POWDER (E.G. GROUND FROM WATERCOLOR BUTTONS/FOOD COLORING) - THIS MODELS CHEMICAL CONTAMINANTS
- ❏ FLOUR - THIS MODELS MICROPLASTICS
- ❏ CONFETTI, OR SHREDDED PAPER - THIS REPRESENTS MACROPLASTICS
- ❏ CARDBOARD (THE LESS IT SOAKS, THE BETTER)
- ❏ DRAWING BOARD (UNDER THE CARDBOARD SO IT CAN BE MOVED)
- ❏ DRAWING TOOLS, SCISSORS, GLUE, INSULATING TAPE
- ❏ LOGBOOK
- ❏ PET BOTTLE CUT IN HALF
- ❏ SPRAY BOTTLE (E.G. WINDOW CLEANING SOLUTION BOTTLE) WITH WATER (THIS SIMULATES RAIN)
- ❏ COTTON WOOL/MOSS/SMALL STRIP OF MOSQUITO NET/CURTAIN MATERIAL - TO MODEL THE DENSE, BUSHY AREA

NAVIGATOR

1. Drawing a part of the settlement and the river bank on the cardboard (you can make several drawings, and then we use separate drawings for each step):

- Cut a 3-4 cm strip from the cardboard. Fold in the bottom 1 cm edge. This will be the “flood barrier” or “embankment” that we will glue to the map in one of the steps of the experiment.
- Draw a top view of the natural strip along the river and some of the houses in the settlement on the cardboard.
- Attach the cardboard to a drawing board!
- Cut a PET bottle in half and attach it to one side of the drawing board (you can also tape it there)! This will collect the water that splashes onto the cardboard, representing the river.

2. Pollution washed into the river:

- Sprinkle different pollutants over the area of the settlement! The paint represents the smallest nanoplastics and chemicals, such as spilled oil, chemicals, the flour represents small pollutants, such as microplastics, while the confetti represents large discarded garbage (macroplastics).
- Tilt the cardboard towards the river (PET bottle). First tilt it slightly, then more (as if the village were in a valley between mountains).
- Spray water on it as if it were raining. The rain will reach the surface, but the water will start flowing towards the river (=PET bottle).
- Observe how the materials wash into the river! Which one washes in the easiest?
- If you have made several drawings, you can test how the materials released by the rain move when the area is flat (the drawing board is horizontal), when it slopes slightly, i.e. we are in a hilly area, or when the drawing board slopes sharply, like the slopes in the mountains.
- Adventurous microscientists can even make real streets (e.g. houses out of medicine boxes), and then they will discover that water and pollution move differently on the street! Try to improve your models! Take photos!

3. Maintaining the good condition of the river by preventing the ingress of pollution:

- Glue the dam (cardboard tape) and the cotton wool representing dense vegetation (moss or mosquito net) to the area between the river (PET bottle) and the settlement.
- Sprinkle the paint, flour, and confetti over the town again. Let it rain! Notice how the materials now wash into the river! Which one washes in the easiest?
- What stops pollution better, a dam or vegetation?
- In reality, what could be done to prevent pollution from entering the river?

We are very curious about your models!
Upload your photos to the website www.tisztatisza.eu !

TREASURE CHEST

TOOLS AND SUPPLIES

- ❑ LOGBOOK
- ❑ YOUR MEMORIES
- ❑ INTERNET, SMARTPHONE
- ❑ COMPUTER

NAVIGATOR

In the next task, form groups and choose from the different science communication methods, then present the completed materials and discuss which target groups might be interested in which. Possibilities: newspaper article, news report, social media post, short video, short lecture.

1. **Choose a science communication tool!**
   Form groups and decide in what form you would like to share your knowledge. You can choose from the following options:
   - **Newspaper article** : Imagine writing an article for a magazine or online portal.
   - **News reporting** : Compose a short report of a news program.
   - **Social Media Post** : Writing an Instagram, TikTok, or Facebook post that is engaging and easy to share.
   - **Mini-video** : A short, 1-2 minute video that conveys a message in a playful or visual way.
   - **Pitch** : A 3-5 minute presentation that you deliver live or online.

2. **Prepare your materials!**
   - Think about how you can explain the topic in an exciting and understandable way.
   - Go over the proposed solutions, but let the audience think for themselves: what could they do to solve the problem?
   - Emphasize the "why"! For example, don't just say "don't litter", but show how littering affects nature or living things, and give a good example!

3. **Personal example**
   Share your own resolutions regarding the issue. What are you doing yourself and how do you manage to keep your own promises?

4. **Show us your work!**
   - Each group should present their completed material to the class or audience.
   - Discuss together:
     - Who were your materials intended for?
     - What methods did you use to capture the attention of the target group?
     - What worked best and why?

We are very curious about your ideas!
Upload the materials to the website www.tisztatisza.eu .
If you have an article or video that has been posted on your school's website or social media platforms, please share it with us!

Be a Microscientist Workbook. E-book, first digital edition.

It was published as part of the Tiszta Tisza Textbook Series , in Hungarian, English, Romanian and Bulgarian, within the framework of the Be a microscientist! Erasmus+ program.

Authors: Dr. Attila Dávid Molnár, Dr. István Szabó, Katalin Vészity, Dr. Tímea Kiss
Illustrated by: Áron Gauder
Design, icons: Emese Silimon
Photos: Krisztina Pálvölgyi, Enikő Kubinyi, Vanda Molnár, Tamás Varga, Anna Géczy, Gergely Hankó and the PET Cup volunteers

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www.petkupa.hu
szemleletformalas@petkupa.hu

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