



ColiQuant EZ

Code 3-0034

Quantity	Contents
10 bottles	Coliscan Easygel® Easygel®, 20 mL
10	Petri dishes, pretreated, with lids, sterile
10	Collection bottles, sterile
10	Droppers, 3 mL, sterile
1	ColiQuant EZ Manual
1	ColiQuant EZ Colony Color Guide

Coliscan Easygel is a registered trademark of Micrology Laboratories LLC

Storage Conditions

Coliscan Easygel should be placed in the freezer (2 – 6°C) as soon as it is received. Coliscan Easygel can be refrozen if it has been thawed and not been used. Coliscan Easygel should be thawed at room temperature overnight. Bottles may also be thawed for same day use by standing the bottles in warm water until the contents become liquid. Coliscan Easygel will keep for 6 weeks in the refrigerator or 12 months in the freezer.

Safety

- Coliscan Easygel is non-toxic. Additional information for all LaMotte reagents is available in the United States, Canada, Puerto Rico, and the US Virgin Islands from Chem-Tel by calling 1-800-255-3924. For other areas, call 813-248-0585 collect to contact Chem-Tel's International access number.
- Read the entire manual before performing any tests.
- Be sure that students understand the danger of treating reagents casually or endangering others through "horseplay".
- Wear safety glasses and protective gloves when appropriate.
- Wash hands or use a hand sanitizer after performing tests. Avoid placing hands in contact with eyes or mouth. Do not eat or drink or apply cosmetics during testing or clean up.
- Wipe tabletops and work areas with disinfectant, such as a 1:10 dilution of household bleach, after each use.
- Follow the general safety guidelines for your school.

- Ensure a safe field-testing experience by using the following: safety glasses for each student, clean pail or bucket for washing hands, jug of clean water for washing hands, soap (biodegradable if possible), towels, protective gloves, eye wash bottle, first aid kit.
- Keep used Petri dishes taped shut and out of the reach of small children and animals.
- Use one of the recommended disposal methods in procedure.

Coliscan Easygel EZ Method

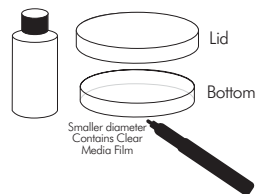
In order for coliforms to ferment lactose, they must produce certain enzymes, which can be identified and used to verify the presence of coliforms and *E. coli*. General coliforms produce the enzyme galactosidase from lactose fermentation whereas, *E. coli* produces the enzyme glucuronidase, in addition to galactosidase. Coliscan Easygel incorporates two special chromogenic substrates, which are acted upon by the enzymes galactosidase and glucuronidase, to produce pigments of different colors. General coliforms will produce the enzyme galactosidase and the colonies that will grow will be a pink color. *E. coli* will produce galactosidase and glucuronidase, and will grow as blue/purple colonies. The sum of the *E. coli* and general coliforms is the total coliform number.³

Collecting a Water Sample

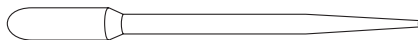
1. Remove the cap of a collection bottle. Do not touch the neck of the bottle or the inside of the cap.
2. If you are testing stream water, face upstream while holding the bottle 5 to 6 inches below the surface.
3. When the bottle has filled, replace the cap.
4. The test can be done at the site or water samples may be collected in the sterile collection bottle and transported back to the testing site. Water samples kept for more than one hour before testing should be kept on ice or refrigerated.
5. Do not reuse the sample collection bottle.

Procedure

1. Use a permanent marker or wax pencil to label a Petri dish and a bottle of Coliscan Easygel with the sample information. Tape the dish shut with two pieces of clear tape. Use one piece of tape as the hinge and the other as a latch.



2. Unwrap a sterile dropper. Handle the dropper by the bulb end. Do not touch the tip of the dropper with anything but the water sample.



3. Squeeze the bulb of the dropper. Insert the tip of the dropper 2 – 3 inches below the surface of the water. Slowly release the bulb to draw the water into the

dropper. Carefully squeeze the bulb to expel excess water until the dropper is filled to the desired sample volume.

Use these general guidelines for determining sample volume to be tested:

- If the coliform level is unknown, begin with 1 mL. This sample size is recommended for sources such as rivers, ponds, streams, lakes, ditches, etc. These samples often have moderate amounts of coliforms. If counts are too low, increase the sample size.
 - If counts are too high for water samples with extremely high coliform levels, the sample size can be reduced to 0.25, 0.5 or 0.75 mL.
 - If the sample is suspected of having very low levels of coliform, such as drinking water, use a 5.0 mL sample size.
- 4.** Remove the cap from one bottle of Coliscan Easygel. Do not touch the neck of the bottle. Do not touch the inside of the cap or put the cap down where it could become contaminated.
 - 5.** Add the water sample from the dropper to the bottle of Coliscan Easygel. Hold the bottle and dropper at an angle to prevent spills. Carefully squirt the sample into the bottle.
 - 6.** Cap the bottle and swirl to distribute the contents. Do not shake or create air bubbles.

Note: After the addition of the water sample to the Coliscan Easygel bottle, samples that can not be plated within 10 minutes should be kept on ice or refrigerated. Keep the bottles out of direct sunlight.
 - 7.** Remove the tape from one side of the dish and lift up the lid. Pour the mixture into the Petri dish bottom.
 - 8.** Replace the lid on the Petri dish. Carefully swirl the poured dish until the bottom of the dish is completely covered with liquid. Do not splash the liquid over the side of the dish or onto the lid. Tape the dish shut.
 - 9.** While the contents of the dish are still liquid, place the dish with the lid side up in a warm level spot or in an incubator. The liquid will solidify in about 30 - 45 minutes.
 - 10.** When the medium has solidified. Turn the dish upside down (with the lid side down). Incubate Petri dish for 48-72 hours at room temperature (68-74°F or 20 – 24°C) or 24-48 hours in a preheated incubator at 95°F (35-37°C). See Incubation Hints.
Note: A liquid may form during incubation. Avoid spilling the liquid. If liquid spills, observe safety procedures; disinfect the spill area and wash hands thoroughly.

11. Colonies will begin to appear after 24 hours. The best time to count colonies is after 30 hours of incubation. Colonies should not be counted after 72 hours. Count the colonies with the dish upside down. Colonies are normally reported as Colony Forming Units (CFU) per 100 milliliter of water. Colonies may appear inside the medium. Count all colonies growing on the surface and within the medium.

12. To determine the result as *E. coli* or **Fecal Coliform** count the **dark blue to purple** colonies. Disregard any light-blue, blue-green or white colonies. Refer to the ColiQuant EZ Colony Color Guide.

- To report the result in terms of *E. coli* or Fecal Coliform per mL of water: Divide the number of colonies by the sample size

$$\frac{E. \text{ Coli or Fecal Coliform}}{\text{Colonies per mL (CFU/mL)}} = \frac{\# \text{ Colonies}}{\text{Amount of sample used}}$$

- To report the results in terms of *E. coli* or **Fecal Coliform** per 100 mL of water (Most state agencies use this measurement): Multiply the number of colonies by 100. Then divide by the sample size.

$$\frac{E. \text{ Coli or Fecal Coliform}}{\text{Colonies per 100mL (CFU/100mL)}} = \frac{\# \text{ Colonies} \times 100}{\text{Amount of sample used}}$$

13. To determine the result as **Total Coliforms** (*E. coli* + non-fecal coliforms) count the number of **pink** and **purple** colonies.

- To report the result in terms of Total Coliforms per mL of water: Divide the number of colonies by the sample size

$$\frac{\text{Total Coliform Colonies}}{\text{per mL (CFU/mL)}} = \frac{\# \text{ Colonies}}{\text{Amount of sample used}}$$

- To report the results in terms of Total Coliforms per 100 mL of water: Multiply the number of colonies by 100. Then divide by the sample size.

$$\frac{\text{Total Coliform Colonies}}{\text{per 100mL (CFU/100mL)}} = \frac{\# \text{ Colonies} \times 100}{\text{Amount of sample used}}$$

14. If there are more than 300 CFU (colonies) of one color, the result should be recorded as Too Numerous To Count (TNTC). If the *E. coli* purple colony count is less than 300, even though there are more than 300 total colonies of all colors and types, the purple colonies can be counted and a result given for *E. coli*. Record TNTC for coliforms or non-coliforms that are present at greater than 300 CFU.

Disposal

Any materials containing living or viable microbes should be disinfected or sterilized before being discarded. Before disposal in normal trash, treat the test kit components in one of the following ways:

- Pour one tablespoon of undiluted household bleach on the dish and one tablespoon in the Coliscan Easygel bottle. Wait 10 minutes. Place the dish and bottle in a waterproof bag. Discard in trash.
- Place the dish and uncapped Coliscan Easygel bottle in a large pan. Cover with water. Boil for 45 minutes. Discard in trash. (Warning: May cause unpleasant odors.)
- Place the dish and uncapped Coliscan Easygel bottle in a sealed ovenproof bag and heat in a 300°F oven for 45 minutes. Discard in trash. (Warning: May cause unpleasant odors.)
- Place dish and uncapped Coliscan Easygel bottle in a pressure cooker and cook at 15 pounds for 15 minutes. Discard in trash. (Warning: May cause unpleasant odors.)

Extensions³

Alternative Method – Streak Plate (Swabbing)

1. Lay Petri dish on a level surface with the lid side up. Remove the lid.
2. Remove the cap from the Coliscan Easygel bottle. Do not touch the rim or inside of the bottle or the Petri dish.
3. Pour all the liquid Coliscan Easygel into the dish bottom. Replace the lid. Gently swirl to cover the bottom.
4. Wait 45 minutes until the Coliscan Easygel has solidified. Pour dishes a day in advance for a firmer surface area.
5. Inoculate the dish.

How clean are your fingers? Divide a poured Coliscan Easygel dish in half by turning the dish over and drawing a line across the bottom with a wax pencil or marker. Remove the lid and touch several fingers to the surface on one half. Wash your hands thoroughly with soap and water, dry on a clean paper towel, and touch the washed fingers to the other half. Label and incubate. Check at 24, 48, and 72 hours for growth. Did you get less growth after washing? Why or why not?

How clean is your doorknob or table? Pour a dish of Coliscan Easygel a day in advance. Save the bottle with the Coliscan Easygel residue. Use a sterile swab, which has been moistened with the Coliscan Easygel residue from the empty bottle, to wipe a doorknob, handle or tabletop. Rotate the swab so that the entire surface has made contact. Remove the lid of the poured dish. Start on one side of the dish and gently wipe the swab against the surface of the gel. Rotate the swab while moving it in a zig zag pattern. Wiping too hard will tear the gel. Put the lid back on the dish and incubate. Check at 24, 48 and 72 hours for growth.

Are insects dirty?: Using a poured dish of Coliscan Easygel, place a live insect on the gelled medium, and replace the lid. Remove the insect with clean forceps after it

has moved around the surface. Place the lid back on the dish and incubate for 48 hours. Disinfect the forceps (alcohol pad, dilute household bleach, soap and water). Did anything grow?

Other inoculum ideas: Gently touch one of the following to a poured dish: dirty sock, old toothbrush, dust, pencil etc.

- Procedure for Testing Food: Coliscan Easygel can be used to determine *E. coli* and coliforms in food, beverages and dairy products. Follow the streak plate method above. Weigh a given size sample of food (10 g for example) and then sterilely blend it in 90 mL of diluent (0.1% peptone water for example) using sterile technique. Add 1-5 mL to a bottle of Easygel, swirl it and pour the Easygel-sample mix into a pretreated plate. Allow it to gel and incubate. Count the number of CFU and determine how many were present per gram of the original sample using the same formulas in steps 12-14.
- Lesson Plans/Activities/Hints: Find additional exercises on our website: www.lamotte.com. Click on education and outdoor monitoring.

Hints

Apparatus

- The equipment supplied with this kit – bottles, dishes, droppers - is sterile. Take care that it remains sterile. Do not touch the inside of dishes, bottlenecks or inside of caps, or tips of droppers with fingers

Coliscan Easygel

- Coliscan Easygel is non-toxic before it is inoculated. It can be stored safely in a freezer with food.
- Coliscan Easygel can be refrozen if it has been thawed and not used.
- Coliscan Easygel can be stored in the freezer for up to 12 months.
- Coliscan Easygel will keep for 6 weeks in the refrigerator or two weeks at room temperature.
- Coliscan Easygel should be thawed at room temperature overnight. Bottles may also be thawed for same day use by standing the bottles in warm water until the contents become liquid.
- Coliscan Easygel contains dissolved solids that may settle out. Shake the bottle vigorously to suspend the solids and allow it to stand for several minutes to let air bubbles dissipate before using it.
- If Coliscan Easygel is contaminated and growth is evident in the bottle, do not use it. If contamination is present, growth will usually be apparent throughout the contents of the bottle, not just on the bottom, and shaking will not make the sediment disappear.

Differentiating Coliforms and *E. coli*

- Colonies that have a blue-green teal color are not exhibiting any β -galactosidase activity (which is evidenced by a pink color). Because of this, they are not considered to be either coliforms or *E. coli* and should be ignored when counting coliform or *E. coli* colonies. Similarly, colonies that are white are exhibiting neither color-causing enzyme and should not be counted.
- Colonies on the surface of the plate are exposed to the medium only on the underside of the colony. This causes these colonies to appear with much less of the indicator color. *E. coli* colonies may have only a slight purple tinge to them. The purple color may appear only in the center of the colony with the remainder of the colony being white. Similarly, coliforms on the surface may be light pink or white with a pink center.
- When there are a lot of colonies of different colors to count, mark the plate into quadrants and count one quadrant at a time. If the bacteria are evenly distributed over the plate, count one quadrant and multiply by four to get the total count.

Incubation Hints

- Incubate dishes with lid side down to prevent condensation from dripping onto the plate from the lid.
- There is no one standard to define room temperature. Most would consider normal room temperature to vary from 68-74°F, but even within this range the growth of bacteria will be varied. Members of the bacterial family Enterobacteriaceae (which include coliforms and *E. coli*) are generally hardy growers that prefer higher than room temperatures, but will grow more slowly at lower temperatures.
- An adequate incubator can be made from a box with a 40 - 60 watt bulb in it to provide heat at an even rate. If plates are incubated in an incubator with a light bulb as the heat source, shade the plates from direct light from the bulb. It is also possible to use heat tape that is used to prevent frozen pipes as a heat source. Always consult your building or fire inspector for advice on the safe handling and operation of homemade incubators.
- At elevated temperatures (90 – 98°F) incubation times for coliforms are generally 24 – 48 hours. At elevated temperatures, no counts should be made after 48 hours as any coliforms will be quite evident by that time. If new colonies form after 48 hours they are most likely not coliforms, but some other type of slow growing organism that should not be included in the data.
- At room temperature incubation times for coliforms are generally 48 hours or more. At room temperature, the best procedure is to check the plates every 10 – 12 hours until some pink or purple colonies start to form. Allow another 24 – 30 hours for these colonies to mature. Do not count anything after 72 hours. Since the coliforms (including *E. coli*) are generally the fastest growing organisms, these will be the first to grow and be counted. Colonies that may show up at a later time are probably not coliforms.

Interpretation of Results

- Non-fecal coliforms are widely distributed in nature, being found both as naturally occurring soil organisms, and in the intestines of warm-blooded animals and humans. Fecal coliforms, such as *E. coli*, are coliforms found naturally only in the intestines of warm-blooded animals and humans. The presence of fecal coliforms is therefore the result of some form of fecal contamination from either animal or human.
- Be aware of animals, like ducks or geese, which may be upstream from where the sample was taken because their feces will increase the *E. coli* and coliform count temporarily, therefore, the results will not reflect the true nature of the water quality.
- Proper application of the Coliscan Easygel method will result in accurate results. Therefore, if the results indicate dangerously contaminated water, contact your local health department for help in performing an official assessment of the water quality.
- Water containing *E. coli* should not be used for drinking water. Contact your local health department for guidelines regarding *E. coli* and coliforms in recreational water.
- Most standard counts are reported as CFU/100mL of water
- Check your state water quality guidelines (see references).

Petri Dishes (Pretreated)

- Petri dishes supplied with this kit are coated inside with a special film. If storage conditions vary, the film may develop a crystal pattern (too dry) or moisture droplets may form or the film may become hazy (too moist). The dishes can be used if these conditions exist.
- Coliscan Easygel WILL NOT work with Petri dishes that have not been pretreated.
- Poured plates will solidify in about 45 minutes. Plates that will be streaked or swabbed can be poured a day ahead.
- Petri dishes are intended for one time use only.
- Dispose of poured dishes in one of the recommended methods.

Sample Size and Ideal Colony Counts

- A smaller sample size should be used for samples with large coliform concentrations to bring the number of colonies into a practical range. The target range should be between 20 and 300 colonies. Below 20 colonies the results will not be significant. Colonies greater than 300 will be too numerous to count (TNTC).
- For samples with unknown levels of coliform, begin with a 1 mL sample size. If counts are less than 20, then try a 5 mL sample size.

Water Sampling

- The sample is collected while facing upstream to avoid contamination from the hand holding the bottle. Wearing protective gloves will also decrease the chance of contamination.
- Be aware of animals, like ducks or geese, which may be upstream from where the sample was taken because their feces will increase the *E. coli* and coliform count temporarily, therefore, the results will not reflect the true nature of the water quality.

Background of Water Testing

In 1972, the U.S. public was concerned about the pollution in our nation's water. Congress responded by passing the Federal Water Pollution Control Act Amendments, also known as, the Clean Water Act of 1972. The goal of the Act was to protect human health by preventing water pollution. Water pollution comes in many forms and from many sources. The U.S. Environmental Protection Agency (EPA or USEPA) manages the water quality standards program, recommends water quality criteria, and works with states to develop standards for different water use, such as beach swimming areas, rarely used swimming areas, off season swimming areas, or fish and wildlife habitat.²

Water can be contaminated or polluted with disease causing organisms (pathogens). When people swim in these waters, they can get sick with ear or skin infections, respiratory infections, or intestinal infections. The pathogens responsible for these diseases can be bacteria (Cholera), viruses (Hepatitis A), or parasites (Giardia and Cryptosporidium) that live in the gastrointestinal tract and are shed into the water through the waste (feces) of warm-blooded animals. However, analyzing for all possible pathogens is impractical. It is difficult, time consuming, and expensive. The EPA recommends using indicator organisms, such as fecal bacteria, as indirect evidence of the possible presence of pathogens in water.² The two most important fecal bacteria indicators are *E. coli* and *Enterococcus*. We will discuss the use of *E. coli* as it relates to the USEPA standards for water pollution.²

Escherichia coli (*E. coli*) is the United States Environmental Protection Agency's (USEPA) most commonly recommended indicator of fecal contamination in fresh waters. It is present in high numbers in the gastrointestinal tracts of warm-blooded animals (humans, dogs, bears, cows, ducks, geese) and therefore provides a sensitive measure of fecal pollution. Researchers have found that its presence in water is often associated with water borne illness outbreaks actually caused by the other pathogens mentioned above. *E. coli* do not live long in water so that their presence indicates a fairly recent contamination event (up to 48 hours).

The current EPA water quality standard for *E. coli* relates to approximately 8 gastrointestinal illnesses per 1,000 swimmers. This is considered an acceptable level of disease for people who come in contact with the tested water. If the indicator counts are measured above the standard acceptable level, then the risk of becoming infected from that water source is unacceptably high. In the past fecal coliforms were used as the indicator for water standards with maximum allowable counts of 200 FC (fecal coliforms) per 100 mL.²

Coliform bacteria are members of the family Enterobacteriaceae, which are gram negative, non-spore forming rods that ferment the sugar lactose to produce gas and acid. *E. coli* is a genus (*Escherichia*) and species (*coli*) in the total coliform group. It is also a fecal coliform (FC), a smaller subset of total coliforms. Fecal coliforms are defined as coliforms that can grow at 44.5°C, which is too hot for most of the other coliforms. Fecal coliforms live in the gastrointestinal tract of warm-blooded animals,

such as dogs, cats, birds, mammals, and people. *E. coli* belongs to both groups of bacteria that are reported in water quality studies; *E. coli* is a fecal coliform (FC) and a total coliform (TC).³

New guidelines from the USEPA recommend *E. coli* or Fecal Coliform standards that vary with the potential human exposure to the water. For example, during summer on a lake which allows swimming and water skiing, the standards will be stricter (require lower counts) than during the winter on that same lake or if it was a rarely used swimming area. Each state works with the EPA to determine the best standards that apply to their water bodies. Refer to the EPA document, “Bacterial Water Quality Standards for Recreational Waters (Freshwater and Marine Waters)-Status Report” at this website: www.epa.gov/waterscience/beaches/local/statreptac.pdf for more specific standards from your state.²

Normal testing for *E. coli* cannot determine the source of the contamination (e.g. animal vs. human), since it is present in all warm-blooded mammals. Drinking water is often drawn from rivers, lakes, streams, and other reservoirs open to non-point source or point source pollution. Water company scientists measure fecal coliform bacteria, in addition to dissolved oxygen, pH, temperature, and turbidity to determine water quality. High levels of fecal coliform or *E. coli* have caused closures of shellfish beds, beaches, and other recreational water sources. Point source pollution may be caused by septic systems, municipal sewage discharges, animal feed operations, farms, and boaters discharging wastes. Non-point source pollution from *E. coli* may be related to runoff of fecal waste from the land after a heavy rainfall. For example, in urban areas, *E. coli* runoff occurs from runoff of pet feces in the park or on the street into creeks, rivers, streams, lakes, or groundwater. *E. coli* levels in urban storm water can reach as high as 100,000/100 mL. *E. coli* levels reaching over 27,000/100 mL were found in an area where gulls routinely roost in Milwaukee.

Reducing bacterial water pollution involves a whole community working together. State, Federal, and Local Water agencies, EPA, community leaders, teachers, students, neighbors, farmers, chemical companies- everybody must work together to plan a best management strategy for your community. Additional tools are available under Resources to make an action plan. Education programs show the impact of individual behaviors on public health and water quality and create a culture for change.

Definitions

CFU	colony-forming units or colonies or cells, one CFU is larger than a period(.), can be seen without magnification, and may contain more than 10,000 individual bacterial cells, all clones of the original bacterial cell
<i>E. coli</i> (<i>Escherichia coli</i>)	those bacteria which grow as dark blue/purple colonies on the Coliscan Easygel plate as a result of the production of both glucuronidase and galactosidase enzymes. These bacteria are of fecal origin.
Total Coliforms	those bacteria which make up the sum of the <i>E. coli</i> (blue/purple colonies) + other coliforms. The other coliforms will appear as pink/magenta colonies because they produce galactosidase, but NOT glucuronidase. Species of the genera <i>Citrobacter</i> , <i>Enterobacter</i> , <i>Escherichia</i> , and <i>Klebsiella</i> are the main groups of coliform bacteria.

Non-Coliforms	bacteria that form colonies that are not blue/purple or pink/magenta on Coliscan Easygel medium and are not considered to be of fecal origin. They live naturally in soil and water.
Pathogen	disease causing microbe
Nonpoint source pollution (NPS)	pollution that cannot be traced to a single point, such as an outlet or pipe, because it comes from many individual places or a widespread area (typically urban, rural, and agricultural runoff, acid mine drainage).
Point source pollution (PS)	pollution that can be traced to a single point source, such as a pipe or culvert (Example: industrial and wastewater treatment plant, and certain storm water discharges).
Pollution	contaminants in the air, water, or soil that cause harm to human health or the environment.

References

Many EPA webpages are valuable resources.

¹www.epa.gov/waterscience/beaches/technical.html#tech

Beach and recreational water quality monitoring and reporting handbook; How to design and implement community water quality monitoring program

²www.epa.gov/waterscience/beaches/local/statreptac.pdf

Bacterial water quality standards adopted by states for marine and fresh water recreational and fish and wildlife use

www.epa.gov/owow/monitoring/volunteer

Volunteer monitoring programs: fact sheets, methods, newsletter, national directory of volunteer monitoring programs, and much more

www.epa.gov/maia/html/fecal.html

What can you do about fecal water contamination?

www.alabamawaterwatch.org

More than a decade of experience in monitoring Alabama water bodies for pollution

³www.micrologylabs.com/html/education_ideas.html

Microbiology for Everyone, Jonathan N. Roth – many science fair ideas, lab activities

⁴USEPA 1997. Volunteer Stream Monitoring: A Methods Manual. EPA 841-B-97-003 pgs 180-184.

www.ccme.ca/sourcetotap/ecoli.html

Canadian Council of Ministers of the Environment *E. coli* fact sheet and suggestions for individuals who want to help avoid contaminating our water supply.

Additional Resources

Protecting Our Watershed (LaMotte product code 5-0093)

Community Action Package How to Manage water pollution, teacher guide, activity notebook, posters to help students pinpoint problems, handy tote bag

GREEN Standard Water Monitoring Kit (LaMotte product code 5848)

This kit will identify 9 different test factors, such as dissolved oxygen, pH, phosphate, turbidity, temperature that contribute to water pollution

Leaf Pack Experiments Stream Ecology Kit (LaMotte product code 5946)

Water quality kit for studying living aquatic macroinvertebrates



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