

Identifying Plastic Marine Debris

Ocean-borne plastics wash up on beaches all around the world. One of the difficulties in identifying the sources of plastic debris is that plastics degrade through mechanical and chemical action, often rendering the plastics unidentifiable.

Fragments of plastics can be identified using attenuated total reflectance Fourier transform infrared spectroscopy (ATR-FTIR) but the required instrumentation is expensive.

Physical characteristics can be helpful in identifying the sources of plastics. Another simple method of identifying plastic polymer type is via density separation.

We will use these simple methods to explore the properties of plastics using marine debris items or plastics from your home.

Number							
	PETE	HDPE	PVC	LDPE	PP	PS	OTHER
Plastic Type	polyethylene terephthalate	high-density polyethylene	polyvinyl chloride	low-density polyethylene	polypropylene	polystyrene	other plastics, including acrylic, polycarbonate, polyactic fibers, nylon, fiberglass
Example	soft drink bottles, mineral water, fruit juice containers and cooking oil 	milk jugs, cleaning agents, laundry detergents, bleaching agents, shampoo bottles, washing and shower soaps 	trays for sweets, fruit, plastic packing (bubble foil) and food foils to wrap the foodstuff 	crushed bottles, shopping bags, highly-resistant sacks and most of the wrappings 	furniture, consumers, luggage, toys as well as bumpers, lining and external borders of the cars 	toys, hard packing, refrigerator trays, cosmetic bags, costume jewellery, audio cassettes, CD cases, vending cups 	an example of one type is a polycarbonate used for CD production and baby feeding bottles 
Density (g/mL)	1.39	0.95	1.3-1.34	0.92-0.94	0.9	1.05-1.07	Varies

modified from: polychem-usa.com

78=563.

Liquid	Honey	Pancake Syrup	Light Corn Syrup	Dish Soap	Milk	Water	Vegetable oil	Baby oil
Density (g/mL)	 1.42	 1.37	 1.33	 1.06	 1.03	 1.00	 0.92	 0.83

Scavenger hunt

In your home, can you find at least one item from each plastic type category 1-7? Check your recycling bin. Find small items or larger items you can cut a small piece off. Can you find any 'unknown' types – I will be using some from a recent beach cleanup.

Kitchen Science

Find these materials:

- 1 to 3 clear drinking glasses or jars (pint size or smaller)
- Pen
- Label tape (masking tape works best, scotch tape also works fine)
- ½ cup each of honey/syrup; water; vegetable/baby oil
- Using the plastic materials from your scavenger hunt, choose 4-5 different plastics that will fit in your jars (for example: legos, water bottle cap, a piece of a plastic water jug, a piece of a plastic fork – get creative!)

Identifiable recycling mark	Identifiable printing or markings (describe)	Is it flexible? (y/n)	Does it crinkle (if film) (y/n)	Sinks in vegetable oil > 0.9 g/ml	Sinks in water > 1.0 g/ml	Sinks in syrup > 1.3 g/ml	Identify plastic type
Example 1	Dasani	y	-	y	y	y	Dasani water bottle
1							
2							
3							
4							
5							
6							
7							
Unknown							
Unknown							

1. Copy your data to the course Google sheet
2. Answer the following questions in 1 or 2 paragraphs and upload this document to the Canvas assignment or paste your answer into the canvas response box:

Fragments of which plastic polymers do you expect to find most commonly on beaches in California and why?

Of the sandy beach invertebrate infauna we studied, which do you expect could be at risk from microplastic ingestion?

Supplemental Information: Characteristics of Common Types of Plastic

Description:

1. Polyethylene Terephthalate (PETE or PET)

The most common thermoplastic polymer resin of the polyester family and is used in fibers for clothing, containers for liquids and foods, thermoforming for manufacturing, and in combination with glass fiber for engineering resins.

2. High-Density Polyethylene (HDPE)

It's made from petroleum. It is sometimes called "alkathene" or "polythene" when used for pipes. With a high strength-to-density ratio, HDPE is used in the production of plastic bottles, corrosion-resistant piping, geomembranes, and plastic lumber.

3. Polyvinyl Chloride (PVC)

PVC is the world's third-most widely produced synthetic plastic polymer, after polyethylene and polypropylene. The rigid form of PVC is used in construction for pipe and in profile applications such as doors and windows. It is also used in making bottles, non-food packaging, and cards (such as bank or membership cards)

4. Low-Density Polyethylene (LDPE)

LDPE is widely used for manufacturing various containers, dispensing bottles, wash bottles, tubing, plastic bags for computer components, and various molded laboratory equipment. Its most common use is in plastic bags.

5. Polypropylene (PP)

It is a mechanically rugged material and has a high chemical resistance. Polypropylene is the second-most widely produced commodity plastic (after polyethylene) and it is often used in packaging and labeling.

6. Polystyrene or Styrofoam (PS)

Uses include protective packaging (such as packing peanuts and CD and DVD cases), containers (such as "clamshells"), lids, bottles, trays, tumblers, disposable cutlery and in the making of models.

7. Miscellaneous plastics (includes: polycarbonate, polylactide, acrylic, acrylonitrile butadiene, styrene, fiberglass, and nylon)

These miscellaneous plastics are often used in medical tools and food storage.

Plastic packets can be made from LDPE, HDPE or PP. Now your senses of touch and hearing are drafted into play.

LDPE feels soft and smooth, like a sandwich bag. Additionally, if you rub it together, it will make a soft swishing sound, as opposed to a crinkling, harsher sound.

HDPE feels harder and essentially, more crinkly. Many plastic shopping bags are manufactured from HDPE and the easiest way to distinguish them from LDPE bags is from the sound they make when you crinkle them in your hands. If the sound is soft and swishing (think of green leaves blowing in the trees), then you have identified LDPE; if the sound is crisper and crinkly (think of dry leaves being squished together), then you have HDPE. The two sounds are quite distinct.

Finally PP, also known as polyprop or polypropylene. Packets made of this plastic sound similar to HDPE and are crinkly. PP is generally used for packaging food, such as chocolate and chips wrappers, or the clear packets you might buy a gentleman's shirt in. It feels much firmer and stiffer, but the most important trick here, is that it does not stretch. It simply rips and tears without stretching at all.