Introduction

Chromophoric dissolved organic matter (CDOM) represents the colored fraction of dissolved organic carbon (DOC). CDOM is colored because it absorbs light at certain regions of the visible spectrum. The substance that leaches from tea bags placed in water is an example of CDOM. Sunlight can lead to the loss of CDOM and DOC in a process called photochemical oxidation, or photobleaching. Most of the sunlight absorbed by CDOM (95–98%) does not cause a chemical change. The remainder of the absorbed sunlight can convert CDOM to CO_2 or cause a structural transformation of CDOM.

CDOM and Coastal Waters

CDOM levels can vary both spatially and temporally. In coastal waters, CDOM can dominate the absorption of sunlight, particularly in the ultraviolet and blue regions of the spectrum. Physical processes that promote vertical mixing of the coastal ocean in both the Northern and Southern hemispheres, such as winter seasonal mixing (due to storms) can introduce CDOM to the surface ocean. As sunlight intensity increases in spring and summer, the water at the ocean's surface warms making it less dense than water at depth, which is colder. This difference in density causes stratification between surface and deep ocean water, essentially forming a barrier that reduces the exchange of dissolved materials between the surface and deeper water.

What you need

- Eye protection
- 3 clear coffee mugs
- 3 tea bags (1 each: black tea, green tea, and Chamomile [herbal])
- Graduated cylinder
- Warm Tap Water
- Spoon

Safety

Always wear eye protection. Make sure the water is not too hot. You do NOT need to boil the water.

Procedure

1. Fill half of each clear mug with warm tap water.
2. Put one of each tea bag in a separate mug of water and stir.
3. Watch for the color changes in the water and record findings for each of the teas.
4. Slowly add water in increments into each of the mugs and stir after each water addition until each mug is full.
5. Record color changes after each incremental water addition until each mug is full.

Questions

1. Why did we use different types of teas (black, green, herbal)?
2. When you added the tea bags to the warm water, what did the substance coming from the tea bags represent?
3. What happened when you added more and more water to the mugs?
4. What processes in nature does the addition of water to the mugs represent?

Extension Questions

1. What other natural Earth materials could we use to demonstrate the same processes as seen with the tea bags.

2. What effect does sunlight have on CDOM and DOC?