

Cosmetic Chemistry

The University of Toledo

Student Affiliate Chapter of the American Chemical Society



What is Cosmetic Chemistry?

•A **Cosmetic** is a product which is intended to be rubbed, poured, sprinkled, sprayed on or otherwise applied to the human body for cleansing, beautifying, promoting attractiveness or altering the appearance with out affecting the body's structure or function.

• **Cosmetic Science** is the science involved in the field of cosmetics. Scientists strive to design and create new products to supply consumers with all of their daily personal care needs.

• **What kind of scientists are cosmetic companies looking for?** Cosmetic industries are looking to hire graduates with an associate's or bachelor's degree, that are marketable in many areas. Positions include, but are not limited to the following.

- Analytical Chemists
- Regulatory Chemists
- Development Chemists
- Research Chemists
- Microbiologists
- Toxicologists

• **Industry-** Cosmetic companies such as AVON, Estee Lauder, Gillette, SC Johnson, and L' Oreal bring in *billions* of dollars every year in total sales.



Abstract

The purpose of this presentation is to provide a demonstration of cosmetic sciences. Household materials will be used to make our own cosmetics which can be taken home and used by our participants. The demonstrations will educate viewers on the science behind these household concoctions. Bath Fizzies are a simple chemical reaction between sodium bicarbonate and citric acid that provide a moisturizing and aromatic bath experience. Home made lip gloss answers challenging questions about antioxidants, emulsifiers and vitamin E. The last demonstration will focus on shampoos. The differences in pH between shampoo and conditioners will be determined using pH paper. Shampoos contain an ingredient called Ethylenediamine tetra acetic acid (EDTA). EDTA is a metal ligand used to remove dirt from hair.

Bath Fizzies

What's Happening?

The key ingredients we are looking at here is citric acid and sodium bicarbonate. The fizzing begins once the citric acid and sodium bicarbonate come in contact with the water.



(sodium bicarbonate) (citric acid) (Sodium Citrate) (Carbon dioxide) (water)

Carbon dioxide forms the fizzing bubbles. As the Bath Fizzies dissolve in the water, the oils and fragrances are released.

Equipment:

- Metal mixing bowl
- Spray bottle
- Gloves
- Molds of your choice
- Sieve
- Measuring cups/spoons



Reagents:

- 1/3 cup citric acid
- 2/3 cup Sodium Bicarbonate (baking soda)
- 20-30 drops of fragrance oil
- 1 tablespoon olive oil (optional)
- 15 drops of food coloring
- 1 teaspoon of water



Instructions:

1. Mix the citric acid and sodium bicarbonate together using the sieve, into the metal mixing bowl.
2. Wearing gloves, add the oils and food colorings of your choice. Mix together. Break up large clumps.
3. Using the spray bottle, mist the mixture until it is able to hold its shape.
4. Pack the mixture into the molds and allow them to dry for a few hours.
5. Remove from the molds and they are ready to use.

(Keep out of direct sunlight, and away from moisture when in storage)

Lip Gloss

What's Happening?

This project is designed to let participants become cosmetic chemists. Using the reagents below, try different proportions, swap ingredients or introduce new ones. Which variations can you come up with for your lip gloss? Ask friends to try samples of the lip gloss. Which do they prefer? Make a prediction.

Terms to be familiar with:

- Emollient*- A thick liquid with soothing or moisturizing effects.
- Oils*- A viscous liquid substance not miscible with water.
- Vitamin E*- A vitamin that helps protect cells in the body against damage.
- Antioxidant*- a substance that slows down or interferes with the deterioration of fats through oxidation
- Emulsifier*- A chemical that can bind two incompatible items, such as oil and water.

Equipment:

- Measuring cups
- Pyrex Glass pouring bowl
- Small containers with lids
- Stove or microwave
- Small frying pan
- Metal spoon
- Glitter
- Food coloring
- Refrigerator



Reagents:

- ½ cup Vaseline
- ½ cup Crisco Shortening
- 10-15 drops of Flavoring Oils (any flavor) (optional)
- 1-5 drops food coloring (optional)
- 1 drop Vitamin E oil

Instructions:

1. Put Vaseline into Pyrex mixing bowl. Add flavored oils and food coloring at this time.
2. Add the Crisco and mix until well blended.
3. Melt the contents of the mixing bowl on a stove at low heat until all components have liquid like properties.
4. If desired, add glitter at this time and Vitamin E oil.
5. Pour the liquid into a smaller container for easy handling.
6. Fill the small lip gloss containers and cover with lid.
7. Place in the refrigerator until lip gloss cools and sets up.
8. Label the container and it is ready to use.

Shampoo Science

What's Happening?

Shampoo is an acidic product formulated to cleanse the hair. Shampoos are acidic to preserve the hair's own natural acidity. Acidic products help keep the hair's cuticle layers oriented downward, improving shine and hair appearance.

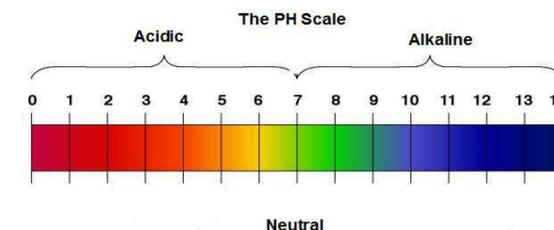


On the contrary, conditioners are basic solutions used to neutralize the natural acidity of hair and shampoo. This keeps hair from losing its natural oils and prevents over drying. The basic pH range of the conditioner leaves hair feeling silky and moisturized.

So just how acidic and basic are some of your hair care products?

Instructions:

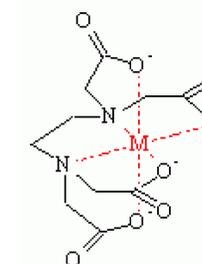
Using a Q-tip, rub a tiny amount of shampoo or conditioner on a strip of pH paper. Watch the paper as it turns colors. Compare the color region to the schematic below to determine the pH.



Did you know?

Ethylenediamine tetra acetic acid or EDTA for short, is a very useful chelating ligand to a cosmetic chemist.

A *Chelating ligand*- is a ligand that binds to a metal ion through more than one atom. Metals such as Mg²⁺, Ca²⁺ and Na⁺ (which are present in tap water)



EDTA is a hexadentate ligand, which means it can bind to the metal at 6 different locations. Usually where a Nitrogen or Oxygen is present. After the metal complex forms, it is washed away leaving the hair clean.