Everyday Emulsions

Tinkering with every day materials for better classroom experiences

RockEDU SCIENCE OUTREACH

Ice cream. Milk. Latex paint. Mayonnaise. Lotions and creams... Emulsions are all around us, but do our students know the link between these everyday materials and the amazing chemistry behind them? Through this resource, we will explore the chemistry of familiar emulsions, applying our current understandings of intermolecular forces to develop new and fun ways to present these concepts in the classroom. We will use specialized dyes to determine emulsion types, make our own lotion using accessible ingredients, and use case studies to explore how this chemistry can impact our environment.

Lotions are Emulsions

In terms of marketing and advertising, lotions are typically lumped into the "cosmetics" category. To a chemist, however, lotions represent a mixture where normally immiscible (unmixable) liquids are combined in a way that evenly distributes one of the immiscible liquids into the other, *without* dissolving it. We encounter these types of mixtures everyday -- in cosmetics, food, medicine, and some household products.

We know lotions as creamy products that feel great on our skin. As it turns out, lotions are a complex mixture of different substances that need to be combined -- in certain proportions -- in order to stably interact. We can bring the science of lotions back to the classroom in so many ways! For one, they are a great way to talk about intermolecular forces. Additionally, the molecules in an emulsion organize at scales similar to the wavelengths of light, which lead to an opaque appearance. Hence, light scattering and other "physics" concepts can be explored through lotions. You can even bring this back to our biology to understand the interplay of lotions and our skin cells.

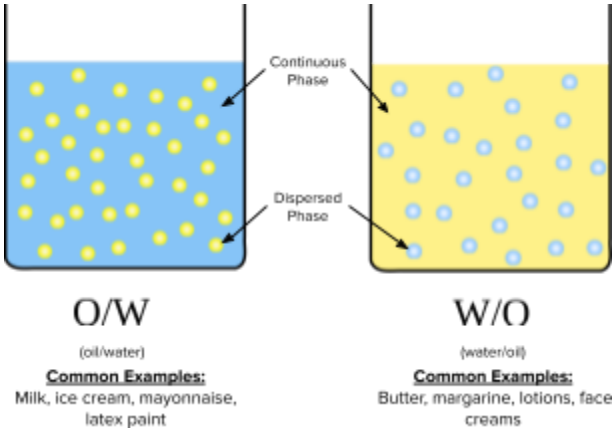
Characteristics of an Emulsion

As mentioned above, an emulsion is a type of colloidal mixture where normally immiscible liquids are combined in a way that maintains their unique chemical identities. In general, there are two parts of an emulsion:

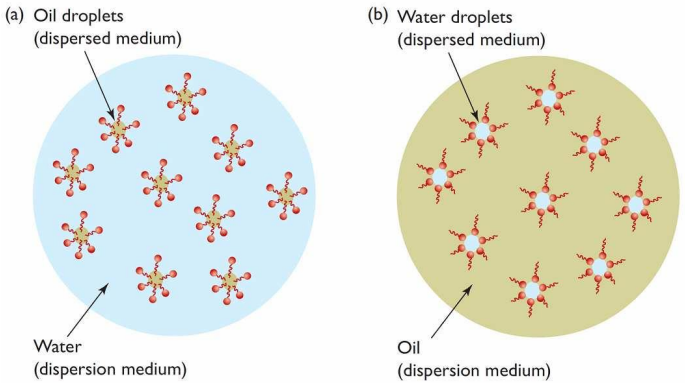
Continuous Phase: the liquid portion of an emulsion in which another liquid is dispersed

Dispersed Phase: the liquid portion that forms tiny droplets that are evenly suspended throughout the continuous phase

The schematic below represents two configurations of oil and water emulsions. On the left, an aqueous solution (water-based) is the continuous phase in which droplets of oil are dispersed. Conversely, the right side depicts oil as the continuous phase, with droplets of water dispersed throughout. Again, it is important to note that the components of the continuous phase do not interact with the dispersed phase -- nothing is dissolved.



Upon zooming in, we can see how a surfactant can help stabilize an emulsion



by forming micelle “cages” around dispersed droplets. Because of the amphipathic nature of surfactants, the dispersed droplets can be protected from the continuous medium in both scenarios depicted above.