WORKSHEET

Characterizing Emulsions

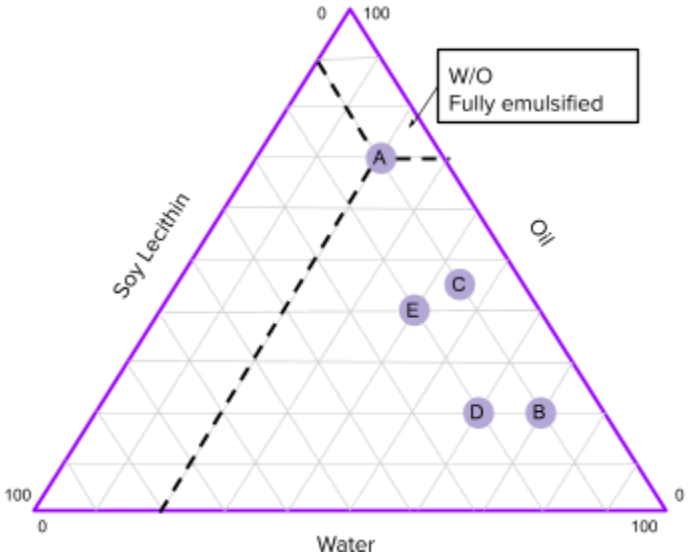
RockEDU SCIENCE OUTREACH

Explore different emulsions (including your lotion!) and observe their physical characteristics to determine how stable (or unstable) they are. Included below are a few of the metrics that scientists could use to characterize an emulsion—can you think of more ways?

Plan your Emulsions

The example below has the following sample emulsions:

	Percent Composition			
	Water	**Oil**	**Soy Lecithin**	**Total**
A	20%	70%	10%	100%
B	70%	20%	10%	100%
C	45%	45%	10%	100%
D	60%	20%	20%	100%
E	40%	40%	20%	100%



What are you wondering about emulsions? Consider emulsion types (O/W vs W/O), emulsifiers (e.g. soy lecithin or mustard), modeling a real world scenario (e.g. dish soap removing oil from dishes), etc. List a few ideas below and explore one that you can pursue with the resources you have:

Visit rockedu.rockefeller.edu/resource/emulsions
Created by Y. Shin and D. Davis for RockEDU, The Rockefeller University, 2021

Compare a set of samples

Central Question: (What question do you hope to answer from doing this experiment?)

Identify your components

Water (e.g. tap water)	
Oil (e.g. canola oil)	
Emulsifier (e.g. soy lecithin)	

Choose your own set of emulsion ratios to compare. Describe your samples as both ratios and measurable masses. Depending on how you're designing your experiment, you can start with either table and use that to calculate the other.

	Percent Composition		
	Water	**Oil**	**Soy Lecithin**
A	%	%	%
B	%	%	%
C	%	%	%
D	%	%	%
E	%	%	%

	Mass Composition		
	Water	**Oil**	**Soy Lecithin**
A	g	g	g
B	g	g	g
C	g	g	g
D	g	g	g
E	g	g	g

Look-fors: (What observations will you be particularly looking for to inform your curiosity? This could take the form of a formal hypothesis or more informal notes on senses to use, types of measurements to make, dimensions to control for, etc.)

Initial Observations

Emulsion State

Take a look at your sample and describe the emulsion state.

- Is your sample uniformly emulsified?
- Do you see pockets of water/oil/soy lecithin?
- Do you see oil layers forming?

	Emulsion State
A	
B	
C	
D	
E	

Texture

Take a look at your sample and describe the texture.

- Is your sample sticky?
- Is your sample watery?
- Is your sample in between the two?

	Texture
A	
B	
C	
D	
E	

_____

What else is important to note for your exploration?

A	
B	
C	
D	
E	

Additional controls or general observations to note:

Take small amounts of each sample for each subsequent test

Conductivity

Transfer some of your sample to a cup and hold the conductivity tester in the sample.

- Record the level of conductivity reported by the meter.

	Conductivity Metric (out of 10)
A	
B	
C	
D	
E	

Viscosity

Follow the Viscosity Protocol for viscosity test and write down the viscosity index for each sample.

- How sticky is your sample?

	Distance (cm)	Viscosity Index
A		
B		
C		
D		
E		

Dye Test

Transfer a pea-size drop of each sample to a glass plate. Add one drop of dye, mix well with a toothpick, and write down and compare the colors of each sample-dye combination.

- Red Food Color
- Oil Red O

	Oil Red O	Red Food Color
1		
2		
3		
Lotion		

Reflect and Discuss

Analyze & Visualize your Data

You may want to graph one or more of your data sets onto a triangle plot to see if you notice emulsion trends in different zones and/or to propose additional sample compositions to try in future tests.

It may be helpful to classify your data into categories by defining the terms and conditions for meeting each term e.g. viscosity could be analyzed as liquid (<0.2), thin emulsion (0.2-0.5), and thick emulsion (>0.5) allowing you to color code and label your data or plot accordingly.

Questions

1. What ratio(s) of water/oil/soy lecithin produced the most stable emulsion?

2. What can you tell about the relationship between ratios of water/oil/soy lecithin and emulsion stability?

3. What have you learned toward answering your question?

4. What do you want to do next to further your ability to answer your question? OR, do your findings cause you to want to shift your question and how?

5. How do your findings impact your understanding of emulsions in your everyday life?