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| Food Chemistry |
| Emulsions |



**Introduction**

An emulsion is a mixture of two fluids such as oil and water that is achieved by breaking up the molecules in both substances into very fine, small droplets in order to keep the combination from separating.

There are several common foods that are considered emulsions: milk, margarine, ice cream, mayonnaise, salad dressings, and sauces like béarnaise and hollandaise. When packaged and manufactured on a larger scale, most of these foods need emulsifiers to stabilise the mixture and keep the different ingredients from becoming separated.

In this investigation you will look at emulsion formation and at the effectiveness of various substances as emulsifying agents..

**You will need**

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| Coloured vegetable oil | Access to a Microscope |
| Small screw cap ‘universal’ bottles or test tubes with bungs | Egg yolk – 2 cm3 |
| Microscope slides (dimple) | Mustard – 2 g |
| Detergent (washing-up liquid) 2 cm3 | timer |
|  |  |
| Polyoxyethylene sorbitan (Tween 40) – 5 ml\* | Sucrose ester (Ryoto sugar ester S-170, HLB 1) – 2 g\* |
| Sucrose ester (Ryoto sugar ester S-170, HLB 15) – 2 g\* |  |

\* these are commercial emulsifiers that you might not have access to. If these are not available, you can try some other households materials to see if they work as emulsifiers.

**Procedure**

**Part one – Oil/Water or Water/oil emulsion**

1. Prepare 2 samples as follows in screw cap tubes of test tubes with stoppers.

Tube A: 1 cm3 oil and 9 cm3 water

Tube B: 1 cm3 water and 9 cm3 oil.

1. Cap the tubes and shake vigorously for 1 minutes.
2. Start the timer
3. Examine a sample of each emulsion under the microscope, keeping an eye on the tube.
4. Record how long it takes the two layers to separate in each emulsion

**Part 2 – Emulsifying agents**

1. Prepare tubes for as many of the emulsifiers as you have, according to the table below. (For example, Lecithin is dissolved in the oil before it is mixed with the water whereas egg yolk is dissolved in the water before the mixing).
2. Cap each tube and shake vigorously for 1 minute.
3. Put the tubes down and start the timer. How long does it take the emulsions to settle out now?

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| Tube Number | Emulsifier | Oil (ml) | Water (ml) | Liquid for dissolving emulsifier |
| *Oil / Water (O/W) emulsions* | | | | |
| 1 | Control (no emulsifier) | 2 | 8 | - |
| 2 | mustard – 0.5 g | 2 | 8 | Oil |
| 3 | Egg yolk - 0.5 cm3 | 2 | 8 | Water |
| 4 | Detergent (eg washing up liquid) – 0.5 cm3 | 2 | 8 | Water |
| 5 | Bile – 0.5 g | 2 | 8 | Water |
| 6 | Polyoxyethylene sorbitan monopalmitate (Tween 40) – 0.5 g | 2 | 8 | Oil |
| 7 | Sucrose ester (HLB 1) – 0.5 g | 2 | 8 | Water |
| 8 | Sucrose ester (HLB 15) – 0.5 g | 2 | 8 | Water |
| *Water / Oil (W/O) emulsions* | | | | |
| 9 | Control (no emulsifier) | 8 | 2 | - |
| 10 | Mustard – 0.5 g | 8 | 2 | Oil |
| 11 | Egg yolk - 0.5 cm3 | 8 | 2 | Water |
| 12 | Detergent (eg washing up liquid) – 0.5 cm3 | 8 | 2 | Water |
| 13 | Bile – 0.5 g | 8 | 2 | Water |
| 14 | Polyoxyethylene sorbitan monopalmitate (Tween 40) – 0.5 g | 8 | 2 | Oil |
| 15 | Sucrose ester (HLB 1) – 0.5 g | 8 | 2 | Water |
| 16 | Sucrose ester (HLB 15) – 0.5 g | 8 | 2 | Water |

**Health & Safety**

All the reagents are of low hazard.