

# Investigating Unsaturation in Fats and Oils

## Background

Fats and oils are esters of triglycerols and fatty acids. The fatty acids consist of a long chain hydrocarbon and may contain carbon-carbon double bonds. If this is the case then the substance is classified as unsaturated. The mass of iodine that reacts with the fat or oil is used to measure the unsaturation. The amount of iodine that reacts is used to find the iodine number of the fat or oil and this is used to indicate the degree of unsaturation in the fat or oil.

## Practical Techniques

You will need to find out about volumetric analysis (titrations) and how to make up accurate solutions.

## Where to start

The iodine number of the fat or oil is defined as the number of grams of iodine that react with 100 grams of the oil or fat. The higher the number - the more unsaturated the oil or fat.

The oil or fat is reacted with iodine monochloride (Wij's solution). An excess of this is added to the fat or oil and the unreacted iodine monochloride is treated with iodide ions. The solution is then titrated against sodium thiosulphate to determine the amount of unused iodine monochloride.

## Possible Investigations

- Investigate the degree of unsaturation in different fats and oils.
- Investigate the effect of temperature on the stability of a particular oil.
- Investigate the effect of light on the stability of a particular oil.
- Investigate the effect of air/oxygen on the stability of a particular oil.
- Investigate the relationship between the freezing point of the fat/oil and the degree of unsaturation

## Sources of Information

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## Teachers' Notes

### General

The Fats and Oils booklet by Unilever is an excellent source for this investigation and has **full details** of this experiment. Each titration experiment can take up to 1 hour.

### Chemical Principles

Fats and oils, alkenes, esters, quantitative chemistry

### Essential Equipment

Burettes, pipettes

### Essential Chemicals

Starch, potassium iodide, sodium thiosulphate, Wij's solution (or chemicals to prepare this)

### Safety

No risk assessment has been given. It is essential that students prepare a detailed risk assessment before they start. Teachers must be satisfied that this is suitable for the proposed investigation.

## Experiment Starter Sheet – Investigation unsaturation of fats and oils

A basic procedure is given below.

Prepare the following solutions

- starch solution
- 10% potassium iodide solution
- 0.1 mol dm<sup>-3</sup> sodium thiosulphate solution
- Wij's Solution - you can purchase this or you can look up a recipe for its preparation. One example of a recipe is to dissolve 2 grams of diiodine hexachloride in 50cm<sup>3</sup> of glacial ethanoic acid and stir in a solution of 2.25 grams of iodine in glacial ethanoic acid. Then dilute to 250 cm<sup>3</sup> with the ethanoic acid. Heat on a water bath for 15 minutes, stir regularly and allow to cool. You may also be able to find other method of preparing Wij's solution.

You will need to think about how much of each solution to prepare. This will depend on how much of the solution is used in each experiment and how many experiments you do (including any repeats).

Weigh out about 0.2 grams of the fat or oil in a dry 250 cm<sup>3</sup> stoppered bottle. Add 10 cm<sup>3</sup> of the Wij's solution and mix by swirling the flask. Set up a blank mixture by omitting the fat or oil. Leave both flasks in the dark for about 30 minutes. Then add 15cm<sup>3</sup> of 10% potassium iodide solution and 10cm<sup>3</sup> of water to each flask and mix thoroughly. Titrate the contents with sodium thiosulphate solution using starch solution as an indicator, just before the end point.