

Who's Cheating on the Vinegar?

Vinegar is an ethanoic acid. A wholesaler supplies chip shops. Design an investigation which identifies which chip shops are watering down the vinegar.

Background Theory

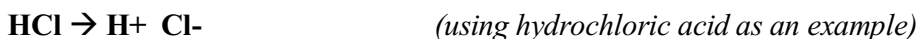
All acids contain the element "hydrogen". Water ionises the hydrogen to make it H⁺.

To react all acids have to be ionised. Strong acids are almost completely ionised and weak acid are only partially ionised, which is why they don't react as much as strong acids.

The pH of any acid would be below 7 (neutral), ranging from 1 (strong acid) to 6 (weak acid). Anything above 7 is an *alkali*, pH 14 being a strong alkali and pH 8 being a weak alkali. In titration we add alkali to the acid until the mixture *neutralises*. We use an indicator to tell us at which point the neutralisation occurs. When we have this information we can find the concentration of the acid using the calculation

$$\text{concentration} = \frac{\text{moles}}{\text{dm}^3}$$

The acid we are using in this experiment is *ethanoic acid* (vinegar). It is a weak acid and is only partly ionised. This is an *organic acid*. In an ionised acid the following process has occurred:



In this investigation we have taken 5 different acids, one being used by a chip shop (acid A), to test which one is the most concentrated and which one is the most dilute (watered down) by using the process of *titration*.

Method

- Measure 20cm³ of sodium hydroxide using a pipette and a safety filler. Transfer the volume carefully into a conical flask. Then add a few drops of indicator (3 drops).
- Fill your burette with acid down to the 0cm³ mark on the burette.
- Run acid (ethanoic acid) from your burette slowly until the neutralisation occurs
- Write down the volume of acid you've used.
- Repeat the method until you have at least two results which are very similar.

Safety

- Goggles
- Chemicals harmful – acids
- Do not run with chemicals.
- Tie hair back
- NaOH (sodium hydroxide) is an irritant.

Apparatus

- 20cm³ pipette
- 20cm³ of sodium hydroxide (concentration = 0.5 moles/dm³)
- 50cm³ burette
- Funnel
- 100ml conical flask
- Two 75ml beakers
- Clamp stand
- Indicator (phenolphthalein)
- Goggles

Diagram

Variables

Independent: My independent variables are 5 different types of ethanoic acid labelled A, B, C, D and E.

Dependent: My dependent variable is the amount of alkali (NaOH) I use to neutralise the acid.

Controlled: My controlled variables are the concentration of alkali (0.5moles/dm³)
The amount of indicator I use and the indicator I use. (phenolphthalein)

Results

	A	B	C	D	E
	Titration				
1 st reading (cm ³)	0.00	0.00	0.00	0.00	0.00
2 nd reading (cm ³)	15.30	15.70	43.80	11.90	21.80
volume of acid used (cm ³)	15.30	15.70	43.80	11.90	21.80

Prediction

I predict that the lower the volume needed to neutralise the acid, the more concentrated the acid is. Therefore the acid that shows the lowest volume result is the most concentrated.

Evaluation

In the experiment I used too much indicator for some of the acids (acids C & E). This made the results inaccurate, so I will only use 6 drops of indicator for acid I test.

I didn't record enough values to get two accurate results, so next time I will test each acid at least 5 times so that my results can be more accurate and so that anomalous results are easier to spot.

The rest of the experiment worked well so I don't plan to change anything else.