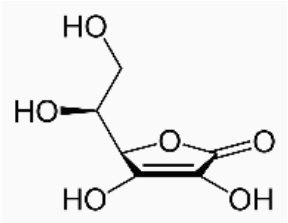
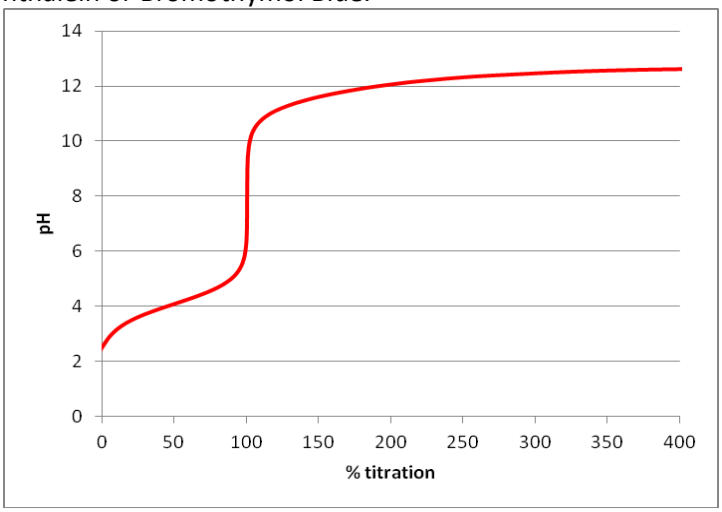
8A. Titration of the ascorbic acid (vitamin C) in tablets

In this experiment students analyze a tablet of Vitamin C (or other drug containing this compound) and calculate the percentage of ascorbic acid, $H_2C_6H_6O_6$, present in it.



Vitamin C (ascorbic acid)

Vitamin C tablets contain ascorbic acid as the active ingredient, however, it is mixed with such fillers as starch which however does not obscure the endpoint. Ascorbic acid has two ionizable hydrogens (pK_{a1}=4.10, pK_{a2}=11.8). Since the second one comes off only at a pH of 10 or 11 the reaction of ascorbic acid with sodium hydroxide will produce the acid salt, sodium hydrogen ascorbate, and not the normal salt when titrated using an indicator like Phenolphthalein or Bromothymol Blue.



Titration curve of 0.1 M ascorbic acid using 0.1 M NaOH as titrant

Procedure

Place a tablet of Vitamin C in an Erlenmeyer flask, add about 50 mL of warm distilled water, and crush the tablet with a glass stirring rod. Cool down the solution. Add two or three drops of indicator to the flask and titrate with sodium hydroxide solution until the endpoint is reached. Make two independent titrations at least.

Result calculation

As seen in the titration curve, vitamin C behaves as monoprotic acid when titrated using Phenolphthalein as indicator. This means that the number of moles of NaOH in titration is equal to the number of moles of the ascorbic acid.

Calculate the mass of acid for two titrations and, finally, calculate the arithmetic average of these two results. Compare the result with the factory value (100 mg or other, your teacher will tell you this when the exercise has been completed).

Note that since this is a quantitative lab exercise all measurements to be used in calculations must be recorded to the proper number of significant digits.

Molecular mass of ascorbic acid is 176.13 g/mol.

Report: Record all the numbers obtained and the name of indicator used, as well as the calculations made. Note your observation concerning the comparison of your result with the factory value.

The same titration can be done pehametrically.

Procedure (pH-metric titration)

1. Place a tablet of Vitamin C in an Erlenmeyer flask, add about 50 mL of warm distilled water, and crush the tablet with a glass stirring rod. Cool down the solution.
2. Dilute the sample in your volumetric flask to the total volume of 100-150 mL with distilled water.
3. Place the beaker on magnetic stirrer, insert the magnet in it, as well as pH-electrode. Ask the assistant to control the correctness of the installation and some advices.
4. Measure and note pH. Repeat this adding small portions of the titrant base (few drops each), noting also the actual volume of titrant added (total). Finish titration when pH exceeds ca. 12.

Processing the results

Using a computer data-sheet, plot the titration curve obtained and determine as exactly as possible the volume of titrant corresponding to the inflection point.

For more aspiring students: The preciseness of determination of the inflection point can be very improved if calculating the second derivative of the titration curve. Ask your teacher for details if want to try this procedure.

Report: Record all the numbers obtained, as well as the calculations made. Note your observation concerning the comparison of your result with the factory value.

Source: http://chem.lapeer.org/Chem1Docs/VitCAnalysis.html (2012-02-15), Wikipedia and textbooks