



Rate of permeation of aspirin through cellulose tubing

Teacher and technician sheet

Health and safety note

Make sure that students wear eye protection. 0.1 mol dm⁻³ sodium hydroxide solution is an irritant.

Equipment and materials

Each student or pair of students will require:

For the permeation

- 15 cm length of cellulose tubing knotted at one end
- Sawn-off plastic syringe barrel to support the cellulose tubing (see student sheet)
- Elastic band
- 400 cm³ beaker
- 5 cm³ pipette (or plastic syringe)
- Paddle stirrer
- 0.05 mol dm⁻³ aspirin (harmful) in buffer solution

For the colorimetric analysis

- Calibration graph for the colorimetric determination of aspirin (see Colorimetric analysis of aspirin)
- Colorimeter and suitable filter
- Boiling tubes (at least 6) and rack
- 0.1 mol dm⁻³ sodium hydroxide solution Irritant
- Dropper pipette
- 0.02 mol dm⁻³ iron(III) chloride solution
- Bunsen burner
- 50 cm³ volumetric flask (or a 50 cm³ measuring cylinder)

Preparation of solutions

0.05 mol dm⁻³ aspirin Weigh out 0.9 g aspirin and transfer quantitatively to a 1 dm³ volumetric flask. Add about 250 cm³ of deionised water and swirl the flask to dissolve the solid. Make up to the mark with deionised water.

0.02 mol dm⁻³ iron(III) chloride solution Weigh out 5.44 g iron(III) chloride-6-water (Harmful) and transfer quantitatively to a 1 dm³ volumetric flask. Add about 100 cm³ deionised water and swirl the flask to dissolve the solid. Now add 3 cm³ of concentrated hydrochloric acid (Corrosive) and 10 g of potassium chloride. Again swirl the contents of the flask to dissolve the potassium chloride before making up to the mark with deionised water.

Buffer solution

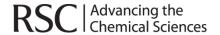
It is suggested that a buffer of pH 1.6 is used as this pH is typical on conditions found in the stomach. Other buffers may be used to compare the permeability at pH values found in other parts of the gastrointestinal tract.

For buffer solutions at a range of pH values you will need:

- 100 cm³ measuring cylinders (number depends on which buffer solutions are being made);
- pH probe and meter;

and depending on the buffer being made:

• 0.02 mol dm⁻³ hydrochloric acid;





- 0.02 mol dm⁻³ potassium chloride solution (14.9 g in 1 dm³ of deionised water);
- 0.02 mol dm⁻³ ethanoic acid (12.0 g glacial ethanoic acid (Corrosive) in 1 dm³ of deionised water);
- 0.02 mol dm⁻³ potassium dihydrogenphosphate solution (27.2 g in 1 dm³ of deionised water);
- 0.02 mol dm⁻³ boric acid (12.4 g in 1 dm³ of deionised water);
- 0.02 mol dm⁻³ sodium hydroxide solution (8 g of sodium hydroxide (Corrosive) in 1 dm³ of deionised water).

Some buffer recipes¹

Volumes of component solutions (each 0.02 mol dm⁻³) used to make 100 cm³ of buffer.

HCI	KCI	CH₃COOH	KH ₂ PO ₄	H ₃ BO ₃	NaOH	H ₂ O	pH of buffer solution
75	25						1.0
10	25					65	1.6
2	25					75	2.3
		100					2.8
		10				90	3.2
		50			10	40	4.0
		50			25	25	4.5
		50			40	10	5.1
		50			48	2	5.9
			50		10	40	6.2
			50		25	25	6.7
			50		40	10	7.2
			50		50		8.1
				50	10	40	8.6
				50	25	25	9.2
				50	35	15	9.6
				50	42	10	10.1
				50	50		10.6

In each case the pH value is approximate and the actual value should be measured using a pH probe and meter.

Commercially-available buffer tablets may also be used.

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¹ P. S. Marrs, Journal of Chemical Education, 2004, **81**, 870.