

Spectrophotometric determination of aspirin in human serum

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Introduction

Aspirin is a salicylate drug, which possesses many qualities that make it one of the commonly used medications in medicine. Aspirin, also known as **acetylsalicylic acid**, helps to relieve following medical conditions:

- pain
- inflammation
- pyrexia (fever)
- rheumatism

Additionally, it has a positive effect on patients with cardiovascular diseases and it has shown a reduction of risk of colorectal adenomas. Furthermore, aspirin is both antiplatelet and antithrombotic as it irreversibly inhibits cyclooxygenase resulting in reduction of thromboxane and prostaglandins production.

Most common adverse effects:

- gastric ulcers
- branchiospasms, especially in asthmatic patients

Aspirin was first synthesised in 1898 by Hoffman and Eichengrün. Their drug, 2-acetoxybenzoic acid (acetylsalicylic acid) (Fig.1), had good medicinal properties and didn't cause a severe irritation of the stomach unlike salicylic acid used in the past.

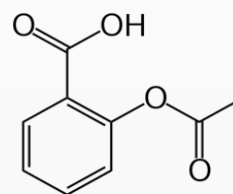


Fig 1. 2-acetoxybenzoic acid

Symptoms for an aspirin overdose include:

- nausea
- abdominal pain
- vomiting
- tinnitus

...and in more serious cases:

- hyperthermia
- coma
- cerebral oedema
- metabolic acidosis (which could be fatal)

Treatment of aspirin overdose involves administering activated charcoal to absorb the drug in gastrointestinal tract. Infusion of HCO_3^- is also used to reduce the acidosis.

Signs of aspirin toxicity appear when the serum salicylate concentration exceeds 300 mg dm^{-3} . This concentration of salicylate in serum could be pathogenic but it usually doesn't result in death. **However, 300 mg dm^{-3} of salicylate in serum of children under 18 months of age could be lethal.** In some cases of an acute poisoning in adults, the conc. of salicylate in serum can reach 1400 mg dm^{-3} .



Aims

The aim of the experiment was to determine salicylate concentration in three samples of serum using a spectrophotometer.



Materials and equipment

Materials:

- Standard solution of salicylic acid (SA) (500 mg dm^{-3})
- Serum samples from a 15 month old baby that was accidentally treated with adult strength aspirin tablets.
- Trinders reagent

Equipment

- Test tubes
- Plastic centrifuge tubes
- Cuvettes
- A centrifuge
- A spectrophotometer



Methods

11 test tubes were set up according to the description in Table 1. Test tubes no. 1-8 were containing various concentrations of SA, while test tubes no. 9-11 were containing 3 samples of the serum.

5 cm^3 of Trinders reagent was added to all test tubes. Vortex mixer was used to disperse the produced precipitate evenly.

Contents of test tubes were transferred to separate centrifuge tubes and centrifuged at $3000 \text{ rev min}^{-1}$ for 5 minutes.

The tube contents were inserted in a spectrophotometer and absorbancies were measured at 540nm.

Standard curve was constructed using the data from tubes 1-8.

Concentration of aspirin in the serum was determined using the standard curve.



Results and Discussion

Test tube	1	2	3	4	5	6	7	8	9	10	11
500mg dm ⁻³ SA / cm ³	0.0	0.1	0.2	0.3	0.4	0.6	0.8	1.0	0.0	0.0	0.0
Serum / cm ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.25	0.5	1.0
Water / cm ³	1.0	0.9	0.8	0.7	0.6	0.4	0.2	0.0	0.75	0.5	1.0
[SA] / mg dm ⁻³	0.0	50.0	100.0	150.0	200.0	300.0	400.0	500.0	57.3	115.1	168.7
A540	0.0	0.103	0.160	0.231	0.292	0.438	0.563	0.709	0.099	0.180	0.255

Table 1. Concentration of salicylic acid of 11 tubes and their absorbance at 540nm

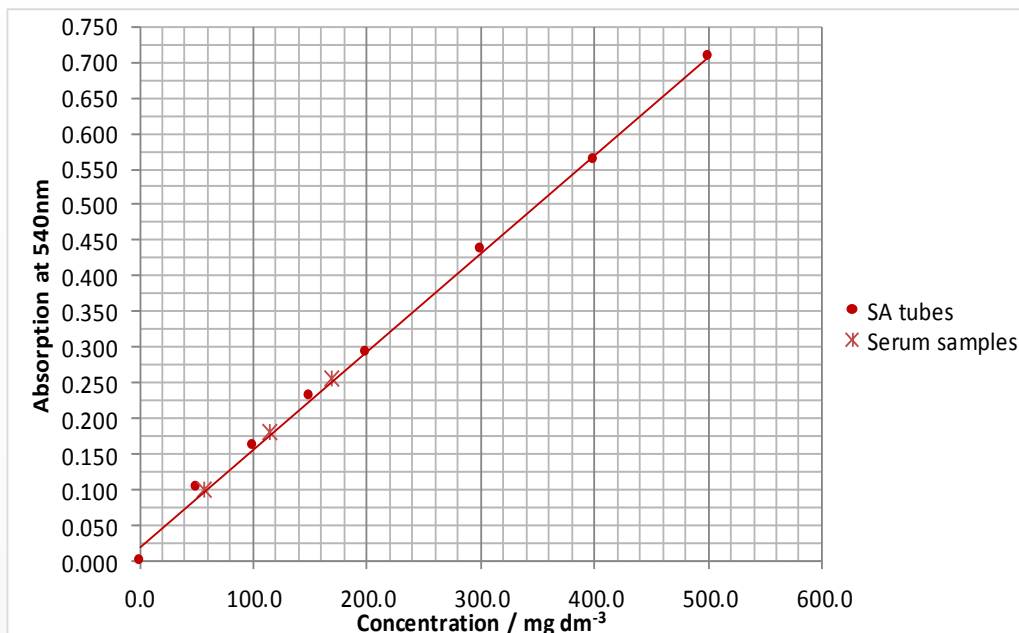


Fig. 2 Standard curve of absorbance against various concentrations of salicylic acid

Tube 9 SA conc.:

$$4 \times 57.3 = 229.2 \text{ mmol dm}^{-3}$$

Tube 10 SA conc.:

$$2 \times 115.5 = 230.2 \text{ mmol dm}^{-3} \quad \bar{x} = \frac{229.2 + 230.2 + 168.7}{3} = 209.36$$

Tube 11 SA conc.:

$$1 \times 168.7 = 168.7 \text{ mmol dm}^{-3}$$



Conclusions

Salicylate concentration in serum collected from a 15 month old baby is about $209.4 \text{ mmol dm}^{-3}$ which is within the safe range for adults as well as children under 18 months of age.

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References:

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