

# Spectrophotometric determination of aspirin in different tablet samples using oxidation-reduction reaction with potassium permanganate

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## ABSTRACT

A sensitive, fast and simple spectrophotometric method for the determination of aspirin is proposed. The method was based on oxidation-reduction reaction of aspirin with potassium permanganate with maximum absorption at 350 nm.

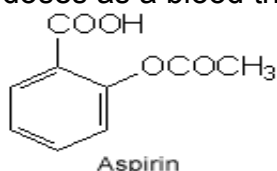
The linearity of the method was found to be ranged between 1.0 to 44.0 ppm of aspirin with molar absorptivity  $8.815 \times 10^3 \text{ L mol}^{-1} \text{ cm}^{-1}$  and detection limit 0.8 ppm. The calibration equation  $A = -0.0408 + 0.0489 C$  with  $r = 0.9986$  was obtained.

The above calibration equation was employed for quantitative determination of Aspirin in drug formulations in different proprietary tablets.

Keywords: Aspirin; UV-Visible spectrophotometer; tablets.

## Introduction

Aspirin is a member of a family of chemicals called salicylates. It is chemically known as acetylsalicylic acid as in Fig. 1 (abbreviated in this manuscript as ASA) [1,2]. Aspirin is used to relieve mild to moderate pain, reduce fever, to reduce inflammation and swelling in conditions such as arthritis aspirin which is used in low doses as a blood thinner to prevent the formation of blood clots [3,4]



Aspirin

Fig. 1 Aspirin structure

Literature survey showed number of method of analysis for the detection of presence of salicylic acid and acetyl salicylic acid in delayed release aspirin tablet by second derivative UV spectrophotometer [5]. Similarly aspirin and paracetamol by UV spectrophotometer [6]. There was successful investigation of salicylic acid by electrochemical oxidation on a glassy carbon electrode using cyclic voltammetry and different pulse voltammetric (DPV) method [7]. Aspirin, Paracetamol, Caffeine, and chlorphenamine using multivariate regression methods by spectrophotometer, acetylsalicylic acid, paracetamol, caffeine, and phenobarbital by HPLC method [8,9]. Also various methods for its determination have been employed by using different techniques including spectrophotometry, chromatography electrochemistry, flow-techniques and electrophoresis [10,11]. But there was a need to develop rapid method for detection of presence of aspirin quantitatively which require fewer chemicals and less man power. The method was developed using differently commercially available drug sample which are usually prescribed or bought over the counter. The aim of the present study is to determine aspirin in different tablet samples using oxidation –reduction reaction with potassium permanganate.

## Experimental

### Apparatus

Spectral and absorbance measurements were performed on 6705 UV/Vis. Spectrophotometer (JENEWAY) equipped with quartz cell of 1-cm path length. pH meter HANNA HI98 11-5 (Romania) was used to measure pH values.

### Reagent and Solutions

All chemicals were used of analytical reagent grade.

- Aspirin stock solution ( 1000 mg/L) : was prepared by dissolving 0.25 g of aspirin in distilled water and diluting to 250 ml in a volumetric flask. Each working solution was freshly prepared by suitable dilution of the stock solution with distilled water.
- Standard potassium permanganate solution (1000mg/L): was prepared and standardized by sodium oxalate. Each working solution was freshly prepared by suitable dilution of the stock solution with distilled water.
- Aspirin tablet solution 0.175 g of each tablet of aspirin was weighed and 10 mL of 0.1M NaOH solution was added to it. The solution was heated until the tablet dissolved. The solution was transferred quantitatively to a 100 mL volumetric flask and diluted to the mark with distilled water [4].

## Results and Discussions

### Spectrophotometric determination of aspirin

A rapid and simple spectrophotometric method was established for the determination of aspirin. The method based upon the reaction of aspirin with potassium permanganate to form colored compound. To a known volume of aqueous sample of aspirin 3.0 ml of 1000 mg/L standard potassium permanganate solution was added. The mixture was diluted to the mark with distilled water in 25 ml volumetric flask. The absorbance was measured at 350 nm against blank, which was prepared as the same way except it not contains aspirin. Applying the recommended procedure, a straight line of calibration curve was obtained, which shows a good linearity over the concentration range of 1-44 mg/L of aspirin, with detection limit 0.8mg/L and good precision and accuracy.

### Optimum conditions

In order to reach the optimum conditions for the method, the following parameters were studied.

### Absorption spectra

Under the conditions of the preliminary test of the proposed method, the colored product showed a maximum absorbance at 350 nm, as shown in Fig. 2.

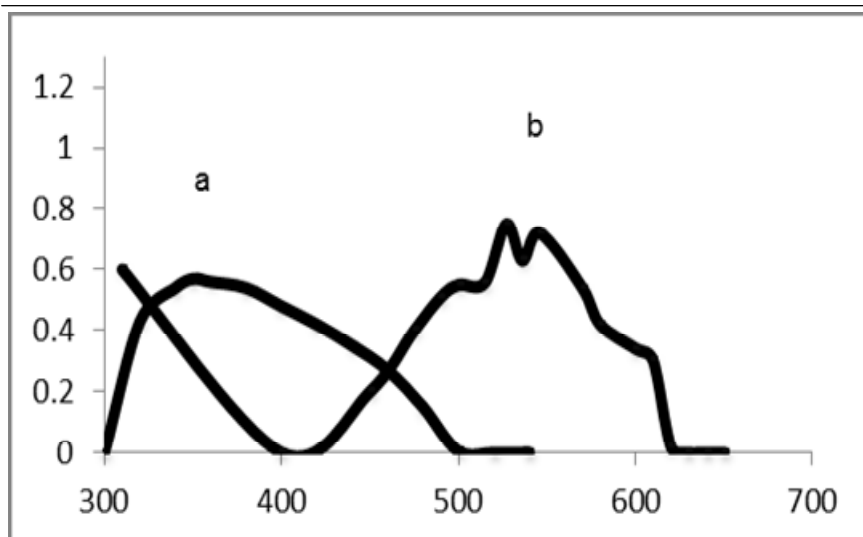


Fig. 2 Absorption spectra of (a) aspirin measured against blank and (b) blank against distilled water according to the preliminary work.

### Effect of pH

Fig. 3 shows the influence of pH on the absorbance of the aspirin with potassium permanganate. It is apparent that the reaction of aspirin with potassium permanganate is quantitative within pH range 4-9. The subsequent measurement of the absorbance measured at pH 5.2.

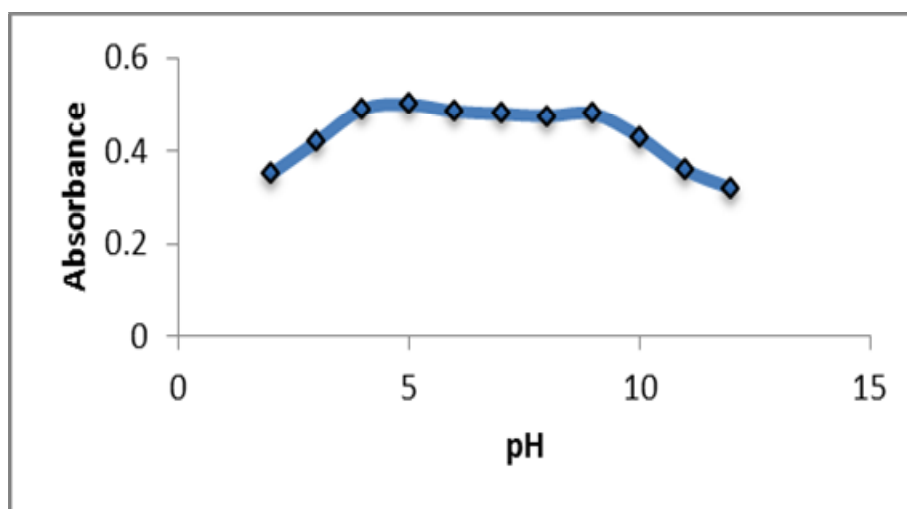


Fig. 3 Effect of pH on the absorbance

### Effect of potassium permanganate solution (1000mg/L)

The influence of the concentration of potassium permanganate solution on the absorbance of the colored solution was studied and the investigation showed that 3.0 ml of 1000 mg/L of the solution gave maximum absorbance, as shown in Fig. 4 Therefore, this volume was used for subsequent works.

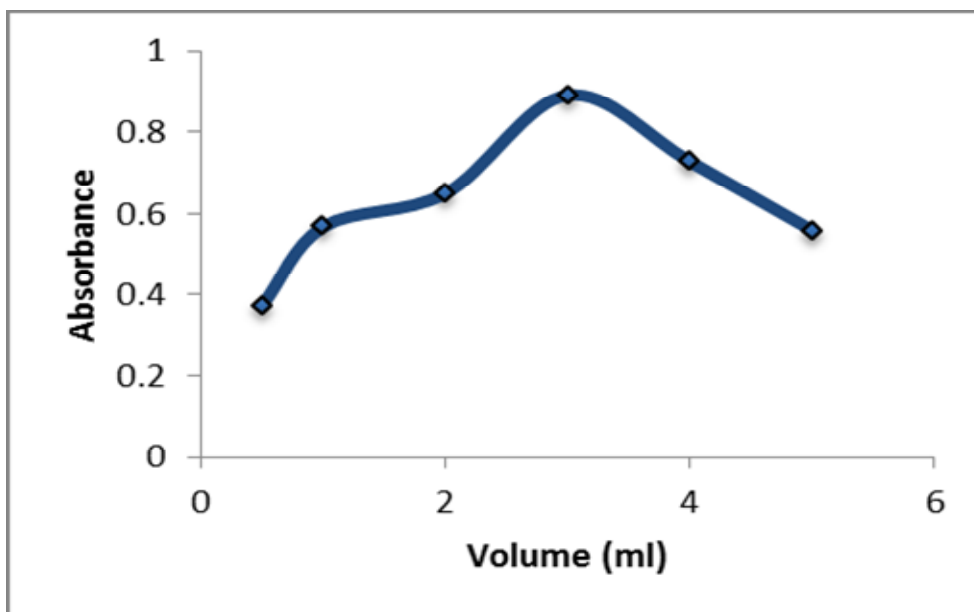


Fig. 4 Effect of potassium permanganate solution

### Calibration curve

Applying the recommended procedure, a straight line of calibration curve was obtained as shown in Fig. 5, which shows a good linearity over the concentration range of 1.0-44.0 mg/L of aspirin, with detection limit 0.8 mg/L. The calibration equation  $A = -0.0408 + 0.0489 C$  with  $r = 0.9986$  was obtained.

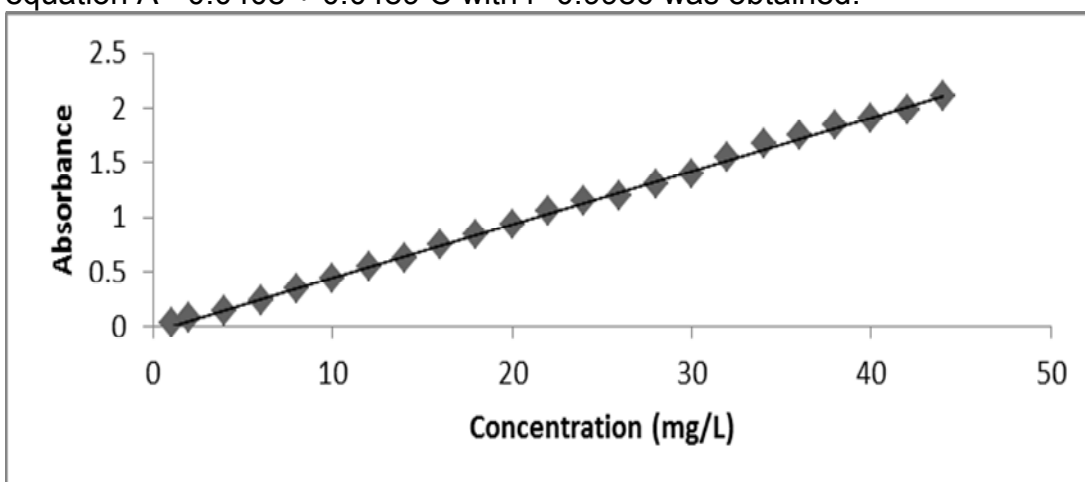


Fig. 5 Calibration curve of the determination of aspirin

### Precision and accuracy

The precision and accuracy of the method were checked depending on values of relative standard deviation (RSD %) and relative error percent (Error %) for five repetitive determination of aspirin at three different concentration levels. Table 4 shows the accuracy and precision data.

Table 1. Precision and accuracy data for the determination of aspirin.

Aspirin conc.(mg/L)	Error%	RSD%
1.0	+1.0	2.8
22.0	-0.85	2.6
44.0	+0.92	1.53

### Application of the method

The method was applied for the determination of aspirin in drug formulations. The results are shown in table 2.

Table 2. Determination of aspirin in tablets of various companies by proposed method.

Formulation	composition	Content(mg) declared	Found (mg) in batch method	Standard method
ATABAY	Aspirin	80	74	75
Bristol Laboratories Ltd	Aspirin	75	72	74
PARS DAROU	Aspirin	100	95	94
BAYER	Aspirin	100	89	93

### Conclusion

The main features of the proposed method for the determination of aspirin, is the use of non-toxic and easily water-soluble reagent potassium permanganate reagent. The rapid color development, good beers law calibration curve, reproducibility, and wide applicable range are further advantages of the method. The application seems to be inexpensive and yielding results in good agreement with those provided by HPLC as reference methods.

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