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The Non-Aqueous Potentiometric Determination of Pharmaceutically Potent Drug Aspirin

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ABSTRACT

The non-aqueous potentiometric determination of pharmaceutically potent drug aspirin by using isopropyl alcohol as the solvent and alcoholic KOH as the titrant has been carried out. The effect of solvent and concentration on potentiometric determination of aspirin has been studied followed by the estimation of aspirin in single component tablets. The titrations were carried out using glass and calomel electrode pair. The method was found to be convenient for assay of aspirin and results obtained are comparable with those obtained by IP method. Solvent isopropyl alcohol gives much more accurate result as compare to other solvents with minimum % error. In study of effect of concentration, the results obtained are more accurate with positive errors at low concentration whereas, negative errors at high concentration. The error is just +0.11% when 1.804 mg of aspirin was titrated. Confidence level of weight titrated and weight found in respect of aspirin is 0.46 which is statistically non significant.

Keywords: Non-aqueous, potentiometric determination, aspirin

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INTRODUCTION

The potentiometric determination in non-aqueous media has been reported earlier using the different electrode pairs[1-5]. Literature is enriched with different methods for the determination of aspirin[6-7]. The potentiometric determination of aspirin by sequential injection analysis[8] and micelle assisted dissolution technique[9] has been reported earlier. IR and NMR spectrophotometric determination of aspirin has been carried out by many workers[10,11].

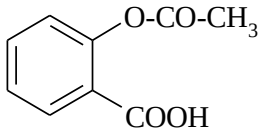


Figure 1: Structure of Aspirin

Aspirin has also been analyzed by conductometry, enthalpimetry[12], HPLC[13] and UV spectrometry[14]. Determination of aspirin by gas-liquid chromatographic method using methylation technique was carried out earlier[15]. The present work is aimed at finding out simple analysis procedure for common drugs. This will help the analysis of raw materials and products for quick check of spurious drugs which are feared to penetrate the markets. In this communication, determination of aspirin by potentiometric titration using isopropyl alcohol as the solvent and alcoholic KOH as the titrant has been reported. Efforts have also been made to study the effect of solvent, concentration and the estimation of aspirin in single component tablets.

MATERIALS AND METHODS

The potentiometric titrations were performed by a digital potentiometer (Equiptronics, EQ-602). Glass was used as an indicator electrode and calomel as a reference electrode. All weighing were made on Precisa-310-M (±0.001 g) balance. The chemicals and solvents used were of AR grade. Solvents were purified and made anhydrous by standard methods[16]. Care was taken to protect the titrant from atmospheric moisture and carbon dioxide. The aspirin selected for present investigation was of pharmaceutical in nature and is included in pharmacopoeias[6,7,17]. It was obtained from pharmaceutical laboratories.

Effect of solvent and concentration on potentiometric determination of aspirin

To study the effect of solvent and concentration on potentiometric determination of aspirin, the required volume of the solution of the aspirin was diluted to 20 ml with isopropyl alcohol. The glass and calomel electrodes were placed in it. The titrant was added in the lots of 0.1 ml and the potential developed across the two electrodes was measured after each addition. Magnetic stirrer

was used to stir the solution and a waiting period of about 1 to 2 minutes was allowed to get the potential stabilized. The addition of titrant was continued till 0.3 to 0.5 ml excess of it was added. Near the end point readings were recorded for each addition of 0.02 ml of the titrant. The end points were determined by plotting the graphs of potential developed against volume of the titrant.

Estimation of aspirin in single component tablets

The alcoholic KOH was standardized by diluting 10 ml of benzoic acid (0.1 M) to 20 ml with isopropyl alcohol and then titrating it with alcoholic KOH solution by potentiometric method using the glass and calomel electrodes. In this analysis, ten tablets of the same batch of aspirin were accurately weighed and powdered. The required quantity of powder was weighed accurately and treated with 50 ml of isopropyl alcohol and stirred vigorously so as to dissolve the active component of the tablet. Binding agents or filler remained insoluble. The additives commonly present in the tablets are calcium carbonate, glucose, lactose, starch, gum etc. which are mostly insoluble in isopropyl alcohol. The solution was filtered, residue was washed three to four times with small portions of isopropyl alcohol and the volume of solution was made to 100 ml with isopropyl alcohol. An aliquot of 10 ml of this solution was diluted to 20 ml with isopropyl alcohol and titrated with 0.1 M of alcoholic KOH solution by potentiometric method using the glass and calomel electrodes. The end points were found out by plotting the graphs as described earlier; the amount of drug present in titrated weight of tablet powder was calculated. The amount of active component (drug) present in one tablet was calculated by knowing the average weight of the tablet. Later on the same tablet powder was analyzed by the method of pharmacopoeias and the results obtained were compared.

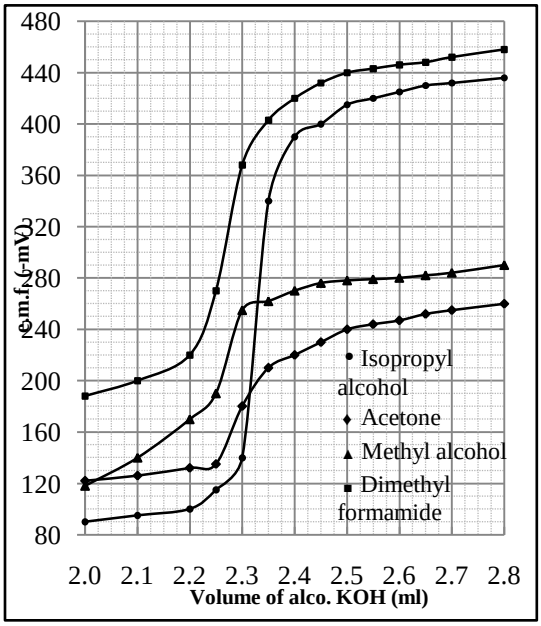
RESULTS AND DISCUSSION

Effect of solvent and concentration on potentiometric determination of aspirin

The accuracy of results in determination of aspirin by using different solvents was checked by potentiometric titration method. Stock solutions of aspirin (1.802 mg/ml, ±0.5%) were prepared by dissolving it in acetone, methanol, dimethyl formamide and isopropyl alcohol. 2 ml of these solutions were diluted to 20 ml with same solvents and titrated separately with alcoholic KOH. The results obtained are tabulated and it can be seen from that, solvent isopropyl alcohol gives much more accurate result as compare to other with minimum % error (Table 1). The potentiometric breaks obtained are much more pronounced using isopropyl alcohol (Graph 1).

Table 1 : Effect of solvent on potentiometric determination of aspirin

Solvent	Weight Titrated (mg) (± 0.5%)	Weight Found (mg)	Error (%)
Acetone	3.604	3.526	– 2.16
Methanol	3.604	3.550	– 1.49
Dimethyl formamide	3.604	3.550	– 1.49
Isopropyl alcohol	3.604	3.628	+ 0.66

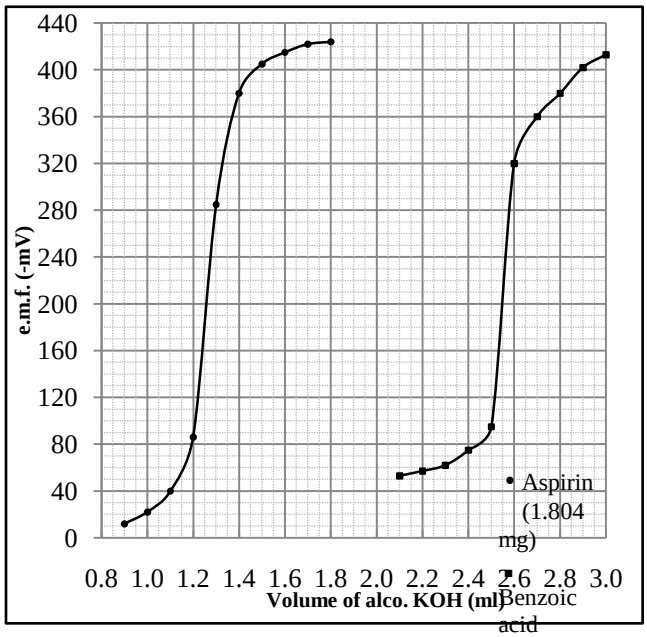


Graph 1 : Effect of solvent on potentiometric determination of aspirin

To study the effect of concentration and to find out the suitable concentration range which gives best results, different amount of aspirin were titrated with alcoholic KOH by non-aqueous potentiometric titration method. A stock solution of aspirin (1.804 mg/ml) was prepared by dissolving it in isopropyl alcohol. Different volumes (1 to 10 ml) of this stock solution were diluted to 20 ml with isopropyl alcohol and titrated separately with alcoholic KOH. The results obtained are tabulated and it can be seen from that, potentiometric method gave an accuracy of ±1.3% for the entire range of 1.804 to 18.04 mg. It is observed that the results obtained are more accurate with positive errors at low concentration whereas, negative errors at high concentration. The error is just +0.11% when 1.804 mg of aspirin was titrated with alcoholic KOH (Table 2). This method is found to be better than the pharmacopoeias method of visual titration in respect of indicator error. The potentiometric breaks obtained are much more pronounced (Graph 2). Values of mean, mean deviation and standard deviation for the determination of effect of concentration of aspirin are 9.92, 4.51, 5.46 (for weight titrated); 9.84, 4.44, 5.38 (for weight found) and –0.48, 0.632, 0.7762 (for % error) respectively. Confidence level of weight titrated and weight found in respect of aspirin is 0.46 which is statistically non significant.

Table 2 : Effect of concentration on potentiometric determination of aspirin

Weight Titrated (mg)	Weight Found (mg)	Error (%)
1.804	1.806	+ 0.11
3.608	3.626	+ 0.49
5.412	5.461	+ 0.90
7.216	7.139	– 1.06
9.020	8.988	– 0.35
10.824	10.780	– 0.40
12.628	12.473	– 1.22
14.432	14.251	– 1.25
16.236	16.114	– 0.75
18.040	17.806	– 1.29



Graph 2 : Effect of concentration on potentiometric determination of aspirin

Estimation of aspirin in single component tablets

Ten tablets of the same batch of aspirin were accurately weighed and powdered. The powder containing 100 mg of the drug was accurately weighed, it was extracted with isopropyl alcohol and the volume was made to 100 ml. An aliquot of 10 ml of this solution was diluted to 20 ml with isopropyl alcohol and titrated with alcoholic KOH using potentiometer. The titrant was standardized by potentiometric titration with standard benzoic acid in isopropyl alcohol. The weight of aspirin present in titrated amount of tablet was calculated. The same tablet powder was analyzed by IP method. The results obtained for four different brands of aspirin tablets are tabulated and it is observed that, the present potentiometric method gives fairly accurate results as compared to those obtained by IP method (Table 3). It is simple, precise and free from

indicator error or interferences. Aspirin gets hydrolyzed in presence of aqueous alkali but this is avoided in non-aqueous medium. However, in US Pharmacopoeia procedure alcoholic solution of aspirin is titrated with aqueous alkali. Such a titration must be performed quickly so as to minimize hydrolysis. The present method has no such limitations. Commonly the additives present in the tablets are calcium carbonate, sugars, gum etc. These additives are insoluble in isopropyl alcohol and do not affect the results.

Table 3 : Estimation of aspirin in single component tablets

Sample	Label Claim (mg)	Weight Found (mg)	
		I.P. Method	Present Method
A	75.0	73.45	72.756
B	75.0	74.78	75.177
C	75.0	74.66	74.228

CONCLUSION

The acidic pharmaceutical drug selected for this study was aspirin. It could be noted that being distinctly acidic could not be titrated directly with aqueous alkali due to its easy hydrolysis but the non-aqueous titration of aspirin gave satisfactory results. The solvent isopropyl alcohol is found to be more satisfactory for all the titrations. Potassium hydroxide in isopropyl alcohol was found to be better titrant. This basic titrant was also superior to the alkoxide solvents which are more susceptible to atmospheric moisture and carbondioxide. The calomel and glass electrode pair gave stable potentials which were quickly attained. The potentiometric breaks obtained with this electrode pair system were much larger. In the present research work, method for determination of acidic drug, aspirin was developed. It is fast, simple and precise which can be used even in common laboratories and do not involve use of any sophisticated instrument.

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