International Journal of Multidisciplinary Research and Development 2014; 1(6): 263-265

International Journal of Multidisciplinary Research and Development

IJMRD 2014; 1(6): 263-265
www.allsubjectjournal.com
Received: 27-10-2014
Accepted: 29-11-2014
E-ISSN: 2349-4182
P-ISSN: 2349-5979

Amita
Department of Chemistry, Baring Union Christian College, Batala, Punjab, India

Navjot Kaur
Department of Chemistry, RCCV Girls College, Ghaziabad, Uttar Pradesh, India

Correspondence
Amita
Department of Chemistry, Baring Union Christian College, Batala, Punjab, India

Quantitative analysis of some NSAIDS and caffeine by titrimetric, UV/visible spectroscopy and potentiometric techniques

Amita and Navjot Kaur

Abstract
The quantitative analysis of some of the non-steroidal anti-inflammatory drugs (NSAID) including: paracetamol (Acetaminophen), Acetylsalicylic acid (Aspirin), Caffeine and / or combination of either two or all the three drugs have been done using titrimetric, potentiometric and UV /Visible spectroscopic techniques. The estimation of Paracetamol, Acetylsalicylic acid, and Caffeine drugs percentage in some commercial dosage tablets was done using these methods. The concentration of a species in solution can be determined by qualitative and quantitative analysis**.** Various methods are adopted. This research paper mainly focuses on quantitative analysis of some selected drugs by titrimetric, UV/visible spectroscopy and potentiometric methods.

Keywords: quantitative techniques, titrimetric, potentiometric and UV/visible, Paracetamol, aspirin, caffeine

1. Introduction

The pharmaceutical activity of a drug formulation depends upon the chemical characteristics of drug molecules, thus any small variation in chemical properties and quantitative composition may lead to considerable variation in therapeutic effects. Aspirin (Acetylsalicylic acid), Paracetamol (Acetaminophen), Caffeine and other anti-inflammatory drugs, produce analgesia both peripheral and central nervous system (CNS) effects and inhibit platelet aggregation by irreversible inhibition of platelet [1-4] The cyclooxygenase, inhibits the generation of thromboxygenase A2, relieves headaches, neuralgia, rheumatism, hence a powerful inducer of platelet aggregation and vasoconstriction [5-7]. Thus, a proper assay and quantification technique to ascertain these drugs content in a multi component pharmaceutical dosage and its stability is indeed necessary, vital and appreciated in order to avoid overdose. Several methods have been put forward for the determination of content as an individual or combined dosage in commercial tablets. Titrimetric or wet analytical classical techniques and UV spectrophotometric analysis are often preferred for quality control testing of analgesics in most pharmaceutical and chemical laboratories due to their broad availability, easy to operate and cost effectiveness [8-10].

In this research paper, the quantitative determination of acetylsalicylic acid contained in most commercially available pharmaceutical formulations was performed using titrimetric method. Qualitative analysis through spectrophotometric methods achieves fast and accurate results using only small sample quantities. UV Spectrophotometry is the best method available for identification and comparison of organic compounds. The pharmaceutical industry relies on spectrophotometric analysis for a variety of applications and choosing the right instrumentation is essential for consistent and quality results. For non-steroidal anti-inflammatory drugs (NSAIDs), its mechanism of action is its ability to inhibit the enzyme (COX) responsible for the synthesis of prostaglandins (pain transducers). PCM, ASA and IB are classified as (NSAIDs) and each of these analgesics has advantages over the other [11-15]. Paracetamol, or acetaminophen, is a common over-the-counter medication and also found in many prescriptive drugs [16-17]. Paracetamol is most widely used NSAID, used to joint aches, middle ear aches, a painkiller effect on headaches, toothaches, neuralgia, aches stem from cold, flue and lumbago. Acetylsalicylic acid used as an analgesic and antipyretic, is also used in low doses as a blood thinner to prevent blood clots, used extensively in the treatment of chronic pain and acute osteoarthritis related conditions and rheumatoid arthritis [18]. Caffeine which is considered as an alkaloid of the Purina group used both recreationally and medically.

Qualitative analysis assures that the measurement process of active ingredients is precise and free of impure compounds. The results from these methods provide data that can be used for quality control and consistency in product formulation. Having precise and accurate results assures that proper dosage and measurements are used for the intended applications. The applications of quantitative analysis through spectroscopy allow pharmaceutical researchers to clearly identify and compare drug ingredients to ensure that the drug molecules are properly absorbed by the body and distributed to the right places. UV/Visible spectroscopy is widely used for the identification of active ingredients or protein analysis, each component of pharmaceutical research depends on spectrophotometers to provide qualitative analysis and exact drug formulations [20-21].

2. Experimental Setup

2.1. Materials

Seven brands of Commercial Tablets including: Crocin, Welset, Dolopar, Saridon, Disprin, Anacin, Micropyrin were purchased. Disprin (Mfd, by Reckitt and colman Ltd.), Saridon (Mfd. by Nicholas Piramal (I) Ltd.), Micropyrin (Nicholas Piramal (I) (Ltd.), Dolopar (Mfd. by Micro Labs Ltd.) Anacin (Mfd. by Geofrke Manners and co. Ltd.), Crocin (Mfd. By GSK consumer healthcare Ltd), Welset (Mfd. by Ranbaxy Laboratories Ltd.). Pure forms of active ingredients including: Paracetamol, Acetylsalicylic acid and Caffeine were supplied by SD Fine chemicals. All chemicals and reagents including NaOH, HCl, H_2SO_4, Cerric ammonium sulphate, acetic anhydride, benzene, 0.1 N Perchloric acids etc. were of analytical reagent grade.

2.2. Methods

2.2.1. Titrimetric Method

Titrimetric assay was performed for Aspirin, Paracetamol and Caffeine in different types of analgesic tablets.

2.2.1.1. Titrimetric analysis of Aspirin (Acetylsalicylic acid)

Reagents Used: 500 ml of 0.5N NaOH (20 g/l of solution), 0.5 N NaOH solution boiled gently for 10 minutes and the access of alkali was titrated with 0.5 N HCl using phenol red solution as indicator. The operation was repeated without substance. The difference between the two represents the amount of 0.5 N NaOH required by Aspirin. Each ml of 0.5 N NaOH is equivalent to 0.04504 g of Aspirin.

2.2.1.2. Titrimetric analysis of Paracetamol

Reagents Used

2 N H_2SO_4, 2 N HCl, ferrous sulphate as indicator, 0.1 N cerric ammonium sulphate solution. 20 tablets of assay were powered and weighed accurately. Weighed powered sample contained 0.3 g of paracetamol. Both were dissolved in 10ml of water and 30 ml of 2 N H_2SO_4 mixture. The mixture was boiled under reflux for 1 hour, cooled and diluted to 100 ml with water. To 20 ml of this solution 40 ml of water, 40 g of ice, 15 ml of 2N HCl, 0.1 ml ferrous sulphate solution were added, then this mixture was titrated with 0.1 N Cerric ammonium sulphate solution until a yellow colour is obtained. The same procedure was repeated without substance. Each ml of 0.1 N cerric ammonium sulphate solution is equivalent to 0.0756 g of paracetamol ($C_8H_9NO_2$).

2.2.1.3. Titrimetric analysis of Caffeine

Reagents Used: Acetic anhydride, Benzene, 0.1 N Perchloric acids.

Powered Sample containing 0.4 g of caffeine was dissolved in 49 ml of warm acetic anhydride, cooled, added 80 ml of benzene and titrated with 0.1 N perchloric acid. The end point was determined potentiometrically and then blank titration was performed. Each ml of 0.1 N perchloric acid is equivalent to 0.01942 g caffeine ($C_4H_{10}N_4O_2$).

2.2.2. Spectrophotometric Method

The spectrophotometric technique was used for determination of paracetamol in CROCIN and WELSET tablets. 20 tablets were weighed and powdered. Powdered tablet equivalent to 100 mg of paracetamol was weighed and taken into 100 ml volumetric flask then 15 ml of methanol was added and shaken well to dissolve it after that 85 ml of water was added to adjust the volume up to 100 ml. 1 ml of this solution was withdrawn and taken in 100 ml volumetric flask. The volume was adjusted with diluent up to 100 ml. The absorbance was taken at λ_{max} 249 nm. UV absorption spectrum of Paracetamol was determined in methanol by scanning the sample solution in the range 200-300 nm at 1cm path length using UV/VISIBLE spectrophotometer (PERKIN-ELMER). Paracetamol showed maximum absorption (λ_{max}) at 249 nm.

3. Results and Discussion

Table 1: Different commercial brands, method adopted and percentage amount calculated

S. No.	Commercial Name	Method Adopted for Analysis	Contents reported on label	Experimentally calculated amount (mg) IP/USP	% Purity
1	Dolopar	Titrimetric Method	Paracetamol-500mg	378.3	75.67
2	Saridon	Titrimetric Method	Paracetamol-250 mg; Caffeine - 50 mg,	266.0 48.55	106.0 97.1
3	Disprin	Titrimetric Method	Acetylsalicylic acid - 350 mg	357	102.0
4	Anacin	Titrimetric Method	Acetylsalicylic acid - 0.4g,	498.5	98.7
5	Micropyrin	Titrimetric Method	Acetylsalicylic acid-350mg, Caffeine - 20 mg	191.0 19.42	55.0 97.1
6	Crocin	UV/Visible spectroscopy	Paracetamol -500mg-	529.0	105.8
7	Welset	UV/Visible spectroscopy	Paracetamol 500mg	468.36	93.7

In this research paper seven commercial available tablets have been analysed according to the method prescribed in Indian Pharmacoepia. The method prescribed for the analysis of paracetamol was titrimetric analysis using cerric ammonium sulphate as a titrant and UV/ Visible spectrophotometric method, while Aspirin was analysed by acidimetric titration and caffeine was analysed potentiometrically via acidimetric titration. The methods

described in the pharmacopeia are simple but are of practical nature and application.

The results of the present analysis tabulated in Table1 show that the Acetylsalicylic acid content of Disprin is 102%. The Saridon tablet was analysed for its Paracetamol and Caffeine content and the results show that the Paracetamol and Caffeine contents are 106 % and 97.01 % respectively of reported value. Micropyrin (Mfd. By Nicholas Piramal India Ltd., company that also manufacture Saridon) was analysed for its Acetylsalicylic acid and Caffeine contents. The amount of Caffeine as determined in the present research was 55% of the quantity as mentioned on the label of the tablet, while the Caffeine content was 97.1% of the reported value. Dolopar contains 75.67% of reported amount of paracetamol.

The percentage of Paracetamol in the tablets Crocin and Welset was also determined by spectrophotometric method. The amount of Paracetamol in these tablets is 105.8% and 93.7% respectively. These results indicate that there is wide fluctuation of the drug content as written on the tablet and as dose actually present in some of the tablets of even reputed manufacturers indicating a great negligence on the part of manufacturer as well as drug control authority. It is therefore recommended that random sampling of drugs be done at various levels to ensure strict quality control measures in case of various pharmaceutical products.

4. Conclusions

Simple, rapid, accurate, precise, and economical titrimetric, UV spectrophotometric and potentiometric methods for the quantitative determination of active drug ingredients in pharmaceutical formulations were successfully employed. Our study has concluded that there is a wide fluctuation in the prescribed drug contents and strict quality measures are required to be adopted to avoid these fluctuations.

5. Acknowledgements

Authors are thankful to Professor Anu Mahajan, Department of Pharmacy, GHG Khalsa College of Pharmacy, Gurusar-Sadhar (Ludhiana), for providing necessary facilities to carry out the research.

6. References

1. Mohamed ME, Aboul-Enein HY. Spectrophotometric and differential pulse polarographic methods of analysis for ketotifen hydrogen fumarate. Drug Development and Industrial Pharmacy. 1986; 12(5):733-746.
2. Szczepaniak W, Cychowska T, Przadka T. Spectrophotometric determination of ketotifen in pharmaceutical preparations after isolation on ion-exchanger. Acta poloniae pharmaceutica. 1992; 49(4):3-5.
3. Hopkała H, Drozd J. Ion-selective electrodes for the determination of antihistaminic drug ketotifen. Chemia Analityczna. 1999; 44(3):603-609.
4. Frag EYZ, Mohamed GG, Gehad, Khalil MM, Hwehy MA. Potentiometric determination of ketotifen fumarate in pharmaceutical preparations and urine using carbon paste and PVC membrane selective electrodes. International Journal of Analytical Chemistry. 2011; 7:604-741.
5. Davidson AG. Ultraviolet-visible absorption spectrophotometry. In Beckett AH, Stenlake JB, (4thedn), Practical Pharmaceutical chemistry. CBS Publishers and distributors, New Delhi, 2002, 275-278.
6. Patil KM, Bodhankar SL, High-performance thin-layer chromatographic determination of lamotrigine in serum. J Chromatogr B Analyt Technol Biomed Life Sci. 2003; 823:152-157.
7. Scottish Intercollegiate Guidelines Network (SIGN), Control of pain in adults with cancer-A national clinical guideline. Scotland: National Health Service (NHS), 2008.
8. Sastry CSP, Naidu PY. Spectrophotometric estimation of ketotifen fumarate in pharmaceutical formulations. *Mikrochimica Acta*. 1997; 127(3-4):219-223.
9. Willard-Hobart H, Merritt Jr Lynne L, Dean John A. Instrumental Methods of Analysis. (5th edn), Von Nostrand, University of Michigan, 1974.
10. Chatwal GR, Anand S. Instrumental Methods of Chemical Analysis. (5th edn), Himalaya Publishing House, New Delhi, 2002.
11. Moller P, Sindet-Pedersen S, Petersen CT, Juhl GI, Dillenschneider A, *et al*., Onset of acetaminophen analgesia: comparison of oral and intravenous routes after third molar surgery. Br J Anaesth. 2005; 94:642-648.
12. Daly FF, Fountain JS, Murray L, Graudins A, Buckley NA. Guidelines for the management of paracetamol poisoning in Australia and New Zealand-explanation and elaboration. A consensus statement from clinical toxicologists consulting to the Australasian poisons information centres. Med J Aust. 2008; 188:296-301.
13. Hawkins LC, Edwards JN, Dargan PI, Impact of restricting paracetamol pack sizes on paracetamol poisoning in the United Kingdom: a review of the literature. Drug Saf. 2007; 30:465-479.
14. Larson AM, Polson J, Fontana RJ, Davern TJ, Lalani E, *et al*., Acetaminophen-induced acute liver failure: results of a United States multicenter, prospective study. Hepatology, 2005, 42: 1364-1372.
15. Bergman K, Müller L, Teigen SW, Series: current issues in mutagenesis and carcinogenesis, No. 65. The genotoxicity and carcinogenicity of paracetamol: a regulatory (re)view. Mutat Res. 1996; 349:263-288.
16. Bradley N. Naming of drugs. BMJ should use paracetamol instead of acetaminophen in its index. BMJ. 1996; 313:689.
17. Bertolini A, Ferrari A, Ottani A, Guerzoni S, Tacchi R, *et al*., Paracetamol: new vistas of an old drug. CNS Drug Reviews 12: 2006, 250-275.
18. Viswanathan AN, Feskanich D, Schernhammer ES, Hankinson SE, Aspirin, NSAID. And Acetaminophen Use and the Risk of Endometrial Cancer. Cancer Res 68: 2008, 2507-2513.
19. Goodman and Gillman. The Pharmacological basis of Therapeutics. 1990, 8th edition, 1:620.
20. Altinoz MA, Korkmaz R, NF-kappa B. Macrophage migration inhibitory factor and cyclooxygenase-inhibitions as likely mechanisms behind the acetaminophen-and NSAID-prevention of the ovarian cancer. Neoplasma. 2004; 51:239-247.
21. ICH, Q2B Validation of Analytical Procedures-Methodology. Consensus Guidelines, ICH Harmonized Tripartite Guidelines, 1996.