RESEARCH ARTICLE

The Utilisation of Standard Addition Method for The Determination of Ibuprofen in Liquid Dosage Form

Rajwan A. Alazawy[1], Awatef A. Ebrahim Al Ani[2]*, Sura L. Alkhafaji[3]

[1]*Department of Pharmaceutical Chemistry-College of Pharmacy-University of Kerbala- Kerbala – Iraq*
[2]*Department of Pharmacy-Al Zahrawi University College -Kerbala – Iraq*
[3]*Department of Pharmaceutical Chemistry-College of Pharmacy-University of Kerbala- Kerbala – Iraq*

Received: 19th October, 19; Revised: 21th November, 19, Accepted: 15th December, 19; Available Online: 25th December, 2019

SUMMARY

Objective: The use of the standard addition method is common in drug analysis protocols. This study aims to quantify the ibuprofen within a pharmaceutical liquid preparation with the aid of a standard addition method relying on robust studies employing the UV-Visible spectrophotometric techniques.

Methods: The oral pediatric syrup liquid dosage form of ibuprofen (Brufen®), wear diluted and inoculated with predetermined spikes of the ibuprofen standards. Consequently, these prepared samples were analyzed, employing UV-Vis techniques.

Results: The absorbance versus concentration standard curve was plotted for Brufen®. This curve shows good linearity. The regression coefficient of 0.9942. The Limit of detection (LoD = 3SD) and Limit of quantification (LoQ = 10SD) were found to be 0.00755 and 0.02517, respectively. The percent amount was found to be 101.533% of ibuprofen content.

Conclusion: In conclusion, the researchers find the standard addition method as a reliable method to acquire rapid, economy, and validated the method for the quantitation of ibuprofen oral pediatric syrup dosage forms, thus, can be utilized in routine laboratory drug-analysis works.

Keywords: Standard addition method, Brufen® Syrup, UV-Vis, ibuprofen quantification.

International Journal of Pharmaceutical Quality Assurance (2019); DOI: 10.25258/ijpqa.10.4.22

How to cite this article: Alazawy, R.A., Ebrahim Al Ani, A.A. and Alkhafaji, S.L. (2019). The Utilisation of Standard Addition Method for The Determination of Ibuprofen in Liquid Dosage Form. International Journal of Pharmaceutical Quality Assurance 10(4): 686-688.

Source of support: Nil

Conflict of interest: The authors declare no conflict of interest is encountered.

INTRODUCTION

Ibuprofen is a week carboxylic acid and is considered a member of the non-steroidal anti-inflammatory drug (NSAID) family.[1] The chemical structure of ibuprofen is shown in Figure 1 below.[2] Ibuprofen, thus, used majorly to control pain and inflammation and was reported for its anticancer activity.[1,3] Ibuprofen exists solely or in combination in many dosage forms, including; tablets, hard gelatine capsules, soft gelatine capsules, oral suspensions, oral syrups and others.[4] This appreciates the value of finding rapid, accurate, and precise method for the quantitation of this commonly utilized drug. For instance, one of the globally utilized instruments is UV-Visible spectrophotometer. This technique is proven as a principal tool for routine drug analyses. This is correlated, in part, to its diverted usage for the identification, quantification, and purity measurement of the Active Pharmaceutical Product (API) in the raw materials, manufacturing processes, and final formulation.[5]

In this work, the authors aim to determine the quantity and percent assay of ibuprofen with a standard addition method relying on robust studies employing the UV-Visible spectrophotometric methods.[6-11]

MATERIALS AND METHODS

Materials

- Ibuprofen standard was gifted from Samarra Drug Industry (SDI), Iraq.

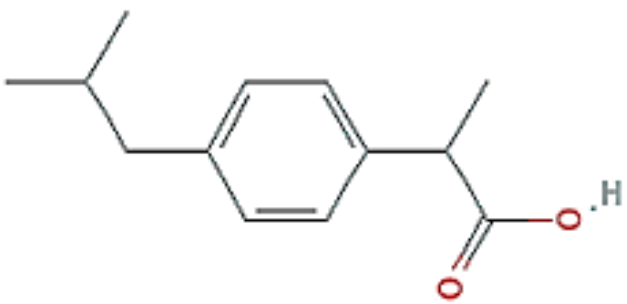

Figure 1: Chemical structure of 2-(4-Isobutylphenyl)propanoic acid (ibuprofen, $C_{13}H_{18}O_2$) (2)

**Author for Correspondence: awatefebrahem@yahoo.com*

- The Brufen®, (ibuprofen) 100 mg/5mL syrup (LOT No. 1099934, Expiry Date 06-2021, Abbott Laboratories Ltd., Berks, UK), were purchased from a local pharmacy.
- NYLON Syringe Filters Polypropylene housing diameter: 25mm pore size: 0.45 µm non-sterilized purchased from Giorgio11185's store Jiangsu, Mainland, China.
- 3-mL and 5-mL disposable syringes (Changzhou, Kangfulia, China) were purchased from a local pharmacy.
- Micropipettes; Yellow: 10µL- 100µL and Blue: 100µL-1000µL, Slamed, Germany.

Instrumentation:

- UV-Visible spectrophotometer (Model UV-1800, Shimadzu, Japan)
- Ultrasonic cleanser with heater (Model SRI, Copley scientific, UK)
- 4-digit sensitive balance (Model Radwang-Wagi Elektroniczne, Poland)

Methods

Ibuprofen Standard Solution Preparation

A 100-mg of anhydrous ibuprofen standard was accurately weighed using a 4-digit sensitive balance and then was transferred to a 100-mL volumetric flask. After that, the volume was completed upto100 ml with distilled water. The solution was sonicated for 15 minutes to assure full dissolution. The solution of 1 mg/mL or 1 µg/µL was obtained.

Lambda Max Selection

A tube filled with exactly measured 10-mL distilled water was inoculated with 150 µL of the ibuprofen standard and mixed well. The diluted solution was scanned to get the maximum absorbance. The lambda max was observed and recorded.

Pharmaceutical Sample Preparation: Brufen® syrup

An accurately measured 10-mL aliquot of the Brufen® syrup oral solution was transferred to a 100-mL volumetric flask and filled to the mark and mixed well. Thereafter, an appropriate volume was filtered through a filter having a 0.45-µm pore size, and from witch, a 7.5-mL of the filtrate was transferred to a 1000-mL volumetric flask. From the final solution, a series of six 10-mL tubes were prepared. Each tube was filled with 10 mL filtrate. The six tubes were labeled and spiked with (0.0, 10, 20, 30, 40, and 50) µL of the ibuprofen standard. The resultant standard concentrations were (0, 1, 2, 3, 4, and 5) µg/mL respectively. Finally, three replicates (three series with a total of 18 tubes) were prepared and tested within 1-mL quartz cell at 224 nm, and the data was recorded. All experiments were conducted at room temperature at the laboratories of the College of Pharmacy, University of Kerbala, from 1-Sep-2019 to 15-September-2019.

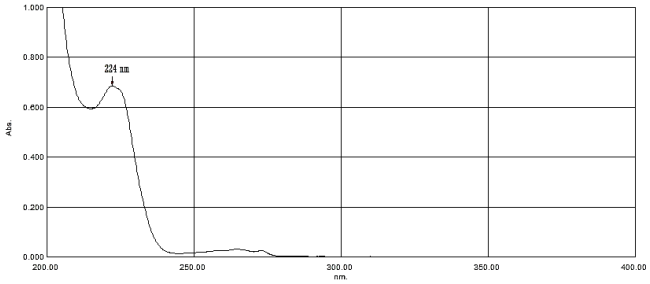

Figure 2: Reveals the observed lambda max for ibuprofen standard solution. The wavelength of 224 nm was selected.

RESULTS

Ibuprofen lambda max selection

The lambda max was found to be 224nm as shown the figure below:

Ibuprofen Standard Addition Calibration Curve Observed with UV-Vis

With the multiplication by the dilution factors for each formula, the data in Table 1 below is gained.

DISCUSSION

The lambda max of 224 nm was selected to be as far as possible from the solvent effect. The cut-off value for water was recorded as 190 nm.[12] Hence, the value of 224 nm has been agreed for many scientists to use this lambda max for ibuprofen. In other work, the standard addition method showed good linearity with a regression coefficient of 0.9996 with respect to the RP-HPLC.[7] This was validated for the UV-Vis standard addition methods. The percent contents were all within acceptable limits of 90–110%, as stated in the USP.[13]

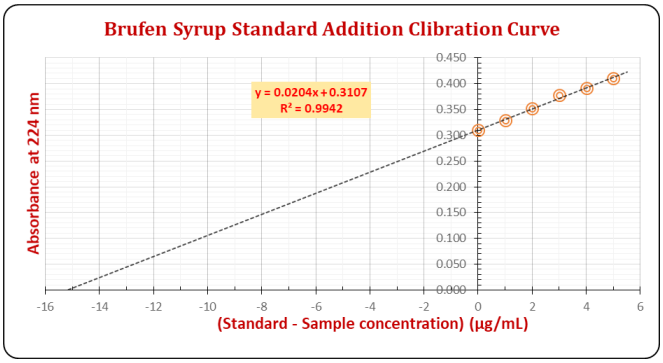

Figure 3: The standard addition calibration curve for ibuprofen (Brufen® Syrup) obtained with UV-Vis machine. The intercept of the extrapolated straight line represents the concentration of the diluted sample alone.

Table 1: The below data gained with the UV-Vis machine, which represents the use of the standard addition method for the quantitation of ibuprofen in Brufen® Syrup.

Parameter	*Values*
Slope	0.0204
Intercept	0.3107
Regression Coefficient (R^2)	0.9942
Standard Deviation (SD)	0.00252
Relative Standard Deviation (RSD)	0.811%
Limit of detection (LOD = 3SD)	0.00755
Limit of quantification (LOQ = 10SD)	0.02517
Dilution factor	1333.333
Stated concentration	100 mg / 5 mL
Concentration found	101.533 mg / 5 mL
Amount found (% of stated)	101.533 %

CONCLUSION

In conclusion, the researchers find the standard addition method as a reliable method to acquire rapid, economy, and validated a method for the quantitation of ibuprofen oral pediatric syrup dosage forms especially when correlated to the data shown in Table 1.

REFERENCES

1. Al-Obaidi, Z. M. J., et al. (2019). "Synthesis of Novel Ibuprofen-Tranexamic Acid Codrug: Estimation of The Clinical Activity Against HCT116 Colorectal Carcinoma Cell Line and The Determination of Toxicity Profile Against MDCK Normal Kidney Cell Line." International Journal of Drug Delivery Technology 9(2).
2. National Center for Biotechnology Information [Internet]. 2019. Available from: National Center for Biotechnology Information. PubChem Database. Ibuprofen, CID=3672, https://pubchem.ncbi.nlm.nih.gov/compound/Ibuprofen (accessed on Sept. 14, 2019)
3. Al-Obaidi, Z. et al. (2019). "In Silico Design, Synthesis and Characterization of New Spebrutinib Analogues." Pharm Anal Acta 10: 612.
4. Price, I. A. (2002). Dosage form of ibuprofen, Google Patents.
5. Kochling J, Wu W, Hua Y, Guan Q, Castaneda-Merced J. A platform analytical quality by design (AQbD) approach for multiple UHPLC-UV and UHPLC–MS methods development for protein analysis. Journal of pharmaceutical and biomedical analysis. 2016;125:130-9.
6. Al-Obaidi, Z. M. J. (2018). "The Employment of Standard Addition Method for the UV Spectrophotometric Assay of Diclofenac Alkaline Salts in Variant Pharmaceutical Dosage Forms." Journal of Global Pharma Technology 10(11s): 377-38.
7. Al-Obaidi, Z. (2019). "A comparative study for the quantification of paracetamol in multicomponent oral solution employing standard addition method utilized in UV-Visible spectroscopy and RP-HPLC." Journal of Pharmaceutical Sciences and Research 11(2): 339-342.
8. Al-Obaidi, Z. (2015). "The qualification and quantification of Caffeine in two different caffeinated pharmaceutical formulas employing RP-HPLC." ALBAHIR 2(4): 76-91.
9. AL-OBAIDI, Z. (2016). "The Effect of Egg Yolk on Enhancing the Solubility of Candesartan Cilexetil." Ijppr 6(1): 43-52.
10. AL-OBAIDI, Z. (2016). "Enhancing the Solubility of Telmisartan by the Employment of Egg Yolk." Ijppr 5(3): 207-214.
11. Muder Al Hayder, Zaid Al-Obaidi, Hasanain Shakir (2015). "Effect of water-soluble polymers and cosolvent on β-cyclodextrin with candisartan–Cyclodextrin complex solubility." Kerbala Journal of Pharmaceutical Sciences 10(1): 1-7.
12. Yabré M, Ferey L, Somé I, Gaudin K. Greening Reversed-Phase Liquid Chromatography Methods Using Alternative Solvents for Pharmaceutical Analysis. Molecules. 2018;23(5):1065.
13. United States Pharmacopeia [Internet]. 2019. Available from: USP 29. Ibuprofen monograph. http://pharmacopeia.cn/v29240/usp29nf24s0_m39870.html (accessed on Sept. 15, 2019).