REVIEW ARTICLE

Determination of Tetracycline in Capsule Dosage Form

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ABSTRACT

Background: Tetracycline antibiotic is widely prescribed that encourages the finding of rapid and reliable protocol for the determination of tetracycline hydrochloride in hard gelatine capsules. Recently, the standard addition method is used commonly with the aid of a UV-visible (UV-vis) spectrophotometer for such purpose. In this work, the authors aim to quantify the percent assay of Apcycline-250 capsules utilizing the standard addition protocol.

Methods: Twenty filled and emptied capsules were weighed and an equivalent amount of 50 mg of tetracycline hydrochloride was diluted, filtered, and an appropriate standard was spiked and prepared for assay.

Results: The λ_{max} was found to be 348 nm and the absorbance *vs.* concentration standard addition curve was plotted for tetracycline hydrochloride capsules. This curve shows good linearity ($R^2 = 0.9994$). The limit of detection (LoD) and limit of quantification (LoQ) were observed as 0.007937 and 0.02646, respectively. While the percent assay was 103.2%.

Conclusion: The authors conclude that the standard addition technique is a reliable method to conduct rapid, economical, and validated day-by-day analyses work of tetracycline hydrochloride hard gelatine capsules.

Keywords: Apcycline-250 capsules, Drug analysis, Standard addition protocol, Tetracycline hydrochloride, UV-vis.

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INTRODUCTION

Tetracycline is a commonly used antibiotic for its characteristic antibacterial features.[1] The chemical name and the 3D chemical structure of tetracycline is revealed in Figure 1.[2] Tetracycline exists widely in hard gelatine capsules that encourage the finding of a fast and reliable method for the determination of this highly utilized drug. Recently, scientists focused on the utilization of the standard addition method with the employment of UV-vis spectrophotometer for such purpose.[3-5] In one study, the standard addition method was compared with the High-performance liquid chromatography (HPLC) analyses and the results were very closed.[6] Nevertheless, the UV-vis spectrophotometer is a principal tool for the day-by-day drug analyses work. This is entirely true in respect to the determination of the pure drug in the multiple drug dosage forms.[7]

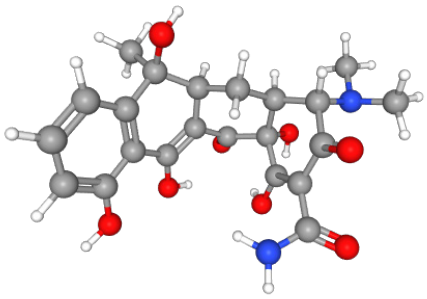

Figure 1: Three-dimensional chemical structure of tetracycline ($C_{22}H_{24}N_2O_8$) with the IUPAC chemical name of (4S,4aS,5aS,6S,12aR)-4-(dimethylamino)-1,6,10,11,12a-pentahydroxy-6-methyl-3,12-dioxo-4,4a,5,5a-tetrahydrotetracene-2-carboxamide[2]

In this study, the researchers aim to determine the percent assay of tetracycline in hard gelatine capsules utilizing the standard addition technique.

MATERIALS AND METHODS

Materials

Tetracycline hydrochloride standard was gifted from Samarra Drug Industry (SDI), Iraq. While, the Apcycline-250 (tetracycline capsules BP 250 mg) (B. No. DJ0339F, expiry date 05/2022, Ajanta Pharma Ltd., Mumbai, India), was purchased from a local pharmacy. Where, the syringe filters (polypropylene housing diameter: 25 mm, pore size: 0.45 µm, non-sterilized) were purchased from Giorgio11185's store in Jiangsu, Mainland, China. Lastly, the micropipettes; yellow: 10 to 100 µL, and blue: 100 to 1,000 µL, were purchased from Slamed, Germany.

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Instrumentation

Two major instruments were utilized; the UV-vis spectrophotometer (Model UV-1800, Shimadzu, Japan) and the ultrasonic cleanser with heater (model SRI, Copley Scientific, UK).

Methods

Tetracycline.HCl Standard Solution Preparation

50 mg of tetracycline.HCl standard was allocated in a 10 mL volumetric flask and the volume was completed with distilled water to the mark. Thereafter, the solution was sonicated for 10 minutes. The final standard solution of 5 mg/mL or 5 µg/µL was obtained.

λ_{max} Selection

A 10 mL tube filled with exactly measured 10 mL distilled water was inoculated with 16 µL of the tetracycline standard solution (5 µg/µL) and mixed well. This gave a concentration of 8 µg/mL. The resultant solution was scanned to drew the absorbance versus wavelength curve. Eventually, the λ_{max} was labeled (Figure 2).

Tetracycline.HCl Sample Preparation: Apcycline-250 Capsules[8]

Twenty Apcycline-250 capsules were accurately weighed and their content was transferred into a mortar. (Figure 3) After cleaning the empty capsule shells, the shells were weighed to calculate the net weight of the tetracycline.HCl powder. After that, the powder was mixed well in the mortar with the aid of pestle. Then, an equivalent amount of 50 mg tetracycline hydrochloride was transferred to a 100 mL volumetric flask and filled to the mark with distilled water and mixed well and sonicated for 5 minutes (Figure 1-4 and Table 1).

Thereafter, a suitable portion was filtered through a 0.45 µm filter. From this filtrate, a 1 mL was transferred to a 100 mL volumetric flask filled with 50 mL distilled water, mixed well, and filled to the mark. From the resultant solution, six-triplicated series of 10 mL tubes were prepared. Each tube was filled with exactly 10 mL of the above filtrate. Each six-tubes series was assorted and inoculated with 0, 10, 20, 30, 40, and 50 µL of the previously prepared tetracycline hydrochloride standard solution. The final concentrations of the added standard were 0, 5, 10, 15, 20, and 25 µg/mL, respectively. Finally, the prepared tubes were tested within 1 mL quartz cell at 348 nm and the data was observed. This work was conducted at room temperature at the laboratories of Asool Al-Deen University College, Department of Pharmacy, Baghdad, from 1st to 20th January 2020.

RESULTS

Selection of Tetracycline.HCl λ_{max}

The λ_{max} was observed to be 348 nm as shown in Figure 2.

Tetracycline.HCl (Apcycline-250 capsule) standard addition curve obtained with UV-vis spectrophotometer.

By retrogression with calculation, the information in Table 1 is obtained.

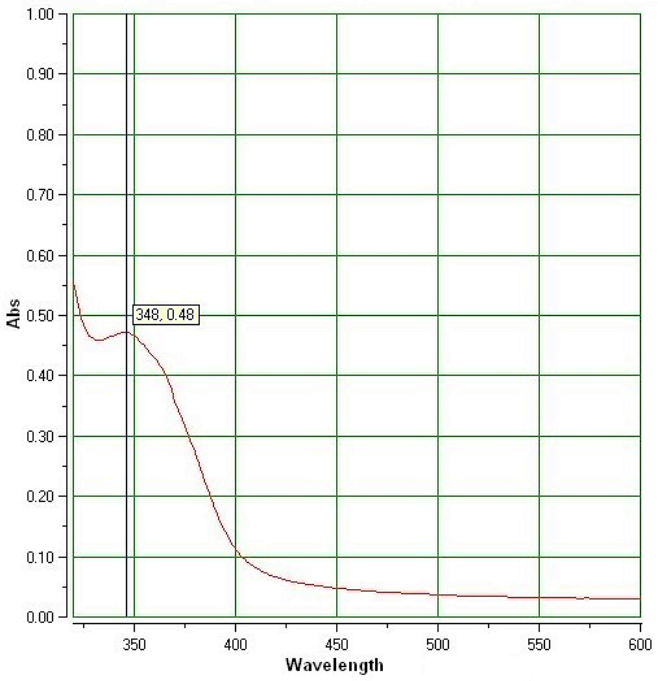

Figure 2: λ_{max} found for Tetracycline.HCl solution, where 348 nm was selected

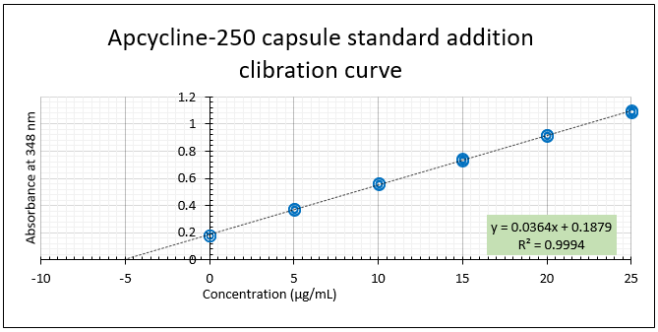

Figure 3: Standard addition curve for tetracycline.HCl (Apcycline-250 capsule) observed with UV-vis spectrophotometer

Table 1: Utilization of the standard addition protocol for the determination of tetracycline.HCl in Apcycline-250 capsule

Factor	*Estimates*
Slope	0.0364
Correlation coefficient (R^2)	0.9994
Intercept	0.1879
Dilution factor (d.f.)	50,000
Stated amount	250 mg
Observed amount	258 mg
Amount found (% of stated)	103.2%
Relative standard error (RSE)	0.014781
Standard error (SE)	0.002646
Limit of quantification (LoQ = 10 SE)	0.02646
Limit of detection (LoD = 3 SE)	0.007937

DISCUSSION

The selected λ of 348 nm was as far as possible from the UV region of the well-known, "the solvent effect." The cut-off edge for distilled water was observed at 190 nm.[9] In a published work, the use of the standard addition technique showed very close results for both the reverse phase high performance liquid chromatography (RP-HPLC) and the UV-vis machines.[6] In this work, the assay content was calculated to be 103.2%. This percent content is within the confidence limit of no less than 90% and no more than 125% as established in the USP.[8]

CONCLUSION

The authors conclude that the standard addition technique is a robust protocol to conduct fast, robust, and validated protocol for the determination of Apcycline-250 capsules.

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