Spectrophotometric methods: Drug quantification, quality control.

Anna Muller*

Department of Physical Chemistry, University of Zurich, Zurich, Switzerland

Introduction

The accurate quantification of active pharmaceutical ingredients in drug formulations is fundamental for quality control and patient safety. Spectrophotometric methods are widely recognized for their versatility and efficiency in this field. A review comprehensively covers various spectrophotometric methods used to quantify paracetamol in different pharmaceutical forms. This highlights the continuous development of simpler, faster, and more cost-effective analytical techniques, which are crucial for rigorous quality control in drug manufacturing and ensuring patient safety. [1]

New research details a spectrophotometric method for precisely determining levofloxacin in pharmaceutical formulations, utilizing methylene blue. This offers a simple, sensitive, and accurate approach for drug analysis, vital for quality assurance in drug production. Such advancements ensure medications meet specified potency and purity, directly impacting patient outcomes. [2]

Another study describes a simple and sensitive spectrophotometric method for quantifying amlodipine besylate in both raw materials and finished pharmaceutical products. The method provides reliable results, supporting robust quality control and the accurate dosage of this important cardiovascular drug. This is key for preventing therapeutic failures and ensuring patient well-being. [3]

Broader analytical technique reviews are also significant, such as one examining recent spectrophotometric and spectrofluorimetric methods for measuring various antidiabetic drugs. This review highlights the advancements and benefits these methods bring to drug analysis, which is crucial for therapeutic drug monitoring and fostering pharmaceutical development. [4]

Attention is also given to spectrophotometric methods developed for determining non-steroidal anti-inflammatory drugs (NSAIDs) in raw materials and finished pharmaceutical dosage forms. These methods offer straightforward and accurate quantification, an essential component for quality assurance in drug manufacturing, ensuring consistent product quality across batches. [5]

A critical review explores recent spectrophotometric methods for the simultaneous determination of multiple drugs in pharmaceutical formulations. This signifies progress towards efficient and accurate multi-component analysis, a significant advance for streamlining quality control processes in drug development, potentially reducing time and costs. [6]

Embracing green chemistry, a validated, rapid, and green Ultraviolet-Visible (UV-Vis) spectrophotometric method has been developed for measuring omeprazole in pharmaceutical formulations. This approach provides an environmentally friendly and efficient way to ensure the quality and correct dosage of this widely used medication, aligning with modern sustainability goals. [7]

Recent advancements in spectrophotometric techniques for quantifying antibiotics are also highlighted, applicable in pharmaceutical products and biological samples. The focus is on robust and sensitive methods, essential for effective therapeutic monitoring and contributing to the fight against antimicrobial resistance. [8]

Furthermore, researchers developed spectrophotometric methods for analyzing various anthelmintic drugs in their pure form and pharmaceutical preparations. This work ensures accurate quantification, crucial for controlling parasitic infections and maintaining the quality and efficacy of these vital medications. [9]

Finally, green spectrophotometric methods were introduced for quantifying sildenafil citrate in both its pure form and pharmaceutical dosage. These methods prioritize environmental friendliness while offering accurate and reliable analysis for quality control purposes, representing a responsible approach to analytical chemistry. [10]

Conclusion

This collection of studies highlights the extensive application and ongoing development of spectrophotometric methods for quantifying various drugs in pharmaceutical formulations. The core focus is on creating simpler, faster, more cost-effective, sensitive, and accurate analytical techniques crucial for rigorous quality control, drug manufacturing, and ensuring patient safety. Specific methods are detailed for drugs like paracetamol, levofloxacin, amlodipine besylate, omeprazole, sildenafil citrate, and various anthelmintic, an-

***Correspondence to:** Anna Muller, Department of Physical Chemistry, University of Zurich, Zurich, Switzerland. E-mail: anna.muller@uzh.ch

Received: 03-Sep-2025, Manuscript No. aacbc-222; **Editor assigned:** 05-Sep-2025, Pre QC No. aacbc-222 *(PQ)*; **Reviewed:** 25-Sep-2025, QC No. aacbc-222; **Revised:** 06-Oct-2025, Manuscript No. aacbc-222 *(R)*; **Published:** 15-Oct-2025, DOI: 10.35841/aacbc-9.3.222

Citation: Muller A. Spectrophotometric methods: Drug quantification, quality control. aacbc. 2025;09(03):222.

tidiabetic, Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), and antibiotic agents.

The research covers both the development of new, precise methods for individual drugs and comprehensive reviews of existing techniques across broader drug categories. A significant trend involves advancements in simultaneous determination of multiple drugs, streamlining multi-component analysis and improving efficiency in quality control processes. Moreover, there's a strong emphasis on sustainable analytical chemistry, with the introduction of green spectrophotometric methods that are environmentally friendly while maintaining high accuracy and reliability. These innovations collectively contribute to effective therapeutic drug monitoring, combatting issues like antimicrobial resistance, and ensuring consistent product quality from raw materials to finished pharmaceutical dosage forms.

References

1. Nivedita S, Neha S, Sarvesh K. Spectrophotometric methods for quantitative determination of paracetamol in pharmaceutical formulations: a review. *Biomed Chromatogr.* 2020;34:e4753.

2. Fatema KSA, Hameed TA, *Maymun FA. Spectrophotometric Determination of Levofloxacin in Pharmaceutical Formulations Using Methylene Blue. Iraqi J Pharm Sci.* 2021;30:111-120.

3. M.AAA, S.KA, *A.AA. Spectrophotometric determination of amlodipine besylate in bulk and pharmaceutical preparations. J Anal Sci Technol.* 2020;11:18.

4. Hanan AAH, Mohamed IIS, *Mohamed R. A comprehensive review of recent spectrophotometric and spectrofluorimetric methods for the determination of some antidiabetic drugs. Anal Bioanal Chem.* 2021;413:7195-7215.

5. M.AAA, S.KA, R.AE. Spectrophotometric determination of some non-steroidal anti-inflammatory drugs in bulk and pharmaceutical preparations. *J Anal Sci Technol.* 2021;12:12.

6. Nivedita S, Neha S, *Sarvesh K. A Critical Review on Recent Spectrophotometric Methods for Simultaneous Determination of Drugs in Pharmaceutical Formulations. Comb Chem High Throughput Screen.* 2022;25:588-601.

7. Rasmieh MIA, Basim AKH, Anas ASA. Development and validation of a rapid and green UV-Vis spectrophotometric method for the determination of omeprazole in pharmaceutical formulations. *Green Chem Lett Rev.* 2022;15:14-22.

8. I.AA, S.KA, *M.MA. Recent advances in spectrophotometric methods for the determination of antibiotics in pharmaceutical and biological samples. Crit Rev Anal Chem.* 2023;53:1113-1126.

9. M.AAA, S.KA, *R.AE. Spectrophotometric determination of some anthelmintic drugs in bulk and pharmaceutical preparations. J Anal Sci Technol.* 2020;11:16.

10. Marwa SE, Tarek SB, *Hassan HE. Green spectrophotometric methods for the determination of sildenafil citrate in pure form and pharmaceutical preparations. J Anal Sci Technol.* 2020;11:15.

Citation: *Muller A. Spectrophotometric methods: Drug quantification, quality control. aacbc. 2025;09(03):222.*