

A computational approach to streamlining drug encapsulation efficiency analysis

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ABSTRACT

This study introduces a Python-based graphical interface designed to analyze encapsulation efficiency (EE) in drug delivery systems, providing an accessible and automated alternative to traditional spreadsheet workflows. Targeting educational and research environments, the tool integrates real-time visualizations, automated reporting, and robust computational capabilities to enhance accuracy and workflow efficiency. Validation using spectrophotometric data from three polymeric nanoparticles demonstrated negligible deviations compared to manual methods, ensuring reliability and precision. The interface supports dynamic data visualization, enabling clear interpretation of experimental results and simplifying documentation. It reduces human error, accelerates analysis, and facilitates real-time feedback through interactive graphical outputs. Open-source and user-friendly, the tool is particularly valuable for resource-limited laboratories, offering scalability and adaptability for diverse experimental workflows. Future enhancements aim to integrate advanced analytical techniques, expand compatibility with laboratory instruments, and include modules for experimental design and controlled release kinetics. These improvements will extend the tool's utility in preclinical drug development and pharmaceutical quality control, emphasizing its potential to streamline nanotechnology and drug delivery research.

Keywords: Encapsulation Efficiency. Python-Based Interface. Nanotechnology Applications.

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