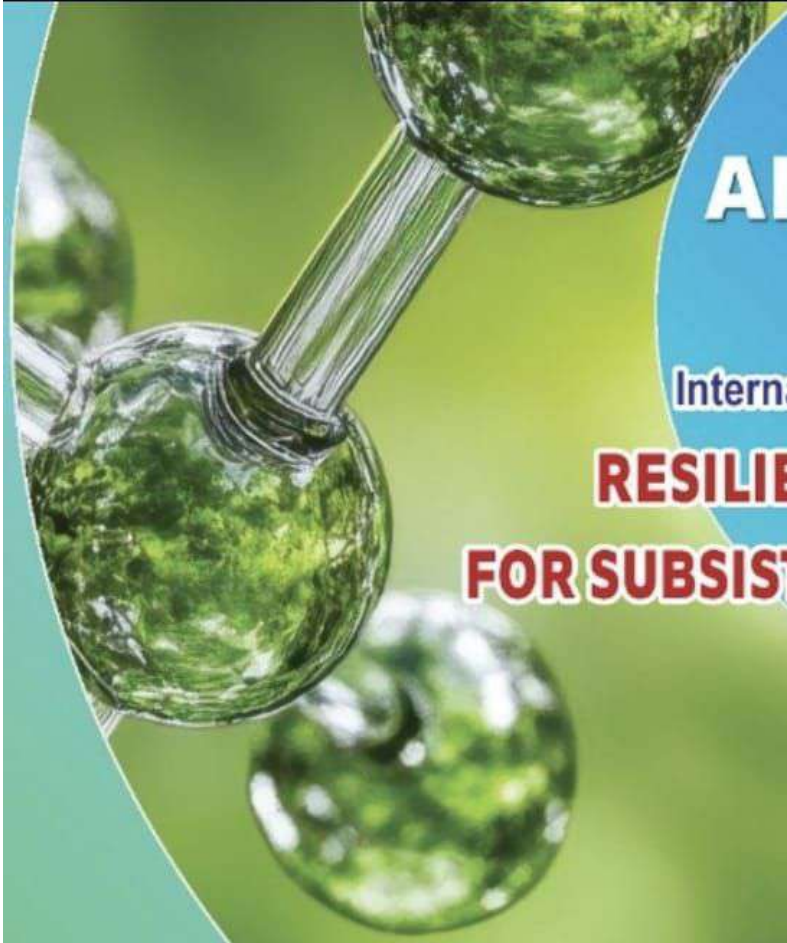

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# A Green sustainable RP-HPLC method for simultaneous estimation of atazanavir and ritonavir: development, validation and environmental impact assessment

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## ABSTRACT

This study presents the novel green analytical method for the simultaneous estimation of Atazanavir and Ritonavir in pharmaceutical dosage forms, employing ethanol as a sustainable solvent. Conventional Chromatographic methods frequently rely on acetonitrile/methanol, which poses environmental and health hazards. The developed RP-HPLC method optimizes the chromatographic conditions to align with the principles of Green Analytical Chemistry. The method was validated per the ICH Q2 A& amp; B guidelines, assessing system suitability, linearity, accuracy, precision, robustness, and forced degradation studies. A comprehensive green metrics assessment using AGREE, GAPI, and COMPLEX GAPI confirmed the method's environmental sustainability. The method demonstrated excellent linearity (r 2 ≥ 0.999), high accuracy (99.86-100.16% recovery), and precision (% RSD ≤ 2.0). Forced degradation showed acceptable levels of degradation for the drug product (5-20%) according to the ICH Q1B guidelines. Compared to traditional methods this approach significantly reduces solvent waste and enhances sustainability making it ideal for routine pharmaceutical analysis.

Keywords: Green Analytical Chemistry, RP-HPLC, Atazanavir, Ritonavir, Green solvent.