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(57) Abstract :
The present invention relates to a comprehensive safety assessment methodology for herbal medicinal plants that integrates validated analytical techniques for simultaneous evaluation of heavy metals, pesticide residues, and aflatoxin contamination. The methodology comprises atomic absorption spectroscopy for quantification of toxic heavy metals including lead, cadmium, mercury, and arsenic through dry ashing and aqua regia digestion, high-performance liquid chromatography with fluorescence detection for determination of aflatoxins B1, B2, G1, and G2 through extraction, purification, and trifluoroacetic acid derivatization, and gas chromatography-mass spectrometry for detection of thirty-one pesticide compounds through multi-stage extraction and purification. The invention was demonstrated through safety assessment of Borago officinalis Linn., revealing heavy metals within permissible limits and complete absence of aflatoxins and pesticides. The validated methods achieve high sensitivity, specificity, and repr

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