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Pesticide Residues in Fruits and Vegetables as a Teaching Innovation: an Interdisciplinary Approach to Chemistry Education

Consuelo Pizarro , Taha Mehany , Antonio-José Nistal , José M. González-Sáiz , Consuelo Pizarro

University Of La Rioja, Spain

Abstract

Innovative teaching strategies in chemistry must combine technical expertise with pedagogical approaches reflecting real-world challenges. This project was designed as an interdisciplinary teaching innovation integrating analytical chemistry, quality and safety in chemical laboratories, environmental engineering and management, and chemical projects into a collaborative framework. The case study of pesticide residues in fruits and vegetables provided a socially relevant context for students to connect theory with practice. The project was structured in interconnected components. First, students in environmental engineering and management identified key issues related to food safety, pesticide use, and sustainable agriculture. Next, students in quality and safety in chemical laboratories developed and applied advanced methods for detecting pesticide residues using gas chromatography with electron capture detector (GC-ECD) and gas chromatography coupled with tandem mass spectrometry (GC-MS). These experimental modules were complemented by workshops on sustainable agricultural practices, biopesticides, and biological control strategies, managed by projects students, fostering a broader understanding of chemistry's societal implications. Chemistry education principles ensured active engagement in teamwork, problem-solving, and scientific communication, with students preparing written reports and oral presentations to consolidate results and reflect on learning. Assessment indicated improved mastery of analytical techniques, enhanced critical perspectives on environmental and agricultural issues, and stronger skills in scientific communication. By embedding pesticide residues as a contextual teaching tool, the project enriched the curriculum, strengthened motivation, and prepared students to confront global challenges through collaborative, interdisciplinary scientific practice.

Keywords: **Pesticide Residues; Interdisciplinary Teaching; Analytical Chemistry; Food Safety; Experiential Learning.**