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Development of inductively coupled plasma-mass spectrometry method for determination of trace metals in black pepper berries

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Abstract

The inductively coupled plasma mass spectrometry (ICP-MS/MS) method was developed and validated for analysis of trace metals in black pepper berries. Pepper berries were digested using microwave assisted acid digestion procedure and analyzed using ICP-MS/MS. The acid digestion mixture, operating conditions (temperature and power) and flow rate of cell gas (helium) were optimized. Pepper berries were well digested using 3 mL of nitric acid at 220°C with a power of 1000 W. The cell gas set at a flow rate of 5 mL/min gave the best detection capacity. The optimized method attained satisfactory recovery performance (98.1–114.83%) with a low matrix effect. The response showed good linearity with correlation coefficient (R^2) above 0.999. Good selectivity and sensitivity were yielded with the limit of detection (LOD) established at < 0.01 mg/kg for all elements. The method was applied to determine five trace metals (As, Cd, Hg, Pb and Sb) present in 115 black pepper berries samples originated from six countries (Cambodia, India, Indonesia, Sri Lanka, Vietnam and Malaysia). In all of the samples tested, As and Pb were elements commonly detected and the method could determine concentrations as low as 0.01 mg/kg. This finding indicated that the ICP-MS/MS method is best efficient for routine and compliance monitoring of trace metals in black pepper berries.

Keywords

Heavy metals, Detection, Black pepper, Microwave digestion, ICP-MS.

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