ICP-MS 与原子吸收法测定藕中铜和铅的方法比较和检测结果分析

摘要

目的：通过利用电感耦合等离子体质谱仪（ICP-MS）和原子吸收光谱仪测定藕中铜和铅元素的方法比较和检测结果分析。方法：分别用微波消解器和全自动石墨消解系统（湿消解）对样品进行前处理，再用 ICP-MS 测定样品中铜和铅元素，火焰原子吸收光谱仪测定样品中铜元素，石墨炉原子吸收光谱仪测定样品中铅元素，分析结果运用统计学方法 t 检验进行比较。结果：ICP-MS 测定铜和铅元素的含量在 0-500ug/L、0-50ug/L 浓度范围内呈良好线性，相关系数为 0.9997，0.9999；全自动石墨消解检出限为 0.044mg/kg，0.020mg/kg，微波消解检出限为 0.018mg/kg，0.022mg/kg；石墨消解加标回收率在 97.3%-112.1%，87.4%-103.4%之间，相对标准偏差在 5%，5%以内；微波消解加标回收率在 93.3%-107.1%，97.4%-106.4%之间，相对标准偏差在 5%，10%以内；原子吸收法测定铜和铅元素的含量在 0-500ug/L，0-50ug/L 浓度范围内呈良好线性，相关系数为 0.9999，0.9991；石墨消解检出限为 0.106mg/kg，0.056mg/kg，微波消解检出限为 0.417mg/kg，0.036mg/kg；石墨消解加标回收率在 88.9%-100.7%，85.9%-106.4%之间，相对标准偏差在 5%，10%以内；微波消解加标回收率在 97.2%-102.1%， 82.0%-113.8%之间，相对标准偏差在 5%，10%以内；通过 t 检验比较后，ICP-MS 与原子吸收光谱法无统计学意义(差异还是意义)，但前者检出限比原子吸收法更低。结论：通过两种方法的比较实验，ICP-MS 具有分析速度快、检出限低、线性范围宽、灵敏度高等优点，更加有利于检测食品藕中铜铅元素。全自动石墨消解和微波消解两种前处理方法对实验没有明显影响。

关键词

电感耦合等离子体质谱仪；原子吸收光谱仪；食品藕；铜；铅；统计学分析

Abstract

Objective: to compare the determination results of copper and lead in lotus root byICP-MS and AAS.Methods: the samples were pretreated by Microwave and Automatic Graphite Digestion System (wet digestion),the copper and lead elements in the samples were determined by ICP-MS,The copper element in the sample was determined by flame atomic absorption spectrometry, and the lead element in the sample was determined by Graphite Furnace Atomic Absorption Spectrometry.The analysis results were compared by t test using statistical method.Results:The content of copper and lead in the ICP-MS determination showed a good linearity in the concentration range of 0-500ug/L and 0-50ug/L, and the correlation coefficient was 0.9997 and 0.9999;The LODs of Wet Digestion were 0.044mg/kg, 0.020mg/kg, and Microwave Digestion were 0.018mg/kg, 0.022mg/kg;The standard recovery of Wet Digestion were 97.3%-112.1%, 87.4%-103.4%, relative standard deviation were 5% and 5% respectively;The standard recoveries of Microwave Digestion were between 93.3% and 107.1%, 97.4% and 106.4%, and the relative standard deviation was within 5% and 10%.The content of copper and lead in aas was in the range of 0-500ug/L and 0-50ug/L with a good linear, and the correlation coefficient of 0.9999 and 0.9991.The LODs of Wet Digestion were 0.106mg/kg, 0.056mg/kg, and Microwave Digestion were 0.417mg/kg, 0.036mg/kg.The standard recovery of Wet Digestion was between 88.9% and 100.7%, 85.9% and 106.4%, and the relative standard deviation was within 5% and 10%.The standard recoveries of Microwave Digestion were 97.2% to 102.1%, 82.0% to 113.8%, and the relative standard deviation was 5% and 10% respectively.After the comparison by t test, there was no statistical significance between icp-ms and aas, but the detection limit of the former was lower than that of the former.Conclusion: ICP-MS has the advantages of rapid analysis, low detection limit, wide linear range, high sensitivity and good precision, which is more conducive to the detection of copper and lead in food lotus root. Automatic graphite digestion and microwave digestion had no significant effect on the experiment.

Keywords:Inductively coupled plasma mass spectrometer; Atomic absorption spectrometer; Food lotus root; Copper; Lead; Statistical analysis

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