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国家市场监督管理总局

国家标准化管理委员会

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**贵金属合金电镀废水化学分析方法**

**第2部分：锌、锰、铬、镉、铅、铁、铝、镍、铜、铍含量的测定**

**电感耦合等离子体原子发射光谱法**

Methods for chemical analysis of precious metals alloys electroplating wastewater—

Part 2：Determination of Zn、Mn、Cr、Cd、Pb、

Fe、Al、Ni、Cu、Be contents—

Inductively coupled plasma-atomic emission spectrometry

**(送审稿)**

GB/T ××××—××××

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前 言

本文件按照GB/T 1.1-2020《标准化工作导则第1 部分：标准化文件的结构和起草规则》的规定起草。

本文件是GB/T ××××《贵金属合金电镀废水化学分析方法》的第4部分：

——第1部分：金、银、铂、钯、铱含量的测定 电感耦合等离子体原子发射光谱法；

——第2部分：锌、锰、铬、镉、铅、铁、铝、镍、铜、铍含量的测定 电感耦合等离子体原子发射光谱法；

——第3部分：硫酸盐含量的测定 硫酸钡重量法；

——第4部分：氯离子含量的测定 氯化银浊度法。

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本文件由中国有色金属工业协会提出。

本文件由全国有色金属标准化技术委员会（SAC/TC 243）归口。

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**贵金属合金电镀废水化学分析方法**

**第2部分：锌、锰、铬、镉、铅、铁、铝、镍、铜、铍含量的测定**

**电感耦合等离子体光谱法**

**警示——使用本文件的人员应当有正规实验室工作的实践经验。本文件并未指出所有可能的安全问题。使用者有责任采取适当的安全和健康措施，并保证符合国家有关法规规定的条件。**

1 范围

本文件描述了采用电感耦合等离子体原子发射光谱法测定贵金属合金电镀及其生产加工产生的废水（如镀件漂洗水、废槽液、设备冷却水和冲洗首饰、地面水等混合水的贵金属废水）中锌、锰、铬、镉、铅、铁、铝、镍、铜、铍含量的方法。

本文件适用于以贵金属合金电镀及其生产加工产生的废水（如镀件漂洗水、废槽液、设备冷却水和冲洗首饰、地面水等混合水的贵金属废水）中、锌、锰、铬、镉、铅、铁、铝、镍、铜、铍的质量浓度的测定方法。

各元素测定范围见表 1 。

表1 元素及测定范围

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定范围  mg/mL | 元素 | 测定范围  mg/mL |
| Al | 0.0001~0.1000 | Fe | 0.0001~0.1000 |
| Be | 0.0001~0.1000 | Mn | 0.0001~0.1000 |
| Cd | 0.0001~0.1000 | Ni | 0.0001~0.1000 |
| Cr | 0.0001~0.1000 | Pb | 0.0001~0.1000 |
| Cu | 0.0001~0.1000 | Zn | 0.0001~0.1000 |

2 规范性引用文件

下列文件中的内容通过文中的规范性引用而构成本文件必不可少的条款。其中，注日期的引用文件，仅该日期对应的版本适用于本文件；不注日期的引用文件，其最新版本（包括所有的修改单）适用于本文件。

GB/T 8170 数值修约规则与极限数值的表示和判断

3 术语和定义

本文件没有需要界定的术语和定义。

4 原理

试样经高氯酸消解有机物，经王水溶解后，在盐酸、硝酸介质中，使用电感耦合等离子体光谱仪~~法~~测定贵金属合金电镀废水中锌、锰、铬、镉、砷、铅、汞、铁、铝、镍、铜、铍的含量。

5 试剂或材料

除非另有说明，在分析中仅使用确认为分析纯的试剂和实验室二级水。

5.1高氯酸：（ρ=1.76 g/mL）。

5.2 硝酸：（ρ=1.43 g/mL）。

5.3 盐酸：（ρ=1.19 g/mL）。

5.4 过氧化氢：（ρ=1.11 g/mL）

5.5 硝酸（1+1）。

5.6 盐酸（1+1）。

5.7 混合酸1：1体积硝酸（5.2）和3体积盐酸（5.3）混匀，用时现配。

5.8 混合酸2：1体积混合酸1（5.7）和1体积水混匀，用时现配。

5.9 锌标准贮存溶液：称取 0.100 0 g 金属锌（ωZn≥99.99%），置于 100 mL 聚四氟乙烯烧杯中，加入 20 mL 硝酸溶液（5.5），低温加热溶解，驱除氮的氧化物，冷却至室温，移入 100 mL 塑料容量瓶中，用水稀释至刻度，混匀。此溶液 1 mL 含 1 mg 锌。

5.10 锰标准贮存溶液：称取 0.100 0 g 金属锰（ωMn≥99.99%），置于 100 mL 聚四氟乙烯烧杯中，加入 20 mL 硝酸溶液（5.5），低温加热溶解，驱除氮的氧化物，冷却至室温，移入 100 mL 塑料容量瓶中，用水稀释至刻度，混匀。此溶液 1 mL 含 1 mg 锰。5.11 铬标准贮存溶液：称取 0.100 0 g 金属铬（ωCr≥99.99%）,置于 100 mL 聚四氟乙烯烧杯中，加入1 mL 硝酸（5.5），5 mL 盐酸（5.6），盖上聚四氟乙烯杯盖，低温加热溶解完全，移入 100 mL 塑料容量瓶中，加入 10 mL 盐酸（5.6），用水稀释至刻度，混匀。此溶液 1 mL 含 1 mg 铬。

5.12 镉标准贮存溶液：称取 0.100 0 g 金属镉（ωCd≥99.99%），置于 100 mL 聚四氟乙烯烧杯中，加入 20 mL 硝酸溶液（5.5），低温加热溶解，挥发驱除氮的氧化物，冷却至室温，移入 100 mL 塑料容量瓶中，用水稀释至刻度，混匀。此溶液 1 mL 含 1 mg 镉。5.13 铅标准贮存溶液：称取 0.100 0 g 金属铅（ωPb≥99.99%），置于 100 mL 聚四氟乙烯烧杯中，加入 20 mL 硝酸溶液（5.5），低温加热溶解，驱除氮的氧化物，冷却至室温，移入 100 mL 塑料容量瓶中，用水稀释至刻度，混匀。此溶液 1 mL 含 1 mg 铅。5.14 铁标准贮存溶液：称取 0.100 0 g 金属铁（ωFe≥99.99%），置于 100 mL 聚四氟乙烯烧杯中，加入 20 mL 硝酸溶液（5.5），低温加热溶解，驱除氮的氧化物，冷却至室温，移入 100 mL 塑料容量瓶中，用水稀释至刻度，混匀。此溶液 1 mL 含 1 mg 铁。5.15 铝标准贮存溶液：称取 0.100 0 g 金属铝（ωAl≥99.99%），置于 100 mL 聚四氟乙烯烧杯中，加入 20 mL 盐酸溶液（5.6），低温加热溶解，冷却至室温，用盐酸溶液（5.6）移入 100 mL 塑料容量瓶中并稀释至刻度，混匀。此溶液 1 mL 含 1 mg 铝。

5.16 镍标准贮存溶液：称取 0.100 0 g 金属镍（ωNi≥99.99%），置于 100 mL 聚四氟乙烯烧杯中，加 入 20 mL 硝酸溶液（5.5），低温加热溶解，驱除氮的氧化物，冷却至室温，移入 100 mL 塑料容量瓶 中，用水稀释至刻度，混匀。此溶液 1 mL 含 1 mg 镍。

5.17 铜标准贮存溶液：称取 0.100 0 g 金属铜（ωCu≥99.99%），置于 100 mL 聚四氟乙烯烧杯中，加入 20 mL 硝酸溶液（5.5），低温加热溶解，驱除氮的氧化物，冷却至室温，移入 100 mL 塑料容量瓶中，用水稀释至刻度，混匀。此溶液 1 mL 含 1 mg 铜。

5.18 铍标准贮存溶液：称取 0.100 0 g金属铍（ωBe≥99.95%），置于 100 mL 聚四氟乙烯烧杯中，加入20mL盐酸（5.6），低温加热至溶解完全，冷却，移入100mL容量瓶中，以水稀释至刻度，混匀。此溶液1mL含1mg铍。

5.19 混合标准溶液1（10μg/mL）：分别移取5.9-5.18标准溶液1mL，以水定容到100mL。

5.20 氩气（体积分数≥99.999%）

6 仪器设备

电感耦合等离子体原子发射光谱仪。在仪器最佳工作条件下，凡能达到下列指标着均可使用：

a) 光源：氩气等离子体光源，发射器最大输出功率不小于1.3KW。

b) 分辨率：200nm左右时的光学分辨率优于0.010nm；400nm左右时的光学分辨率优于0.020nm。

c) 仪器稳定性：仪器1h内稳定性（RSD）不大于2.0%

d) 推荐的元素分析谱线参见附录B

e) 推荐的元素分析谱线波长参见附录B。

7 样品

样品储存于塑料瓶中备用。

8 试验步骤

8.1 试料

用移液枪（6.4）按表2所示分档准确移取试料，精确到0.005mL。

表2 试料表

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 浓度范围  mg/mL | 取样体积  mL | 总稀释倍数 |
| Al | 0.0001~0.0050 | 100 | 1 |
| Be |
| Cd |
| Cr |
| Cu |
| Fe |
| Mn |
| Ni |
| Pb |
| Zn |
| Al | 0.0050~0.0500 | 10 | 10 |
| Be |
| Cd |
| Cr |
| Cu |
| Fe |
| Mn |
| Ni |
| Pb |
| Zn |
| Al | 0.0500~0.1000 | 5 | 20 |
| Be |
| Cd |
| Cr |

表2 试料表（续）

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 浓度范围  mg/mL | 取样体积  mL | 总稀释倍数 |
| Cu | 0.0500~0.1000 | 5 | 20 |
| Fe |
| Mn |
| Ni |
| Pb |
| Zn |

8.2 平行实验

独立进行两次测定，取其平均值。

8.3 空白实验

随同试料做空白试验。

8.4 标准曲线

8.4.1于一组100mL的容量瓶中，加入10mL混合酸2（5.7）和15mL盐酸（5.3），移取混合标准溶液1（5.18）0mL、0.4mL、1 mL、5 mL、10 mL 、20 mL、50 mL，根据各元素的测定范围配置标准溶液，以水稀释至刻度，摇匀。

8.4.2 在与测量试料溶液相同的条件下，采用电感耦合等离子体原子发射光谱仪在选定的最佳仪器条件下按选定的的各元素的波长，测定锌、锰、铬、镉、砷、铅、汞、铁、铝、镍、铜、铍各元素的发射强度，减去标准溶液中“零”浓度溶液的强度，以锌、锰、铬、镉、砷、铅、汞、铁、铝、镍、铜、铍各元素的浓度为横坐标，发射强度为纵坐标，绘制工作曲线。曲线方程的相关系数不小于0.999。

8.5测定

8.5.1 按表3所示移取样品至200mL烧杯中，加入5mL高氯酸（5.1），盖上表皿，蒸至冒高氯酸烟，继续加热至湿盐状，取下稍冷，加入30mL水，再加入15mL盐酸（5.3），加入10mL混合酸2（5.7），加热溶解样品，至盐类完全溶解，将试液取下稍冷后转入容量瓶，加入适量水混匀，待完全冷却后，用水稀释至刻度，混匀，待测。

8.5.2 采用电感耦合等离子体原子发射光谱仪在选定的最佳仪器条件下按选定的各元素的波长，测定锌、锰、铬、镉、砷、铅、汞、铁、铝、镍、铜、铍各元素的发射强度，减去试料空白试验溶液的强度以工作曲线计算出锌、锰、铬、镉、砷、铅、汞、铁、铝、镍、铜、铍的含量。

9 实验数据处理

按式（1）计算被测元素的质量浓度C，数值以mg/mL表示：

… … … … … … … …（1）

式中：

——试料溶液中被测元素的浓度，单位为毫克每升mg/L；

——试料溶液定容体积，单位为毫升mL；

——空白溶液中被测元素的浓度，单位为毫克每升mg/L；

——空白溶液定容体积，单位为毫升mL；

——样品取样体积，单位为毫升mL；

计算结果保留至小数点后两位有效数字。

10精密度

10.1重复性

在重复性条件下获得的两次独立测试结果的测定值，在以下给出的平均值范围内，这两个测试结果的绝对值不超过重复性限（r），超过重复性限（r）的情况不超过 5%，重复性限（r）按表 3 数据采用线性内插法求得。

表 4 重复性限

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 铝（Al） mg/mL | 0.0003 | 0.0218 | 0.1030 | 铁（Fe) mg/mL | 0.0011 | 0.0246 | 0.1031 |
| r/% | 0.0001 | 0.0012 | 0.0055 | r/% | 0.0003 | 0.0011 | 0.0028 |
| 铍（Be） mg/mL | 0.0050 | 0.0202 | 0.0997 | 镍（Ni) mg/mL | 0.0002 | 0.0184 | 0.0973 |
| r/% | 0.0003 | 0.0011 | 0.0022 | r/% | 0.0001 | 0.0008 | 0.0016 |
| 镉（Cd） mg/mL | 0.0001 | 0.0201 | 0.0998 | 锰（Mn) mg/mL | 0.0009 | 0.0213 | 0.0986 |
| r/% | 0.0001 | 0.0007 | 0.0013 | r/% | 0.0002 | 0.0007 | 0.0020 |
| 铬（Cr） mg/mL | 0.0002 | 0.0208 | 0.0971 | 铅（Pb) mg/mL | 0.0009 | 0.0201 | 0.0990 |
| r/% | 0.0001 | 0.0007 | 0.0029 | r/% | 0.0001 | 0.0013 | 0.0026 |
| 铜（Cu) mg/mL | 0.0001 | 0.0700 | 0.1019 | 锌（Zn) mg/mL | 0.0003 | 0.0217 | 0.1009 |
| r/% | 0.0000 | 0.0018 | 0.0017 | r/% | 0.0001 | 0.0006 | 0.0017 |

10.2再现性

在再现性条件下获得的两次独立测试结果的测定值，在以下给出的平均值范围内，这两个测试结 果的绝对值不超过再现性限（R），超过再现性限（R）的情况不超过 5%，再现性限（R）按表 4 数据 采用线性内插法求得。

表5 再现性限

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 铝（Al） mg/mL | 0.0003 | 0.0218 | 0.1030 | 铁（Fe) mg/mL | 0.0011 | 0.0246 | 0.1031 |
| R/% | 0.0002 | 0.0018 | 0.0105 | R/% | 0.0006 | 0.0036 | 0.0115 |
| 铍（Be） mg/mL | 0.0050 | 0.0202 | 0.0997 | 镍（Ni) mg/mL | 0.0002 | 0.0184 | 0.0973 |
| R/% | 0.0004 | 0.0029 | 0.0045 | R/% | 0.0001 | 0.0161 | 0.0039 |
| 镉（Cd） mg/mL | 0.0001 | 0.0201 | 0.0998 | 锰（Mn) mg/mL | 0.0009 | 0.0213 | 0.0986 |
| R/% | 0.0001 | 0.0015 | 0.0056 | R/% | 0.0003 | 0.0033 | 0.0037 |
| 铬（Cr） mg/mL | 0.0002 | 0.0208 | 0.0971 | 铅（Pb) mg/mL | 0.0009 | 0.0201 | 0.0990 |
| R/% | 0.0001 | 0.0012 | 0.0069 | R/% | 0.0002 | 0.0016 | 0.0041 |
| 铜（Cu) mg/mL | 0.0001 | 0.0700 | 0.1019 | 锌（Zn) mg/mL | 0.0003 | 0.0217 | 0.1009 |
| R/% | 0.0000 | 0.0228 | 0.0057 | R/% | 0.0002 | 0.0099 | 0.0277 |

11 试验报告

本章规定试验报告所包括的内容。至少应给出以下几个方面的内容：

——试验对象；

——使用的文件（GB/T ××××. ×-202×）；

——分析结果及其表示；

——与基本分析步骤的差异；

——测定中观察到的异常现象；

——试验日期。

附 录A

（资料性）

精密度试验原始数据

精密度数据是由10家实验室对不同贵金属合金电镀废液中所测元素含量的10个不同水平样品进行共同试验确定的。每个实验室对每个水平的所测元素含量在重复性条件下独立测定7次。测定的原始数据见表A.1- A.10。

表A.1 验证单位一方法精密度实验

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 样品编号 | 平均值 | 样品含量 mg/mL | | | | | | | | | | |
| 铝（Al） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0000 | 0.68 |
| 1#-1 | 0.0102 | 0.0101 | 0.0103 | 0.0103 | 0.0102 | 0.0101 | 0.0102 | 0.0103 | 0.0103 | 0.0101 | 0.0001 | 0.96 |
| 2# | 0.0022 | 0.0022 | 0.0022 | 0.0022 | 0.0022 | 0.0022 | 0.0022 | 0.0022 | 0.0022 | 0.0022 | 0.0000 | 0.84 |
| 2#-1 | 0.0222 | 0.0221 | 0.0222 | 0.0223 | 0.0224 | 0.0223 | 0.0222 | 0.0222 | 0.0224 | 0.0221 | 0.0001 | 0.42 |
| 3# | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0000 | 0.75 |
| 3#-1 | 0.1005 | 0.1004 | 0.1004 | 0.1004 | 0.1005 | 0.1005 | 0.1006 | 0.1006 | 0.1006 | 0.1004 | 0.0001 | 0.08 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0050 | 0.0050 | 0.0050 | 0.0050 | 0.0051 | 0.0050 | 0.0050 | 0.0050 | 0.0051 | 0.0050 | 0.0000 | 0.97 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0512 | 0.0510 | 0.0511 | 0.0511 | 0.0507 | 0.0512 | 0.0512 | 0.0517 | 0.0517 | 0.0507 | 0.0003 | 0.60 |
| 样品编号 | 铍（Be） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0108 | 0.0108 | 0.0108 | 0.0108 | 0.0108 | 0.0108 | 0.0110 | 0.0109 | 0.0110 | 0.0108 | 0.0001 | 0.73 |
| 2# | - | - | - | - | - | - | - | - | — | — | — | — |
| 2#-1 | 0.0207 | 0.0209 | 0.0206 | 0.0209 | 0.0207 | 0.0206 | 0.0205 | 0.0207 | 0.0209 | 0.0205 | 0.0002 | 0.78 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0997 | 0.0996 | 0.0997 | 0.0997 | 0.1000 | 0.0997 | 0.0998 | 0.0997 | 0.1000 | 0.0996 | 0.0001 | 0.13 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0049 | 0.0050 | 0.0049 | 0.0049 | 0.0049 | 0.0050 | 0.0050 | 0.0049 | 0.0050 | 0.0049 | 0.0000 | 0.97 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0494 | 0.0490 | 0.0490 | 0.0492 | 0.0493 | 0.0496 | 0.0497 | 0.0497 | 0.0497 | 0.0490 | 0.0003 | 0.61 |
| 样品编号 | 镉（Cd） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0000 | 1.46 |
| 1#-1 | 0.0106 | 0.0106 | 0.0106 | 0.0105 | 0.0106 | 0.0106 | 0.0106 | 0.0106 | 0.0106 | 0.0105 | 0.0000 | 0.31 |
| 2# | - | - | - | - | - | - | - | - | — | — | — | — |
| 2#-1 | 0.0201 | 0.0201 | 0.0201 | 0.0201 | 0.0201 | 0.0201 | 0.0201 | 0.0200 | 0.0201 | 0.0200 | 0.0000 | 0.12 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.1001 | 0.0999 | 0.1003 | 0.1002 | 0.1003 | 0.1002 | 0.0996 | 0.1001 | 0.1003 | 0.0996 | 0.0003 | 0.25 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0053 | 0.0053 | 0.0053 | 0.0053 | 0.0052 | 0.0053 | 0.0053 | 0.0053 | 0.0053 | 0.0052 | 0.0000 | 0.94 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0504 | 0.0507 | 0.0504 | 0.0503 | 0.0504 | 0.0502 | 0.0504 | 0.0502 | 0.0507 | 0.0502 | 0.0002 | 0.34 |
| 样品编号 | 铬（Cr） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0001 | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0001 | 0.0000 | 0.72 |
| 1#-1 | 0.0100 | 0.0100 | 0.0100 | 0.0100 | 0.0101 | 0.0101 | 0.0100 | 0.0101 | 0.0101 | 0.0100 | 0.0000 | 0.48 |
| 2# | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0000 | 0.71 |
| 2#-1 | 0.0210 | 0.0209 | 0.0209 | 0.0210 | 0.0209 | 0.0210 | 0.0209 | 0.0211 | 0.0211 | 0.0209 | 0.0001 | 0.33 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0942 | 0.0937 | 0.0942 | 0.0939 | 0.0942 | 0.0942 | 0.0945 | 0.0947 | 0.0947 | 0.0937 | 0.0003 | 0.37 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0050 | 0.0050 | 0.0049 | 0.0050 | 0.0050 | 0.0049 | 0.0050 | 0.0049 | 0.0050 | 0.0049 | 0.0000 | 0.87 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0482 | 0.0481 | 0.0481 | 0.0482 | 0.0480 | 0.0482 | 0.0484 | 0.0486 | 0.0486 | 0.0480 | 0.0002 | 0.46 |
| 样品编号 | 铜（Cu） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0643 | 0.0646 | 0.0643 | 0.0641 | 0.0643 | 0.0641 | 0.0643 | 0.0644 | 0.0646 | 0.0641 | 0.0002 | 0.24 |
| 1#-1 | 0.0754 | 0.0752 | 0.0757 | 0.0754 | 0.0752 | 0.0756 | 0.0757 | 0.0753 | 0.0757 | 0.0752 | 0.0002 | 0.30 |
| 2# | 0.0477 | 0.0473 | 0.0477 | 0.0476 | 0.0477 | 0.0484 | 0.0477 | 0.0475 | 0.0484 | 0.0473 | 0.0003 | 0.71 |
| 2#-1 | 0.0676 | 0.0674 | 0.0676 | 0.0677 | 0.0677 | 0.0675 | 0.0677 | 0.0675 | 0.0677 | 0.0674 | 0.0001 | 0.17 |
| 3# | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0000 | 0.85 |
| 3#-1 | 0.1015 | 0.1010 | 0.1013 | 0.1011 | 0.1015 | 0.1015 | 0.1019 | 0.1020 | 0.1020 | 0.1010 | 0.0004 | 0.39 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0049 | 0.0049 | 0.0049 | 0.0049 | 0.0050 | 0.0050 | 0.0049 | 0.0049 | 0.0050 | 0.0049 | 0.0000 | 0.77 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0500 | 0.0498 | 0.0496 | 0.0501 | 0.0497 | 0.0502 | 0.0504 | 0.0504 | 0.0504 | 0.0496 | 0.0003 | 0.68 |
| 样品编号 | 铁（Fe） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0103 | 0.0103 | 0.0103 | 0.0103 | 0.0103 | 0.0103 | 0.0103 | 0.0103 | 0.0103 | 0.0103 | 0.0000 | 0.21 |
| 2# | 0.0047 | 0.0048 | 0.0048 | 0.0047 | 0.0048 | 0.0048 | 0.0047 | 0.0047 | 0.0048 | 0.0047 | 0.0000 | 0.97 |
| 2#-1 | 0.0248 | 0.0247 | 0.0245 | 0.0249 | 0.0247 | 0.0251 | 0.0246 | 0.0249 | 0.0251 | 0.0245 | 0.0002 | 0.78 |
| 3# | 0.0011 | 0.0011 | 0.0011 | 0.0011 | 0.0011 | 0.0011 | 0.0011 | 0.0011 | 0.0011 | 0.0011 | 0.0000 | 0.89 |
| 3#-1 | 0.1107 | 0.1112 | 0.1105 | 0.1104 | 0.1105 | 0.1102 | 0.1109 | 0.1110 | 0.1112 | 0.1102 | 0.0004 | 0.33 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0052 | 0.0052 | 0.0051 | 0.0052 | 0.0052 | 0.0052 | 0.0052 | 0.0051 | 0.0052 | 0.0051 | 0.0000 | 0.89 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0499 | 0.0498 | 0.0498 | 0.0499 | 0.0497 | 0.0501 | 0.0500 | 0.0502 | 0.0502 | 0.0497 | 0.0002 | 0.39 |
| 样品编号 | 锰（Mn） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0103 | 0.0103 | 0.0103 | 0.0103 | 0.0103 | 0.0104 | 0.0104 | 0.0104 | 0.0104 | 0.0103 | 0.0001 | 0.49 |
| 2# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0000 | 2.72 |
| 2#-1 | 0.0201 | 0.0202 | 0.0200 | 0.0203 | 0.0202 | 0.0203 | 0.0199 | 0.0200 | 0.0203 | 0.0199 | 0.0002 | 0.92 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0960 | 0.0956 | 0.0958 | 0.0961 | 0.0958 | 0.0958 | 0.0963 | 0.0966 | 0.0966 | 0.0956 | 0.0004 | 0.37 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0052 | 0.0051 | 0.0051 | 0.0052 | 0.0051 | 0.0052 | 0.0051 | 0.0052 | 0.0051 | 0.0000 | 0.85 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0488 | 0.0485 | 0.0491 | 0.0485 | 0.0487 | 0.0485 | 0.0490 | 0.0495 | 0.0495 | 0.0485 | 0.0004 | 0.82 |
| 样品编号 | 镍（Ni） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0056 | 0.0056 | 0.0056 | 0.0057 | 0.0056 | 0.0056 | 0.0056 | 0.0057 | 0.0057 | 0.0056 | 0.0000 | 0.65 |
| 1#-1 | 0.0162 | 0.0161 | 0.0162 | 0.0162 | 0.0163 | 0.0163 | 0.0165 | 0.0161 | 0.0165 | 0.0161 | 0.0001 | 0.71 |
| 2# | 0.0009 | 0.0009 | 0.0010 | 0.0009 | 0.0010 | 0.0009 | 0.0010 | 0.0009 | 0.0010 | 0.0009 | 0.0000 | 2.78 |
| 2#-1 | 0.0212 | 0.0212 | 0.0213 | 0.0214 | 0.0212 | 0.0214 | 0.0209 | 0.0210 | 0.0214 | 0.0209 | 0.0002 | 0.83 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0987 | 0.0981 | 0.0988 | 0.0987 | 0.0986 | 0.0985 | 0.0992 | 0.0993 | 0.0993 | 0.0981 | 0.0004 | 0.41 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0053 | 0.0053 | 0.0052 | 0.0053 | 0.0054 | 0.0053 | 0.0053 | 0.0052 | 0.0054 | 0.0052 | 0.0001 | 1.00 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0499 | 0.0499 | 0.0498 | 0.0498 | 0.0496 | 0.0500 | 0.0500 | 0.0503 | 0.0503 | 0.0496 | 0.0002 | 0.44 |
| 样品编号 | 铅（Pb） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0009 | 0.0009 | 0.0009 | 0.0009 | 0.0009 | 0.0009 | 0.0009 | 0.0009 | 0.0009 | 0.0009 | 0.0000 | 1.81 |
| 1#-1 | 0.0105 | 0.0103 | 0.0106 | 0.0106 | 0.0104 | 0.0106 | 0.0106 | 0.0105 | 0.0106 | 0.0103 | 0.0001 | 0.90 |
| 2# | 0.0005 | 0.0004 | 0.0005 | 0.0004 | 0.0005 | 0.0004 | 0.0005 | 0.0005 | 0.0005 | 0.0004 | 0.0000 | 5.87 |
| 2#-1 | 0.0199 | 0.0202 | 0.0201 | 0.0201 | 0.0198 | 0.0202 | 0.0195 | 0.0194 | 0.0202 | 0.0194 | 0.0003 | 1.63 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.1004 | 0.0997 | 0.1005 | 0.1000 | 0.1005 | 0.1001 | 0.1010 | 0.1006 | 0.1010 | 0.0997 | 0.0004 | 0.43 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0050 | 0.0049 | 0.0048 | 0.0049 | 0.0051 | 0.0050 | 0.0051 | 0.0049 | 0.0051 | 0.0048 | 0.0001 | 2.34 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0502 | 0.0501 | 0.0501 | 0.0500 | 0.0499 | 0.0502 | 0.0506 | 0.0507 | 0.0507 | 0.0499 | 0.0003 | 0.59 |
| 样品编号 | 锌（Zn） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0143 | 0.0142 | 0.0142 | 0.0142 | 0.0142 | 0.0143 | 0.0143 | 0.0144 | 0.0144 | 0.0142 | 0.0001 | 0.43 |
| 1#-1 | 0.0246 | 0.0246 | 0.0247 | 0.0245 | 0.0248 | 0.0248 | 0.0243 | 0.0244 | 0.0248 | 0.0243 | 0.0002 | 0.73 |
| 2# | 0.0006 | 0.0007 | 0.0007 | 0.0006 | 0.0006 | 0.0006 | 0.0006 | 0.0006 | 0.0007 | 0.0006 | 0.0000 | 1.72 |
| 2#-1 | 0.0207 | 0.0209 | 0.0206 | 0.0209 | 0.0207 | 0.0205 | 0.0205 | 0.0205 | 0.0209 | 0.0205 | 0.0002 | 0.87 |
| 3# | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0000 | 1.93 |
| 3#-1 | 0.1043 | 0.1038 | 0.1042 | 0.1039 | 0.1044 | 0.1044 | 0.1048 | 0.1049 | 0.1049 | 0.1038 | 0.0004 | 0.39 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0048 | 0.0049 | 0.0048 | 0.0047 | 0.0049 | 0.0048 | 0.0048 | 0.0048 | 0.0049 | 0.0047 | 0.0000 | 0.98 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0518 | 0.0517 | 0.0516 | 0.0517 | 0.0515 | 0.0518 | 0.0520 | 0.0522 | 0.0522 | 0.0515 | 0.0002 | 0.48 |

表A.2 验证单位二方法精密度实验

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 铝含量精密度实验数据 | | | | | | | | | |
| 样品编号 | 结果（mg/mL） | | | | | | | 平均值（mg/mL） | RSD/% |
| 1# | 0.0005 | 0.0006 | 0.0006 | 0.0005 | 0.0005 | 0.0006 | 0.0006 | 0.0005 | 8.98 |
| 1#-1 | 0.0113 | 0.0108 | 0.011 | 0.0106 | 0.0115 | 0.0109 | 0.0111 | 0.011 | 2.76 |
| 2# | 0.0028 | 0.0028 | 0.0023 | 0.0025 | 0.0022 | 0.0025 | 0.0026 | 0.0025 | 4.69 |
| 2#-1 | 0.0205 | 0.0214 | 0.02 | 0.0203 | 0.0214 | 0.0211 | 0.0209 | 0.0208 | 2.63 |
| 3# | 0.0009 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.0009 | 0.001 | 5.3 |
| 3#-1 | 0.1005 | 0.1028 | 0.1025 | 0.1018 | 0.1019 | 0.1026 | 0.102 | 0.102 | 0.75 |
| 4# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 4#-1 | 0.0053 | 0.0054 | 0.0054 | 0.005 | 0.0049 | 0.0052 | 0.0051 | 0.0052 | 3.76 |
| 5# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 5#-1 | 0.0509 | 0.0507 | 0.0506 | 0.0503 | 0.0508 | 0.0512 | 0.0511 | 0.0508 | 0.6 |
| 铍含量精密度实验数据 | | | | | | | | | |
| 样品编号 | 结果（mg/mL） | | | | | | | 平均值（mg/mL） | RSD/% |
| 1# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 1#-1 | 0.0094 | 0.0095 | 0.0093 | 0.0092 | 0.0095 | 0.0096 | 0.0095 | 0.0094 | 1.43 |
| 2# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 2#-1 | 0.0185 | 0.0184 | 0.0183 | 0.0184 | 0.0186 | 0.0185 | 0.0181 | 0.0184 | 0.9 |
| 3# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 3#-1 | 0.0973 | 0.0991 | 0.0987 | 0.0976 | 0.0977 | 0.0997 | 0.0985 | 0.0984 | 0.89 |
| 4# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 4#-1 | 0.005 | 0.0051 | 0.005 | 0.0052 | 0.0052 | 0.0052 | 0.005 | 0.0051 | 1.96 |
| 5# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 5#-1 | 0.052 | 0.0514 | 0.0518 | 0.0508 | 0.0516 | 0.0506 | 0.0511 | 0.0513 | 1.01 |
| 镉含量精密度实验数据 | | | | | | | | | |
| 样品编号 | 结果（mg/mL） | | | | | | | 平均值（mg/mL） | RSD/% |
| 1# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 1#-1 | 0.0095 | 0.0098 | 0.0097 | 0.0095 | 0.0096 | 0.0095 | 0.0093 | 0.0096 | 1.69 |
| 2# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 2#-1 | 0.0188 | 0.019 | 0.0192 | 0.0195 | 0.0192 | 0.0191 | 0.0187 | 0.0191 | 1.41 |
| 3# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 3#-1 | 0.0955 | 0.0971 | 0.0962 | 0.0963 | 0.0969 | 0.0974 | 0.0959 | 0.0965 | 0.71 |
| 4# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 4#-1 | 0.005 | 0.0049 | 0.0049 | 0.005 | 0.005 | 0.0049 | 0.0049 | 0.0049 | 1.08 |
| 5# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 5#-1 | 0.0505 | 0.0512 | 0.0512 | 0.0508 | 0.0506 | 0.0509 | 0.051 | 0.0509 | 0.54 |
| 铬含量精密度实验数据 | | | | | | | | | |
| 样品编号 | 结果（mg/mL） | | | | | | | 平均值（mg/mL） | RSD/% |
| 1# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 1#-1 | 0.0097 | 0.0097 | 0.0096 | 0.0095 | 0.0091 | 0.0098 | 0.0096 | 0.0096 | 2.32 |
| 2# | 0.0008 | 0.0009 | 0.0009 | 0.0009 | 0.0009 | 0.0009 | 0.0009 | 0.0009 | 6.02 |
| 2#-1 | 0.0199 | 0.0204 | 0.0195 | 0.0207 | 0.0197 | 0.0196 | 0.0202 | 0.02 | 2.24 |
| 3# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 3#-1 | 0.0986 | 0.0984 | 0.0985 | 0.0993 | 0.0983 | 0.0995 | 0.0985 | 0.0987 | 0.78 |
| 4# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 4#-1 | 0.0048 | 0.0046 | 0.0048 | 0.0051 | 0.0049 | 0.0045 | 0.0047 | 0.0048 | 4.14 |
| 5# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 5#-1 | 0.0465 | 0.0472 | 0.0485 | 0.0468 | 0.0471 | 0.0469 | 0.0459 | 0.047 | 1.7 |
| 铜含量精密度实验数据 | | | | | | | | | |
| 样品编号 | 结果（mg/mL） | | | | | | | 平均值（mg/mL） | RSD/% |
| 1# | 0.0639 | 0.0636 | 0.0656 | 0.0642 | 0.062 | 0.0648 | 0.0638 | 0.064 | 1.72 |
| 1#-1 | 0.0777 | 0.0782 | 0.0786 | 0.0788 | 0.0795 | 0.0791 | 0.0775 | 0.0785 | 0.93 |
| 2# | 0.0465 | 0.0471 | 0.0468 | 0.0476 | 0.0465 | 0.048 | 0.0462 | 0.047 | 1.38 |
| 2#-1 | 0.0665 | 0.0668 | 0.0675 | 0.0682 | 0.0659 | 0.0665 | 0.0684 | 0.0671 | 1.4 |
| 3# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 3#-1 | 0.1007 | 0.1018 | 0.1024 | 0.1018 | 0.1015 | 0.1026 | 0.1014 | 0.1017 | 0.63 |
| 4# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 4#-1 | 0.0043 | 0.0041 | 0.0042 | 0.0045 | 0.0043 | 0.0046 | 0.0043 | 0.0043 | 3.94 |
| 5# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 5#-1 | 0.0479 | 0.0483 | 0.0492 | 0.0484 | 0.0482 | 0.0475 | 0.0471 | 0.0481 | 1.41 |
| 铁含量精密度实验数据 | | | | | | | | | |
| 样品编号 | 结果（mg/mL） | | | | | | | 平均值（mg/mL） | RSD/% |
| 1# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 1#-1 | 0.0107 | 0.0102 | 0.0106 | 0.0103 | 0.0108 | 0.0102 | 0.011 | 0.0105 | 2.91 |
| 2# | 0.0042 | 0.004 | 0.0041 | 0.0043 | 0.0046 | 0.0042 | 0.0045 | 0.0043 | 5.01 |
| 2#-1 | 0.0251 | 0.0245 | 0.0248 | 0.0242 | 0.0239 | 0.0248 | 0.0246 | 0.0246 | 1.64 |
| 3# | 0.0019 | 0.002 | 0.0019 | 0.0012 | 0.0014 | 0.0016 | 0.0019 | 0.0017 | 17.97 |
| 3#-1 | 0.0983 | 0.0995 | 0.0993 | 0.0983 | 0.099 | 0.0992 | 0.0977 | 0.0988 | 0.67 |
| 4# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 4#-1 | 0.0045 | 0.0046 | 0.0048 | 0.0049 | 0.005 | 0.0046 | 0.0047 | 0.0047 | 3.81 |
| 5# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 5#-1 | 0.0487 | 0.0495 | 0.0478 | 0.0483 | 0.0489 | 0.049 | 0.0488 | 0.0487 | 1.11 |
| 锰含量精密度实验数据 | | | | | | | | | |
| 样品编号 | 结果（mg/mL） | | | | | | | 平均值（mg/mL） | RSD/% |
| 1# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 1#-1 | 0.009 | 0.0093 | 0.0092 | 0.009 | 0.0096 | 0.0093 | 0.0092 | 0.0092 | 2.17 |
| 2# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 2#-1 | 0.0197 | 0.0189 | 0.0194 | 0.0192 | 0.0187 | 0.0196 | 0.0194 | 0.0193 | 1.89 |
| 3# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 3#-1 | 0.0956 | 0.0961 | 0.0965 | 0.0954 | 0.0957 | 0.0964 | 0.0946 | 0.0957 | 0.67 |
| 4# | 0.0002 | 0.0001 | 0.0002 | 0.0002 | 0.0002 | 0.0001 | 0.0002 | 0.0002 | 28.46 |
| 4#-1 | 0.0053 | 0.005 | 0.005 | 0.0045 | 0.0043 | 0.0046 | 0.0043 | 0.0047 | 8.25 |
| 5# | 0.0002 | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0001 | 0.0002 | 0.0002 | 34.02 |
| 5#-1 | 0.051 | 0.0508 | 0.0509 | 0.0505 | 0.0502 | 0.0503 | 0.0494 | 0.0504 | 1.09 |
| 镍含量精密度实验数据 | | | | | | | | | |
| 样品编号 | 结果（mg/mL） | | | | | | | 平均值（mg/mL） | RSD/% |
| 1# | 0.0048 | 0.0058 | 0.005 | 0.0053 | 0.0049 | 0.0051 | 0.0055 | 0.0052 | 6.84 |
| 1#-1 | 0.0152 | 0.0159 | 0.0152 | 0.0161 | 0.0157 | 0.0151 | 0.0163 | 0.0156 | 3.08 |
| 2# | 0.0007 | 0.0008 | 0.0009 | 0.0009 | 0.0009 | 0.001 | 0.0009 | 0.0009 | 10.41 |
| 2#-1 | 0.0217 | 0.0228 | 0.0207 | 0.0211 | 0.0221 | 0.021 | 0.0214 | 0.0215 | 3.34 |
| 3# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 3#-1 | 0.0958 | 0.0965 | 0.095 | 0.0966 | 0.0971 | 0.0967 | 0.0969 | 0.0964 | 0.76 |
| 4# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 4#-1 | 0.0049 | 0.0048 | 0.0048 | 0.0049 | 0.0048 | 0.005 | 0.0049 | 0.0049 | 1.55 |
| 5# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 5#-1 | 0.0489 | 0.0489 | 0.0494 | 0.0499 | 0.0501 | 0.05 | 0.0495 | 0.0495 | 1.01 |
| 铅含量精密度实验数据 | | | | | | | | | |
| 样品编号 | 结果（mg/mL） | | | | | | | 平均值（mg/mL） | RSD/% |
| 1# | 0.001 | 0.0009 | 0.0008 | 0.0009 | 0.0009 | 0.0008 | 0.001 | 0.0009 | 9.07 |
| 1#-1 | 0.0101 | 0.0099 | 0.0098 | 0.01 | 0.0104 | 0.0096 | 0.0103 | 0.01 | 2.79 |
| 2# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 2#-1 | 0.0189 | 0.019 | 0.0198 | 0.0192 | 0.0193 | 0.0198 | 0.0198 | 0.0194 | 2.04 |
| 3# | 0.0002 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 22.84 |
| 3#-1 | 0.0976 | 0.0984 | 0.0982 | 0.0972 | 0.0979 | 0.0984 | 0.0981 | 0.098 | 0.45 |
| 4# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 4#-1 | 0.0051 | 0.005 | 0.0056 | 0.0052 | 0.0051 | 0.0052 | 0.0051 | 0.0052 | 3.76 |
| 5# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 5#-1 | 0.0516 | 0.051 | 0.0509 | 0.0511 | 0.051 | 0.0509 | 0.0508 | 0.051 | 0.52 |
| 锌含量精密度实验数据 | | | | | | | | | |
| 样品编号 | 结果（mg/mL） | | | | | | | 平均值（mg/mL） | RSD/% |
| 1# | 0.0136 | 0.0138 | 0.0138 | 0.0136 | 0.0138 | 0.0139 | 0.0137 | 0.0137 | 0.77 |
| 1#-1 | 0.0236 | 0.0242 | 0.0239 | 0.0235 | 0.0241 | 0.0241 | 0.0241 | 0.0239 | 1.12 |
| 2# | 0.0007 | 0.0007 | 0.0007 | 0.0006 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 3.11 |
| 2#-1 | 0.0209 | 0.0207 | 0.021 | 0.0211 | 0.0207 | 0.021 | 0.0212 | 0.021 | 0.95 |
| 3# | 0.0005 | 0.0004 | 0.0004 | 0.0005 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 9.19 |
| 3#-1 | 0.0974 | 0.098 | 0.0981 | 0.097 | 0.0975 | 0.0976 | 0.0962 | 0.0974 | 0.66 |
| 4# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 4#-1 | 0.005 | 0.0048 | 0.0049 | 0.005 | 0.0051 | 0.0048 | 0.0049 | 0.0049 | 2.26 |
| 5# | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | / | / |
| 5#-1 | 0.0514 | 0.0506 | 0.0505 | 0.0511 | 0.0509 | 0.0502 | 0.0501 | 0.0507 | 0.94 |

表A.3 验证单位三方法精密度实验

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 样品编号 | 测定值/mg/mL | | | | | | | 平均值 | RSD/% |
| Al | 4#-1 | 0.0051 | 0.0052 | 0.0050 | 0.0052 | 0.0050 | 0.0051 | 0.0050 | 0.0051 | 1.87 |
| 5#-1 | 0.0499 | 0.0496 | 0.0496 | 0.0501 | 0.0499 | 0.0502 | 0.0500 | 0.0499 | 0.45 |
| Be | 4#-1 | 0.0049 | 0.0050 | 0.0048 | 0.0050 | 0.0050 | 0.0050 | 0.0049 | 0.0050 | 1.21 |
| 5#-1 | 0.0495 | 0.0498 | 0.0498 | 0.0498 | 0.0501 | 0.0497 | 0.0499 | 0.0498 | 0.37 |
| Cd | 4#-1 | 0.0049 | 0.0049 | 0.0052 | 0.0051 | 0.0049 | 0.0050 | 0.0052 | 0.0050 | 2.6 |
| 5#-1 | 0.0497 | 0.0501 | 0.0499 | 0.0502 | 0.0497 | 0.0504 | 0.0499 | 0.0500 | 0.52 |
| Cr | 4#-1 | 0.0049 | 0.0049 | 0.0051 | 0.0049 | 0.0051 | 0.0049 | 0.0051 | 0.0050 | 1.89 |
| 5#-1 | 0.0498 | 0.0497 | 0.0496 | 0.0491 | 0.0498 | 0.0499 | 0.0496 | 0.0497 | 0.53 |
| Cu | 4#-1 | 0.0049 | 0.0049 | 0.0050 | 0.0050 | 0.0051 | 0.0050 | 0.0049 | 0.0050 | 1.69 |
| 5#-1 | 0.0493 | 0.0500 | 0.0497 | 0.0499 | 0.0497 | 0.0499 | 0.0499 | 0.0498 | 0.44 |
| Fe | 4#-1 | 0.0051 | 0.0051 | 0.0051 | 0.0049 | 0.0051 | 0.0048 | 0.0052 | 0.0050 | 2.56 |
| 5#-1 | 0.0495 | 0.0495 | 0.0499 | 0.0499 | 0.0501 | 0.0503 | 0.0496 | 0.0498 | 0.63 |
| Mn | 4#-1 | 0.0049 | 0.0050 | 0.0049 | 0.0051 | 0.0051 | 0.0049 | 0.0050 | 0.0050 | 1.54 |
| 5#-1 | 0.0495 | 0.0498 | 0.0502 | 0.0504 | 0.0501 | 0.0499 | 0.0500 | 0.0500 | 0.56 |
| Ni | 4#-1 | 0.0049 | 0.0050 | 0.0049 | 0.0050 | 0.0050 | 0.0051 | 0.0051 | 0.0050 | 1.54 |
| 5#-1 | 0.0500 | 0.0495 | 0.0495 | 0.0499 | 0.0502 | 0.0501 | 0.0499 | 0.0499 | 0.56 |
| Pb | 4#-1 | 0.0051 | 0.0049 | 0.0051 | 0.0051 | 0.0049 | 0.0050 | 0.0051 | 0.0050 | 1.61 |
| 5#-1 | 0.0494 | 0.0499 | 0.0498 | 0.0496 | 0.0501 | 0.0498 | 0.0498 | 0.0498 | 0.47 |
| Zn | 4#-1 | 0.0051 | 0.0051 | 0.0050 | 0.0050 | 0.0049 | 0.0050 | 0.0050 | 0.0050 | 1.01 |
| 5#-1 | 0.0499 | 0.0502 | 0.0499 | 0.0503 | 0.0499 | 0.0502 | 0.0501 | 0.0501 | 0.36 |

表A.4 验证单位四方法精密度实验

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 精密度试验原始数据 | | | | | | | | | |
| 元素 | 样品 | n | | | | | | | 单位：mg/mL |
|  |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 平均值 |
| Al | 1#-1 | 0.01123 | 0.00971 | 0.01106 | 0.01052 | 0.01066 | 0.00987 | 0.01016 | 0.0105 |
| 2#-1 | 0.02105 | 0.02043 | 0.01957 | 0.02031 | 0.02091 | 0.02191 | 0.02129 | 0.02078 |
| 3#-1 | 0.10581 | 0.10959 | 0.12183 | 0.10919 | 0.11323 | 0.10759 | 0.11017 | 0.1112 |
| 4#-1 | 0.00499 | 0.00516 | 0.00514 | 0.00514 | 0.00515 | 0.00516 | 0.00509 | 0.00512 |
| 5#-1 | 0.04893 | 0.04855 | 0.04951 | 0.04943 | 0.04913 | 0.04841 | 0.04999 | 0.04913 |
| Be | 1#-1 | 0.00948 | 0.00953 | 0.00948 | 0.00963 | 0.00974 | 0.00969 | 0.0095 | 0.0096 |
| 2#-1 | 0.01927 | 0.01935 | 0.01939 | 0.01914 | 0.01917 | 0.01952 | 0.01931 | 0.01931 |
| 3#-1 | 0.09602 | 0.0965 | 0.09568 | 0.09672 | 0.09644 | 0.09584 | 0.09618 | 0.0962 |
| 4#-1 | 0.00497 | 0.00484 | 0.00482 | 0.00504 | 0.00491 | 0.00486 | 0.00498 | 0.00492 |
| 5#-1 | 0.04852 | 0.04864 | 0.04874 | 0.04966 | 0.04876 | 0.04942 | 0.04898 | 0.04896 |
| Cd | 1#-1 | 0.00935 | 0.00945 | 0.00947 | 0.00955 | 0.00967 | 0.00964 | 0.00951 | 0.0095 |
| 2#-1 | 0.01915 | 0.0193 | 0.0192 | 0.01922 | 0.019 | 0.01933 | 0.01919 | 0.0192 |
| 3#-1 | 0.09596 | 0.09688 | 0.09592 | 0.09662 | 0.09746 | 0.09596 | 0.09668 | 0.09647 |
| 4#-1 | 0.00511 | 0.00488 | 0.00488 | 0.00501 | 0.00497 | 0.00495 | 0.00513 | 0.00499 |
| 5#-1 | 0.04822 | 0.04868 | 0.0489 | 0.04928 | 0.04856 | 0.04944 | 0.049 | 0.04887 |
| Cr | 1#-1 | 0.00986 | 0.00951 | 0.00983 | 0.01037 | 0.00985 | 0.01036 | 0.00984 | 0.00995 |
| 2#-1 | 0.02098 | 0.02097 | 0.02091 | 0.02081 | 0.02116 | 0.02102 | 0.02097 | 0.02098 |
| 3#-1 | 0.0997 | 0.09952 | 0.09946 | 0.09953 | 0.09971 | 0.0997 | 0.09946 | 0.0996 |
| 4#-1 | 0.0048 | 0.00495 | 0.00497 | 0.00493 | 0.00493 | 0.00497 | 0.00496 | 0.00493 |
| 5#-1 | 0.04936 | 0.04974 | 0.04852 | 0.04912 | 0.04816 | 0.04966 | 0.04945 | 0.04915 |
| Cu | 1#-1 | 0.06209 | 0.06169 | 0.06157 | 0.06227 | 0.06315 | 0.06283 | 0.06219 | 0.06225 |
| 2#-1 | 0.09661 | 0.09609 | 0.09625 | 0.09487 | 0.09469 | 0.09603 | 0.09579 | 0.09576 |
| 3#-1 | 0.09911 | 0.09947 | 0.09863 | 0.09805 | 0.09959 | 0.09941 | 0.09909 | 0.09904 |
| 4#-1 | 0.00512 | 0.00454 | 0.00482 | 0.00516 | 0.00509 | 0.00511 | 0.00513 | 0.005 |
| 5#-1 | 0.04739 | 0.04715 | 0.04705 | 0.04753 | 0.04685 | 0.04733 | 0.04691 | 0.04717 |
| Fe | 1#-1 | 0.01062 | 0.01037 | 0.01152 | 0.01022 | 0.01145 | 0.01162 | 0.01067 | 0.01092 |
| 2#-1 | 0.02075 | 0.02241 | 0.02097 | 0.01997 | 0.02099 | 0.02085 | 0.02121 | 0.02102 |
| 3#-1 | 0.10006 | 0.10238 | 0.09952 | 0.10158 | 0.10362 | 0.09812 | 0.09912 | 0.10088 |
| 4#-1 | 0.00501 | 0.00482 | 0.00493 | 0.00491 | 0.00481 | 0.00489 | 0.0048 | 0.00488 |
| 5#-1 | 0.05091 | 0.05039 | 0.05199 | 0.05047 | 0.04995 | 0.04989 | 0.05217 | 0.05082 |
| Mn | 1#-1 | 0.01015 | 0.00939 | 0.00936 | 0.00944 | 0.00947 | 0.00917 | 0.01045 | 0.00963 |
| 2#-1 | 0.01888 | 0.0186 | 0.01896 | 0.01885 | 0.01881 | 0.01925 | 0.01902 | 0.01891 |
| 3#-1 | 0.09732 | 0.09876 | 0.09742 | 0.09766 | 0.09904 | 0.09722 | 0.09842 | 0.0979 |
| 4#-1 | 0.005 | 0.00491 | 0.00497 | 0.00502 | 0.00496 | 0.00501 | 0.0049 | 0.00497 |
| 5#-1 | 0.04762 | 0.04792 | 0.0476 | 0.04774 | 0.0479 | 0.04798 | 0.04766 | 0.04777 |
| Ni | 1#-1 | 0.01026 | 0.01016 | 0.01021 | 0.0103 | 0.01042 | 0.01038 | 0.01043 | 0.01031 |
| 2#-1 | 0.02463 | 0.02471 | 0.02489 | 0.02473 | 0.02469 | 0.02487 | 0.02485 | 0.02477 |
| 3#-1 | 0.09539 | 0.09665 | 0.09545 | 0.09633 | 0.09797 | 0.09571 | 0.09725 | 0.09625 |
| 4#-1 | 0.00512 | 0.00495 | 0.00496 | 0.00507 | 0.00501 | 0.00502 | 0.00515 | 0.00504 |
| 5#-1 | 0.04819 | 0.04881 | 0.04891 | 0.04925 | 0.04855 | 0.04901 | 0.04889 | 0.04881 |
| Pb | 1#-1 | 0.00936 | 0.00971 | 0.01027 | 0.00943 | 0.00986 | 0.01049 | 0.00969 | 0.00983 |
| 2#-1 | 0.01943 | 0.01977 | 0.01994 | 0.01959 | 0.01955 | 0.0195 | 0.01975 | 0.01965 |
| 3#-1 | 0.09544 | 0.0957 | 0.09742 | 0.09634 | 0.09722 | 0.09554 | 0.09706 | 0.09628 |
| 4#-1 | 0.00505 | 0.00508 | 0.00498 | 0.00495 | 0.00496 | 0.0049 | 0.00497 | 0.00498 |
| 5#-1 | 0.04946 | 0.04958 | 0.05024 | 0.05002 | 0.0495 | 0.05008 | 0.05048 | 0.04991 |
| Zn | 1#-1 | 0.01066 | 0.0108 | 0.01051 | 0.01018 | 0.01003 | 0.01381 | 0.0108 | 0.01097 |
| 2#-1 | 0.03285 | 0.03365 | 0.03279 | 0.03271 | 0.03255 | 0.03257 | 0.03315 | 0.0329 |
| 3#-1 | 0.09661 | 0.09743 | 0.10511 | 0.09729 | 0.09935 | 0.09791 | 0.09879 | 0.09895 |
| 4#-1 | 0.00514 | 0.00504 | 0.00511 | 0.00491 | 0.00506 | 0.00525 | 0.00512 | 0.00509 |
| 5#-1 | 0.04835 | 0.04871 | 0.05179 | 0.04927 | 0.04823 | 0.04919 | 0.05203 | 0.04966 |

表A.5 验证单位五方法精密度实验

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 样品编号 | 平均值 | 样品含量  mg/mL | | | | | | | | |
| 铝（Al） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | STD | RSD |
| 1# | 0.00030 | 0.00029 | 0.00031 | 0.00030 | 0.00029 | 0.00030 | 0.00030 | 0.00031 | 0.00001 | 2.72 |
| 1#-1 | 0.01029 | 0.01029 | 0.01031 | 0.01025 | 0.01023 | 0.01034 | 0.01028 | 0.01034 | 0.00004 | 0.41 |
| 2# | 0.00214 | 0.00220 | 0.00213 | 0.00213 | 0.00212 | 0.00209 | 0.00211 | 0.00217 | 0.00004 | 1.75 |
| 2#-1 | 0.02228 | 0.02245 | 0.02241 | 0.02239 | 0.02218 | 0.02227 | 0.02219 | 0.02207 | 0.00014 | 0.64 |
| 3# | 0.00041 | 0.00042 | 0.00041 | 0.00039 | 0.00042 | 0.00041 | 0.00041 | 0.00040 | 0.00001 | 2.62 |
| 3#-1 | 0.09990 | 0.09986 | 0.09993 | 0.10005 | 0.09982 | 0.09990 | 0.10008 | 0.09968 | 0.00014 | 0.14 |
| 4# | - | - | - | - | - | - | - | - | — | — |
| 4#-1 | 0.00497 | 0.00502 | 0.00501 | 0.00498 | 0.00493 | 0.00504 | 0.00489 | 0.00492 | 0.00006 | 1.15 |
| 5# | - | - | - | - | - | - | - | - | — | — |
| 5#-1 | 0.05056 | 0.05014 | 0.05098 | 0.05055 | 0.05029 | 0.05036 | 0.05078 | 0.05082 | 0.00031 | 0.62 |
| 样品编号 | 铍（Be） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — |
| 1#-1 | 0.01078 | 0.01078 | 0.01079 | 0.01068 | 0.01072 | 0.01073 | 0.01092 | 0.01082 | 0.00008 | 0.73 |
| 2# | - | - | - | - | - | - | - | - | — | — |
| 2#-1 | 0.02070 | 0.02088 | 0.02054 | 0.02087 | 0.02073 | 0.02065 | 0.02052 | 0.02071 | 0.00014 | 0.69 |
| 3# | - | - | - | - | - | - | - | - | — | — |
| 3#-1 | 0.10023 | 0.10002 | 0.10023 | 0.10045 | 0.10008 | 0.10026 | 0.10034 | 0.10021 | 0.00015 | 0.15 |
| 4# | - | - | - | - | - | - | - | - | — | — |
| 4#-1 | 0.00520 | 0.00502 | 0.00511 | 0.00529 | 0.00524 | 0.00524 | 0.00539 | 0.00511 | 0.00013 | 2.43 |
| 5# | - | - | - | - | - | - | - | - | — | — |
| 5#-1 | 0.05002 | 0.05012 | 0.05002 | 0.04986 | 0.05007 | 0.04986 | 0.05004 | 0.05014 | 0.00011 | 0.23 |
| 样品编号 | 镉（Cd） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | STD | RSD |
| 1# | 0.00013 | 0.00013 | 0.00013 | 0.00012 | 0.00014 | 0.00013 | 0.00013 | 0.00014 | 0.00001 | 5.25 |
| 1#-1 | 0.01037 | 0.01043 | 0.01039 | 0.01042 | 0.01028 | 0.01026 | 0.01041 | 0.01040 | 0.00007 | 0.67 |
| 2# | - | - | - | - | - | - | - | - | — | — |
| 2#-1 | 0.02006 | 0.01984 | 0.02008 | 0.02005 | 0.02013 | 0.02017 | 0.02001 | 0.02011 | 0.00011 | 0.54 |
| 3# | - | - | - | - | - | - | - | - | — | — |
| 3#-1 | 0.09986 | 0.09987 | 0.10002 | 0.09969 | 0.09975 | 0.09990 | 0.09959 | 0.10021 | 0.00021 | 0.21 |
| 4# | - | - | - | - | - | - | - | - | — | — |
| 4#-1 | 0.00515 | 0.00512 | 0.00523 | 0.00519 | 0.00524 | 0.00508 | 0.00511 | 0.00506 | 0.00007 | 1.41 |
| 5# | - | - | - | - | - | - | - | - | — | — |
| 5#-1 | 0.05012 | 0.05017 | 0.05024 | 0.05013 | 0.05022 | 0.05009 | 0.04995 | 0.05002 | 0.00011 | 0.21 |
| 样品编号 | 铬（Cr） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | STD | RSD |
| 1# | 0.00013 | 0.00013 | 0.00014 | 0.00014 | 0.00013 | 0.00013 | 0.00014 | 0.00013 | 0.00001 | 3.98 |
| 1#-1 | 0.01015 | 0.01009 | 0.01019 | 0.01012 | 0.01002 | 0.01023 | 0.01024 | 0.01018 | 0.00008 | 0.79 |
| 2# | 0.00104 | 0.00102 | 0.00108 | 0.00101 | 0.00101 | 0.00107 | 0.00107 | 0.00100 | 0.00003 | 3.33 |
| 2#-1 | 0.02121 | 0.02121 | 0.02113 | 0.02102 | 0.02107 | 0.02134 | 0.02139 | 0.02128 | 0.00014 | 0.66 |
| 3# | - | - | - | - | - | - | - | - | — | — |
| 3#-1 | 0.09818 | 0.09872 | 0.09772 | 0.09769 | 0.09859 | 0.09898 | 0.09728 | 0.09831 | 0.00063 | 0.64 |
| 4# | - | - | - | - | - | - | - | - | — | — |
| 4#-1 | 0.00489 | 0.00492 | 0.00498 | 0.00485 | 0.00485 | 0.00479 | 0.00493 | 0.00491 | 0.00006 | 1.30 |
| 5# | - | - | - | - | - | - | - | - | — | — |
| 5#-1 | 0.04926 | 0.04916 | 0.04957 | 0.04929 | 0.04933 | 0.04925 | 0.04896 | 0.04928 | 0.00018 | 0.37 |
| 样品编号 | 铜（Cu） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | STD | RSD |
| 1# | 0.06502 | 0.06525 | 0.06517 | 0.06489 | 0.06473 | 0.06502 | 0.06533 | 0.06473 | 0.00024 | 0.37 |
| 1#-1 | 0.07593 | 0.07613 | 0.07598 | 0.07635 | 0.07599 | 0.07567 | 0.07571 | 0.07566 | 0.00026 | 0.34 |
| 2# | 0.04735 | 0.04703 | 0.04729 | 0.04752 | 0.04728 | 0.04736 | 0.04744 | 0.04751 | 0.00017 | 0.36 |
| 2#-1 | 0.06778 | 0.06785 | 0.06773 | 0.06759 | 0.06791 | 0.06790 | 0.06768 | 0.06780 | 0.00012 | 0.18 |
| 3# | 0.00012 | 0.00013 | 0.00012 | 0.00013 | 0.00012 | 0.00012 | 0.00012 | 0.00013 | 0.00001 | 4.30 |
| 3#-1 | 0.10070 | 0.10025 | 0.10068 | 0.10066 | 0.10102 | 0.10082 | 0.10059 | 0.10090 | 0.00025 | 0.25 |
| 4# | - | - | - | - | - | - | - | - | — | — |
| 4#-1 | 0.00515 | 0.00513 | 0.00522 | 0.00502 | 0.00519 | 0.00509 | 0.00504 | 0.00533 | 0.00011 | 2.13 |
| 5# | - | - | - | - | - | - | - | - | — | — |
| 5#-1 | 0.05042 | 0.05018 | 0.05029 | 0.05076 | 0.05049 | 0.05066 | 0.05017 | 0.05041 | 0.00023 | 0.45 |
| 样品编号 | 铁（Fe） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — |
| 1#-1 | 0.01017 | 0.00989 | 0.00993 | 0.01002 | 0.01013 | 0.01107 | 0.00991 | 0.01025 | 0.00042 | 4.10 |
| 2# | 0.00485 | 0.00490 | 0.00487 | 0.00483 | 0.00490 | 0.00482 | 0.00487 | 0.00476 | 0.00005 | 1.04 |
| 2#-1 | 0.02517 | 0.02501 | 0.02517 | 0.02529 | 0.02525 | 0.02496 | 0.02522 | 0.02531 | 0.00014 | 0.54 |
| 3# | 0.00099 | 0.00095 | 0.00095 | 0.00097 | 0.00102 | 0.00103 | 0.00100 | 0.00099 | 0.00003 | 3.24 |
| 3#-1 | 0.10202 | 0.10217 | 0.10269 | 0.10176 | 0.10108 | 0.10222 | 0.10208 | 0.10217 | 0.00050 | 0.49 |
| 4# | - | - | - | - | - | - | - | - | — | — |
| 4#-1 | 0.00516 | 0.00503 | 0.00524 | 0.00509 | 0.00528 | 0.00508 | 0.00523 | 0.00516 | 0.00009 | 1.84 |
| 5# | - | - | - | - | - | - | - | - | — | — |
| 5#-1 | 0.05014 | 0.05012 | 0.05036 | 0.05002 | 0.05047 | 0.05028 | 0.04992 | 0.04983 | 0.00024 | 0.47 |
| 样品编号 | 锰（Mn） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — |
| 1#-1 | 0.01024 | 0.01036 | 0.01025 | 0.01029 | 0.01017 | 0.01022 | 0.01019 | 0.01020 | 0.00007 | 0.65 |
| 2# | 0.00020 | 0.00020 | 0.00019 | 0.00020 | 0.00021 | 0.00021 | 0.00020 | 0.00019 | 0.00001 | 4.08 |
| 2#-1 | 0.02039 | 0.02053 | 0.02041 | 0.02029 | 0.02036 | 0.02047 | 0.02050 | 0.02019 | 0.00012 | 0.60 |
| 3# | - | - | - | - | - | - | - | - | — | — |
| 3#-1 | 0.09834 | 0.09830 | 0.09790 | 0.09860 | 0.09790 | 0.09830 | 0.09910 | 0.09830 | 0.00042 | 0.42 |
| 4# | - | - | - | - | - | - | - | - | — | — |
| 4#-1 | 0.00504 | 0.00503 | 0.00512 | 0.00511 | 0.00498 | 0.00491 | 0.00502 | 0.00509 | 0.00008 | 1.51 |
| 5# | - | - | - | - | - | - | - | - | — | — |
| 5#-1 | 0.04969 | 0.05001 | 0.04983 | 0.04978 | 0.04909 | 0.04958 | 0.05003 | 0.04951 | 0.00033 | 0.66 |
| 样品编号 | 镍（Ni） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | STD | RSD |
| 1# | 0.00572 | 0.00567 | 0.00560 | 0.00571 | 0.00582 | 0.00569 | 0.00572 | 0.00582 | 0.00008 | 1.39 |
| 1#-1 | 0.01558 | 0.01542 | 0.01593 | 0.01528 | 0.01566 | 0.01566 | 0.01573 | 0.01536 | 0.00023 | 1.49 |
| 2# | 0.00094 | 0.00092 | 0.00096 | 0.00093 | 0.00095 | 0.00092 | 0.00094 | 0.00095 | 0.00002 | 1.68 |
| 2#-1 | 0.02077 | 0.02058 | 0.02092 | 0.02093 | 0.02068 | 0.02077 | 0.02074 | 0.02079 | 0.00012 | 0.60 |
| 3# | - | - | - | - | - | - | - | - | — | — |
| 3#-1 | 0.09928 | 0.09926 | 0.09879 | 0.09935 | 0.09928 | 0.09933 | 0.09942 | 0.09951 | 0.00023 | 0.23 |
| 4# | - | - | - | - | - | - | - | - | — | — |
| 4#-1 | 0.00491 | 0.00498 | 0.00483 | 0.00502 | 0.00486 | 0.00488 | 0.00490 | 0.00491 | 0.00007 | 1.36 |
| 5# | - | - | - | - | - | - | - | - | — | — |
| 5#-1 | 0.04962 | 0.04929 | 0.04936 | 0.04966 | 0.04987 | 0.04958 | 0.04969 | 0.04991 | 0.00023 | 0.47 |
| 样品编号 | 铅（Pb） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | STD | RSD |
| 1# | 0.00090 | 0.00091 | 0.00091 | 0.00089 | 0.00088 | 0.00091 | 0.00090 | 0.00089 | 0.00001 | 1.35 |
| 1#-1 | 0.01065 | 0.01026 | 0.01073 | 0.01059 | 0.01064 | 0.01069 | 0.01082 | 0.01080 | 0.00019 | 1.78 |
| 2# | 0.00047 | 0.00047 | 0.00046 | 0.00046 | 0.00047 | 0.00048 | 0.00047 | 0.00049 | 0.00001 | 2.27 |
| 2#-1 | 0.02017 | 0.02013 | 0.02020 | 0.02015 | 0.02026 | 0.02005 | 0.02013 | 0.02025 | 0.00007 | 0.37 |
| 3# | - | - | - | - | - | - | - | - | — | — |
| 3#-1 | 0.10079 | 0.10059 | 0.10102 | 0.10113 | 0.10068 | 0.10079 | 0.10067 | 0.10064 | 0.00021 | 0.21 |
| 4# | - | - | - | - | - | - | - | - | — | — |
| 4#-1 | 0.00520 | 0.00502 | 0.00511 | 0.00544 | 0.00525 | 0.00509 | 0.00530 | 0.00521 | 0.00014 | 2.75 |
| 5# | - | - | - | - | - | - | - | - | — | — |
| 5#-1 | 0.04987 | 0.04986 | 0.04976 | 0.04992 | 0.04985 | 0.04990 | 0.04997 | 0.04983 | 0.00007 | 0.14 |
| 样品编号 | 锌（Zn） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | STD | RSD |
| 1# | 0.01443 | 0.01453 | 0.01462 | 0.01429 | 0.01436 | 0.01421 | 0.01437 | 0.01463 | 0.00016 | 1.14 |
| 1#-1 | 0.02461 | 0.02463 | 0.02471 | 0.02456 | 0.02482 | 0.02469 | 0.02435 | 0.02453 | 0.00015 | 0.61 |
| 2# | 0.00068 | 0.00068 | 0.00069 | 0.00070 | 0.00068 | 0.00068 | 0.00067 | 0.00065 | 0.00002 | 2.32 |
| 2#-1 | 0.02077 | 0.02079 | 0.02092 | 0.02083 | 0.02076 | 0.02069 | 0.02073 | 0.02068 | 0.00008 | 0.41 |
| 3# | 0.00038 | 0.00036 | 0.00038 | 0.00039 | 0.00037 | 0.00037 | 0.00038 | 0.00038 | 0.00001 | 2.60 |
| 3#-1 | 0.10168 | 0.10213 | 0.10186 | 0.10159 | 0.10173 | 0.10169 | 0.10150 | 0.10126 | 0.00028 | 0.27 |
| 4# | - | - | - | - | - | - | - | - | — | — |
| 4#-1 | 0.00498 | 0.00493 | 0.00502 | 0.00526 | 0.00498 | 0.00476 | 0.00482 | 0.00506 | 0.00016 | 3.31 |
| 5# | - | - | - | - | - | - | - | - | — | — |
| 5#-1 | 0.05065 | 0.05076 | 0.05083 | 0.05068 | 0.05049 | 0.05061 | 0.05057 | 0.05062 | 0.00012 | 0.23 |

表A.6 验证单位六方法精密度实验

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 样品编号 | 样品含量 mg/mL | | | | | | | | | | | |
| **铝（Al）** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0000 | 4.35 |
| 1#-1 | 0.0101 | 0.0101 | 0.0099 | 0.0102 | 0.0104 | 0.0099 | 0.0101 | 0.0103 | 0.0104 | 0.0099 | 0.0002 | 1.87 |
| 2# | 0.0017 | 0.0017 | 0.0018 | 0.0017 | 0.0018 | 0.0017 | 0.0018 | 0.0017 | 0.0018 | 0.0017 | 0.0001 | 2.89 |
| 2#-1 | 0.0220 | 0.0219 | 0.0220 | 0.0221 | 0.0221 | 0.0220 | 0.0221 | 0.0217 | 0.0221 | 0.0217 | 0.0001 | 0.67 |
| 3# | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0000 | 2.30 |
| 3#-1 | 0.1003 | 0.1002 | 0.1004 | 0.1003 | 0.1002 | 0.1005 | 0.1003 | 0.1004 | 0.1005 | 0.1002 | 0.0001 | 0.11 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0052 | 0.0051 | 0.0050 | 0.0049 | 0.0050 | 0.0052 | 0.0051 | 0.0052 | 0.0049 | 0.0001 | 2.19 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0497 | 0.0496 | 0.0495 | 0.0498 | 0.0495 | 0.0498 | 0.0494 | 0.0502 | 0.0502 | 0.0494 | 0.0003 | 0.55 |
| 样品编号 | **铍（Be）** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0104 | 0.0102 | 0.0103 | 0.0103 | 0.0101 | 0.0106 | 0.0105 | 0.0106 | 0.0106 | 0.0101 | 0.0002 | 1.91 |
| 2# | - | - | - | - | - | - | - | - | — | — | — | — |
| 2#-1 | 0.0201 | 0.0196 | 0.0202 | 0.0200 | 0.0203 | 0.0204 | 0.0203 | 0.0197 | 0.0204 | 0.0196 | 0.0003 | 1.57 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.1004 | 0.1004 | 0.1005 | 0.1007 | 0.1000 | 0.1005 | 0.1002 | 0.1005 | 0.1007 | 0.1000 | 0.0002 | 0.24 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0048 | 0.0051 | 0.0047 | 0.0049 | 0.0048 | 0.0049 | 0.0048 | 0.0047 | 0.0051 | 0.0047 | 0.0001 | 2.89 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0505 | 0.0505 | 0.0503 | 0.0507 | 0.0508 | 0.0506 | 0.0501 | 0.0504 | 0.0508 | 0.0501 | 0.0002 | 0.48 |
| 样品编号 | **镉（Cd）** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0101 | 0.0100 | 0.0100 | 0.0103 | 0.0105 | 0.0100 | 0.0101 | 0.0102 | 0.0105 | 0.0100 | 0.0002 | 2.04 |
| 2# | - | - | - | - | - | - | - | - | — | — | — | — |
| 2#-1 | 0.0203 | 0.0203 | 0.0201 | 0.0202 | 0.0201 | 0.0203 | 0.0203 | 0.0205 | 0.0205 | 0.0201 | 0.0001 | 0.69 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0997 | 0.0993 | 0.0994 | 0.0996 | 0.0994 | 0.1002 | 0.0996 | 0.1001 | 0.1002 | 0.0993 | 0.0004 | 0.37 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0049 | 0.0048 | 0.0049 | 0.0051 | 0.0049 | 0.0049 | 0.0048 | 0.0048 | 0.0051 | 0.0048 | 0.0001 | 2.19 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0500 | 0.0498 | 0.0501 | 0.0499 | 0.0504 | 0.0502 | 0.0495 | 0.0499 | 0.0504 | 0.0495 | 0.0003 | 0.60 |
| 样品编号 | **铬（Cr）** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0000 | 5.25 |
| 1#-1 | 0.0103 | 0.0101 | 0.0104 | 0.0102 | 0.0105 | 0.0102 | 0.0101 | 0.0104 | 0.0105 | 0.0101 | 0.0002 | 1.56 |
| 2# | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0014 | 0.0014 | 0.0013 | 0.0014 | 0.0014 | 0.0013 | 0.0001 | 3.98 |
| 2#-1 | 0.0209 | 0.0211 | 0.0210 | 0.0209 | 0.0208 | 0.0207 | 0.0206 | 0.0211 | 0.0211 | 0.0206 | 0.0002 | 0.93 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.1001 | 0.1003 | 0.1004 | 0.1002 | 0.1005 | 0.0995 | 0.0993 | 0.1002 | 0.1005 | 0.0993 | 0.0005 | 0.46 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0051 | 0.0052 | 0.0050 | 0.0052 | 0.0051 | 0.0050 | 0.0053 | 0.0053 | 0.0050 | 0.0001 | 2.17 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0493 | 0.0493 | 0.0491 | 0.0495 | 0.0490 | 0.0493 | 0.0494 | 0.0496 | 0.0496 | 0.0490 | 0.0002 | 0.43 |
| 样品编号 | **铜（Cu）** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0653 | 0.0655 | 0.0652 | 0.0654 | 0.0651 | 0.0654 | 0.0656 | 0.0652 | 0.0656 | 0.0651 | 0.0002 | 0.28 |
| 1#-1 | 0.0756 | 0.0757 | 0.0756 | 0.0758 | 0.0754 | 0.0753 | 0.0755 | 0.0758 | 0.0758 | 0.0753 | 0.0002 | 0.26 |
| 2# | 0.0495 | 0.0497 | 0.0493 | 0.0498 | 0.0495 | 0.0494 | 0.0496 | 0.0494 | 0.0498 | 0.0493 | 0.0002 | 0.36 |
| 2#-1 | 0.0695 | 0.0692 | 0.0696 | 0.0693 | 0.0697 | 0.0695 | 0.0697 | 0.0696 | 0.0697 | 0.0692 | 0.0002 | 0.28 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.1009 | 0.1008 | 0.1010 | 0.1011 | 0.1007 | 0.1005 | 0.1008 | 0.1012 | 0.1012 | 0.1005 | 0.0002 | 0.24 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0050 | 0.0049 | 0.0051 | 0.0050 | 0.0052 | 0.0050 | 0.0048 | 0.0049 | 0.0052 | 0.0048 | 0.0001 | 2.70 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0498 | 0.0498 | 0.0497 | 0.0497 | 0.0496 | 0.0499 | 0.0501 | 0.0500 | 0.0501 | 0.0496 | 0.0002 | 0.36 |
| 样品编号 | **铁（Fe）** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0106 | 0.0105 | 0.0106 | 0.0106 | 0.0107 | 0.0105 | 0.0107 | 0.0108 | 0.0108 | 0.0105 | 0.0001 | 1.05 |
| 2# | 0.0049 | 0.0049 | 0.0048 | 0.0050 | 0.0049 | 0.0051 | 0.0050 | 0.0049 | 0.0051 | 0.0048 | 0.0001 | 1.97 |
| 2#-1 | 0.0250 | 0.0251 | 0.0250 | 0.0249 | 0.0248 | 0.0253 | 0.0252 | 0.0249 | 0.0253 | 0.0248 | 0.0002 | 0.72 |
| 3# | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0011 | 0.0011 | 0.0010 | 0.0011 | 0.0011 | 0.0010 | 0.0001 | 4.92 |
| 3#-1 | 0.1013 | 0.1015 | 0.1013 | 0.1014 | 0.1010 | 0.1012 | 0.1013 | 0.1014 | 0.1015 | 0.1010 | 0.0002 | 0.16 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0048 | 0.0047 | 0.0046 | 0.0048 | 0.0049 | 0.0048 | 0.0047 | 0.0048 | 0.0049 | 0.0046 | 0.0001 | 2.05 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0502 | 0.0505 | 0.0504 | 0.0500 | 0.0501 | 0.0503 | 0.0502 | 0.0501 | 0.0505 | 0.0500 | 0.0002 | 0.36 |
| 样品编号 | **锰（Mn）** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0099 | 0.0099 | 0.0097 | 0.0101 | 0.0098 | 0.0100 | 0.0098 | 0.0097 | 0.0101 | 0.0097 | 0.0002 | 1.53 |
| 2# | - | - | - | - | - | - | - | - | — | — | — | — |
| 2#-1 | 0.0202 | 0.0203 | 0.0199 | 0.0202 | 0.0201 | 0.0203 | 0.0204 | 0.0199 | 0.0204 | 0.0199 | 0.0002 | 0.99 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0991 | 0.0994 | 0.0992 | 0.0989 | 0.0991 | 0.0995 | 0.0988 | 0.0987 | 0.0995 | 0.0987 | 0.0003 | 0.31 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0049 | 0.0048 | 0.0049 | 0.0049 | 0.0050 | 0.0051 | 0.0050 | 0.0048 | 0.0051 | 0.0048 | 0.0001 | 2.26 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0506 | 0.0510 | 0.0507 | 0.0502 | 0.0508 | 0.0506 | 0.0503 | 0.0504 | 0.0510 | 0.0502 | 0.0003 | 0.57 |
| 样品编号 | **镍（Ni）** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0051 | 0.0052 | 0.0051 | 0.0051 | 0.0050 | 0.0052 | 0.0049 | 0.0049 | 0.0052 | 0.0049 | 0.0001 | 2.52 |
| 1#-1 | 0.0153 | 0.0155 | 0.0152 | 0.0153 | 0.0152 | 0.0154 | 0.0154 | 0.0151 | 0.0155 | 0.0151 | 0.0001 | 0.92 |
| 2# | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0000 | 2.90 |
| 2#-1 | 0.0205 | 0.0202 | 0.0205 | 0.0204 | 0.0208 | 0.0205 | 0.0206 | 0.0204 | 0.0208 | 0.0202 | 0.0002 | 0.91 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.1003 | 0.1003 | 0.1005 | 0.1000 | 0.1002 | 0.1000 | 0.1004 | 0.1006 | 0.1006 | 0.1000 | 0.0002 | 0.23 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0049 | 0.0048 | 0.0049 | 0.0051 | 0.0049 | 0.0048 | 0.0050 | 0.0051 | 0.0051 | 0.0048 | 0.0001 | 2.57 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0497 | 0.0495 | 0.0498 | 0.0496 | 0.0497 | 0.0495 | 0.0499 | 0.0498 | 0.0499 | 0.0495 | 0.0002 | 0.32 |
| 样品编号 | **铅（Pb）** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0008 | 0.0008 | 0.0009 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0009 | 0.0008 | 0.0000 | 2.85 |
| 1#-1 | 0.0108 | 0.0107 | 0.0105 | 0.0111 | 0.0109 | 0.0106 | 0.0107 | 0.0109 | 0.0111 | 0.0105 | 0.0002 | 1.91 |
| 2# | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0000 | 3.37 |
| 2#-1 | 0.0203 | 0.0203 | 0.0205 | 0.0205 | 0.0204 | 0.0201 | 0.0199 | 0.0202 | 0.0205 | 0.0199 | 0.0002 | 1.09 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0994 | 0.0992 | 0.0991 | 0.0997 | 0.0995 | 0.0998 | 0.0989 | 0.0993 | 0.0998 | 0.0989 | 0.0003 | 0.33 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0049 | 0.0049 | 0.0048 | 0.0049 | 0.0050 | 0.0051 | 0.0048 | 0.0049 | 0.0051 | 0.0048 | 0.0001 | 2.18 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0497 | 0.0497 | 0.0500 | 0.0496 | 0.0496 | 0.0497 | 0.0501 | 0.0495 | 0.0501 | 0.0495 | 0.0002 | 0.45 |
| 样品编号 | **锌（Zn）** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0143 | 0.0142 | 0.0143 | 0.0143 | 0.0142 | 0.0144 | 0.0142 | 0.0143 | 0.0144 | 0.0142 | 0.0001 | 0.53 |
| 1#-1 | 0.0245 | 0.0245 | 0.0242 | 0.0245 | 0.0247 | 0.0246 | 0.0248 | 0.0244 | 0.0248 | 0.0242 | 0.0002 | 0.81 |
| 2# | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0000 | 2.09 |
| 2#-1 | 0.0207 | 0.0208 | 0.0205 | 0.0207 | 0.0208 | 0.0209 | 0.0204 | 0.0205 | 0.0209 | 0.0204 | 0.0002 | 0.92 |
| 3# | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0000 | 2.54 |
| 3#-1 | 0.1005 | 0.1009 | 0.1002 | 0.1001 | 0.1006 | 0.1004 | 0.1003 | 0.1007 | 0.1009 | 0.1001 | 0.0003 | 0.29 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0049 | 0.0048 | 0.0050 | 0.0049 | 0.0048 | 0.0049 | 0.0049 | 0.0048 | 0.0050 | 0.0048 | 0.0001 | 1.55 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0506 | 0.0506 | 0.0508 | 0.0507 | 0.0505 | 0.0507 | 0.0505 | 0.0502 | 0.0508 | 0.0502 | 0.0002 | 0.39 |

表A.7 验证单位七方法精密度实验

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 样品编号 | 平均值 mg/mL |  | | | | | | | | | | |
| 铝（Al） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0000 | 4.83 |
| 1#-1 | 0.0102 | 0.0101 | 0.0102 | 0.0100 | 0.0103 | 0.0102 | 0.0103 | 0.0101 | 0.0103 | 0.0100 | 0.0001 | 1.17 |
| 2# | 0.0021 | 0.0021 | 0.0022 | 0.0020 | 0.0020 | 0.0021 | 0.0021 | 0.0021 | 0.0022 | 0.0020 | 0.0001 | 3.83 |
| 2#-1 | 0.0219 | 0.0215 | 0.0218 | 0.0214 | 0.0213 | 0.0222 | 0.0224 | 0.0224 | 0.0224 | 0.0213 | 0.0005 | 2.07 |
| 3# | 0.0004 | 0.0004 | 0.0005 | 0.0005 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0005 | 0.0004 | 0.0000 | 9.17 |
| 3#-1 | 0.1041 | 0.0997 | 0.1054 | 0.1055 | 0.1022 | 0.1065 | 0.1075 | 0.1017 | 0.1075 | 0.0997 | 0.0029 | 2.74 |
| 4# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 4#-1 | 0.0050 | 0.0049 | 0.0052 | 0.0050 | 0.0052 | 0.0049 | 0.0049 | 0.0051 | 0.0052 | 0.0049 | 0.0001 | 2.53 |
| 5# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 5#-1 | 0.0506 | 0.0500 | 0.0489 | 0.0503 | 0.0511 | 0.0513 | 0.0511 | 0.0512 | 0.0513 | 0.0489 | 0.0009 | 1.71 |
| 样品编号 | 铍（Be） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 1#-1 | 0.0102 | 0.0101 | 0.0103 | 0.0102 | 0.0103 | 0.0100 | 0.0102 | 0.0102 | 0.0103 | 0.0100 | 0.0001 | 1.01 |
| 2# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 2#-1 | 0.0204 | 0.0205 | 0.0204 | 0.0206 | 0.0201 | 0.0206 | 0.0199 | 0.0205 | 0.0206 | 0.0199 | 0.0003 | 1.41 |
| 3# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 3#-1 | 0.1006 | 0.1015 | 0.1023 | 0.0998 | 0.0990 | 0.1011 | 0.1016 | 0.0989 | 0.1023 | 0.0989 | 0.0014 | 1.36 |
| 4# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 4#-1 | 0.0050 | 0.0049 | 0.0049 | 0.0051 | 0.0048 | 0.0049 | 0.0051 | 0.0049 | 0.0051 | 0.0048 | 0.0001 | 2.35 |
| 5# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 5#-1 | 0.0505 | 0.0494 | 0.0513 | 0.0505 | 0.0514 | 0.0489 | 0.0505 | 0.0513 | 0.0514 | 0.0489 | 0.0010 | 1.97 |
| 样品编号 | 镉（Cd） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0000 | 3.50 |
| 1#-1 | 0.0101 | 0.0103 | 0.0098 | 0.0104 | 0.0098 | 0.0099 | 0.0103 | 0.0101 | 0.0104 | 0.0098 | 0.0003 | 2.65 |
| 2# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 2#-1 | 0.0202 | 0.0207 | 0.0200 | 0.0200 | 0.0207 | 0.0201 | 0.0202 | 0.0201 | 0.0207 | 0.0200 | 0.0003 | 1.57 |
| 3# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 3#-1 | 0.1008 | 0.0996 | 0.1014 | 0.0999 | 0.1015 | 0.1008 | 0.1012 | 0.1012 | 0.1015 | 0.0996 | 0.0007 | 0.73 |
| 4# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 4#-1 | 0.0052 | 0.0051 | 0.0052 | 0.0052 | 0.0049 | 0.0053 | 0.0052 | 0.0052 | 0.0053 | 0.0049 | 0.0001 | 2.40 |
| 5# | - |  |  |  |  |  |  |  | 0.0000 | — | — | — |
| 5#-1 | 0.0500 | 0.0495 | 0.0510 | 0.0497 | 0.0503 | 0.0507 | 0.0493 | 0.0495 | 0.0510 | 0.0493 | 0.0007 | 1.33 |
| 样品编号 | 铬（Cr） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0000 | 9.65 |
| 1#-1 | 0.0102 | 0.0101 | 0.0100 | 0.0101 | 0.0102 | 0.0102 | 0.0104 | 0.0104 | 0.0104 | 0.0100 | 0.0002 | 1.61 |
| 2# | 0.0011 | 0.0010 | 0.0012 | 0.0013 | 0.0011 | 0.0012 | 0.0010 | 0.0012 | 0.0013 | 0.0010 | 0.0001 | 10.02 |
| 2#-1 | 0.0211 | 0.0213 | 0.0214 | 0.0213 | 0.0211 | 0.0208 | 0.0206 | 0.0211 | 0.0214 | 0.0206 | 0.0003 | 1.38 |
| 3# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 3#-1 | 0.0973 | 0.0997 | 0.0974 | 0.0955 | 0.0975 | 0.0987 | 0.0983 | 0.0938 | 0.0997 | 0.0938 | 0.0020 | 2.08 |
| 4# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 4#-1 | 0.0051 | 0.0051 | 0.0049 | 0.0052 | 0.0049 | 0.0053 | 0.0049 | 0.0052 | 0.0053 | 0.0049 | 0.0002 | 3.57 |
| 5# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 5#-1 | 0.0500 | 0.0489 | 0.0502 | 0.0513 | 0.0513 | 0.0486 | 0.0503 | 0.0494 | 0.0513 | 0.0486 | 0.0011 | 2.20 |
| 样品编号 | 铜（Cu） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0645 | 0.0644 | 0.0647 | 0.0648 | 0.0639 | 0.0643 | 0.0647 | 0.0646 | 0.0648 | 0.0639 | 0.0003 | 0.47 |
| 1#-1 | 0.0754 | 0.0752 | 0.0753 | 0.0755 | 0.0755 | 0.0756 | 0.0755 | 0.0751 | 0.0756 | 0.0751 | 0.0002 | 0.25 |
| 2# | 0.0475 | 0.0475 | 0.0472 | 0.0479 | 0.0477 | 0.0478 | 0.0471 | 0.0471 | 0.0479 | 0.0471 | 0.0003 | 0.67 |
| 2#-1 | 0.0680 | 0.0671 | 0.0687 | 0.0688 | 0.0679 | 0.0684 | 0.0673 | 0.0678 | 0.0688 | 0.0671 | 0.0007 | 1.00 |
| 3# | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0000 | 5.40 |
| 3#-1 | 0.1039 | 0.1049 | 0.1034 | 0.1056 | 0.1033 | 0.1035 | 0.1034 | 0.1035 | 0.1056 | 0.1033 | 0.0009 | 0.90 |
| 4# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 4#-1 | 0.0051 | 0.0049 | 0.0053 | 0.0053 | 0.0049 | 0.0050 | 0.0051 | 0.0052 | 0.0053 | 0.0049 | 0.0002 | 2.98 |
| 5# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 5#-1 | 0.0499 | 0.0503 | 0.0504 | 0.0500 | 0.0493 | 0.0496 | 0.0507 | 0.0488 | 0.0507 | 0.0488 | 0.0007 | 1.36 |
| 样品编号 | 铁（Fe） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 1#-1 | 0.0102 | 0.0103 | 0.0102 | 0.0103 | 0.0103 | 0.0101 | 0.0103 | 0.0100 | 0.0103 | 0.0100 | 0.0001 | 1.06 |
| 2# | 0.0047 | 0.0048 | 0.0048 | 0.0048 | 0.0046 | 0.0046 | 0.0048 | 0.0046 | 0.0048 | 0.0046 | 0.0001 | 2.04 |
| 2#-1 | 0.0248 | 0.0252 | 0.0250 | 0.0246 | 0.0249 | 0.0254 | 0.0235 | 0.0248 | 0.0254 | 0.0235 | 0.0006 | 2.47 |
| 3# | 0.0011 | 0.0010 | 0.0010 | 0.0010 | 0.0012 | 0.0011 | 0.0010 | 0.0012 | 0.0012 | 0.0010 | 0.0001 | 9.25 |
| 3#-1 | 0.1023 | 0.0998 | 0.1003 | 0.1022 | 0.1037 | 0.1057 | 0.1014 | 0.1029 | 0.1057 | 0.0998 | 0.0020 | 1.99 |
| 4# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 4#-1 | 0.0051 | 0.0051 | 0.0050 | 0.0050 | 0.0051 | 0.0052 | 0.0052 | 0.0053 | 0.0053 | 0.0050 | 0.0001 | 2.17 |
| 5# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 5#-1 | 0.0499 | 0.0511 | 0.0488 | 0.0496 | 0.0504 | 0.0502 | 0.0497 | 0.0493 | 0.0511 | 0.0488 | 0.0008 | 1.54 |
| 样品编号 | 锰（Mn） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 1#-1 | 0.0100 | 0.0099 | 0.0101 | 0.0098 | 0.0099 | 0.0099 | 0.0101 | 0.0100 | 0.0101 | 0.0098 | 0.0001 | 1.09 |
| 2# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0000 | 7.33 |
| 2#-1 | 0.0209 | 0.0214 | 0.0215 | 0.0202 | 0.0215 | 0.0204 | 0.0203 | 0.0209 | 0.0215 | 0.0202 | 0.0006 | 2.76 |
| 3# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 3#-1 | 0.0965 | 0.0957 | 0.0957 | 0.0973 | 0.0971 | 0.0967 | 0.0957 | 0.0971 | 0.0973 | 0.0957 | 0.0007 | 0.77 |
| 4# | - |  |  |  |  |  |  |  | 0.0000 | — | — | — |
| 4#-1 | 0.0051 | 0.0050 | 0.0051 | 0.0050 | 0.0051 | 0.0051 | 0.0051 | 0.0050 | 0.0051 | 0.0050 | 0.0000 | 0.93 |
| 5# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 5#-1 | 0.0501 | 0.0498 | 0.0506 | 0.0499 | 0.0510 | 0.0497 | 0.0499 | 0.0496 | 0.0510 | 0.0496 | 0.0005 | 1.00 |
| 样品编号 | 镍（Ni） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0052 | 0.0053 | 0.0051 | 0.0054 | 0.0054 | 0.0051 | 0.0051 | 0.0050 | 0.0054 | 0.0050 | 0.0002 | 3.46 |
| 1#-1 | 0.0159 | 0.0155 | 0.0160 | 0.0157 | 0.0157 | 0.0164 | 0.0161 | 0.0157 | 0.0164 | 0.0155 | 0.0003 | 1.83 |
| 2# | 0.0011 | 0.0010 | 0.0011 | 0.0010 | 0.0011 | 0.0011 | 0.0011 | 0.0010 | 0.0011 | 0.0010 | 0.0001 | 5.80 |
| 2#-1 | 0.0208 | 0.0208 | 0.0207 | 0.0209 | 0.0206 | 0.0207 | 0.0210 | 0.0206 | 0.0210 | 0.0206 | 0.0002 | 0.77 |
| 3# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 3#-1 | 0.0987 | 0.0982 | 0.0977 | 0.0992 | 0.0988 | 0.0982 | 0.0984 | 0.1002 | 0.1002 | 0.0977 | 0.0008 | 0.83 |
| 4# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 4#-1 | 0.0051 | 0.0050 | 0.0051 | 0.0053 | 0.0052 | 0.0053 | 0.0049 | 0.0052 | 0.0053 | 0.0049 | 0.0002 | 3.01 |
| 5# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 5#-1 | 0.0498 | 0.0495 | 0.0508 | 0.0488 | 0.0500 | 0.0509 | 0.0491 | 0.0497 | 0.0509 | 0.0488 | 0.0008 | 1.60 |
| 样品编号 | 铅（Pb） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0009 | 0.0009 | 0.0009 | 0.0010 | 0.0009 | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0009 | 0.0000 | 4.72 |
| 1#-1 | 0.0101 | 0.0103 | 0.0099 | 0.0099 | 0.0099 | 0.0102 | 0.0099 | 0.0103 | 0.0103 | 0.0099 | 0.0002 | 1.95 |
| 2# | 0.0005 | 0.0004 | 0.0005 | 0.0004 | 0.0005 | 0.0005 | 0.0005 | 0.0004 | 0.0005 | 0.0004 | 0.0000 | 6.11 |
| 2#-1 | 0.0200 | 0.0204 | 0.0194 | 0.0204 | 0.0201 | 0.0198 | 0.0193 | 0.0206 | 0.0206 | 0.0193 | 0.0005 | 2.52 |
| 3# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 3#-1 | 0.0984 | 0.0996 | 0.0976 | 0.0981 | 0.0968 | 0.0992 | 0.1000 | 0.0973 | 0.1000 | 0.0968 | 0.0012 | 1.26 |
| 4# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 4#-1 | 0.0053 | 0.0052 | 0.0052 | 0.0051 | 0.0052 | 0.0055 | 0.0055 | 0.0052 | 0.0055 | 0.0051 | 0.0002 | 3.28 |
| 5# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 5#-1 | 0.0497 | 0.0492 | 0.0484 | 0.0501 | 0.0502 | 0.0508 | 0.0489 | 0.0500 | 0.0508 | 0.0484 | 0.0008 | 1.69 |
| 样品编号 | 锌（Zn） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0135 | 0.0136 | 0.0137 | 0.0131 | 0.0131 | 0.0136 | 0.0139 | 0.0137 | 0.0139 | 0.0131 | 0.0003 | 2.14 |
| 1#-1 | 0.0243 | 0.0244 | 0.0243 | 0.0244 | 0.0244 | 0.0241 | 0.0243 | 0.0243 | 0.0244 | 0.0241 | 0.0001 | 0.43 |
| 2# | 0.0006 | 0.0006 | 0.0007 | 0.0006 | 0.0007 | 0.0006 | 0.0006 | 0.0006 | 0.0007 | 0.0006 | 0.0000 | 6.82 |
| 2#-1 | 0.0207 | 0.0209 | 0.0208 | 0.0206 | 0.0209 | 0.0208 | 0.0205 | 0.0206 | 0.0209 | 0.0205 | 0.0002 | 0.85 |
| 3# | 0.0003 | 0.0002 | 0.0002 | 0.0003 | 0.0002 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0002 | 0.0000 | 7.88 |
| 3#-1 | 0.0994 | 0.0992 | 0.1001 | 0.1012 | 0.0991 | 0.0978 | 0.0983 | 0.1002 | 0.1012 | 0.0978 | 0.0012 | 1.17 |
| 4# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 4#-1 | 0.0050 | 0.0050 | 0.0049 | 0.0052 | 0.0051 | 0.0049 | 0.0049 | 0.0050 | 0.0052 | 0.0049 | 0.0001 | 2.48 |
| 5# | - | - | - | - | - | - | - | - | 0.0000 | — | — | — |
| 5#-1 | 0.0496 | 0.0485 | 0.0489 | 0.0508 | 0.0494 | 0.0498 | 0.0498 | 0.0503 | 0.0508 | 0.0485 | 0.0008 | 1.62 |

表A.8 验证单位八方法精密度实验

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 样品编号 | 平均值 | 样品含量mg/mL | | | | | | | | | | |
| 铝（Al） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0000 | 5.69 |
| 1#-1 | 0.0101 | 0.0100 | 0.0100 | 0.0101 | 0.0100 | 0.0103 | 0.0101 | 0.0104 | 0.0104 | 0.0100 | 0.0001 | 1.42 |
| 2# | 0.0022 | 0.0020 | 0.0023 | 0.0022 | 0.0024 | 0.0023 | 0.0021 | 0.0022 | 0.0024 | 0.0020 | 0.0001 | 6.21 |
| 2#-1 | 0.0220 | 0.0222 | 0.0218 | 0.0218 | 0.0222 | 0.0222 | 0.0217 | 0.0218 | 0.0222 | 0.0217 | 0.0002 | 1.09 |
| 3# | 0.0005 | 0.0004 | 0.0004 | 0.0005 | 0.0004 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0004 | 0.0000 | 6.42 |
| 3#-1 | 0.1058 | 0.1059 | 0.1038 | 0.1065 | 0.1089 | 0.1043 | 0.1048 | 0.1061 | 0.1089 | 0.1038 | 0.0017 | 1.63 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0050 | 0.0052 | 0.0049 | 0.0049 | 0.0052 | 0.0050 | 0.0051 | 0.0052 | 0.0049 | 0.0001 | 2.74 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0504 | 0.0500 | 0.0492 | 0.0511 | 0.0515 | 0.0499 | 0.0506 | 0.0507 | 0.0515 | 0.0492 | 0.0008 | 1.54 |
| 样品编号 | 铍（Be） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0101 | 0.0100 | 0.0100 | 0.0101 | 0.0103 | 0.0102 | 0.0103 | 0.0100 | 0.0103 | 0.0100 | 0.0001 | 1.39 |
| 2# | - | - | - | - | - | - | - | - | — | — | — | — |
| 2#-1 | 0.0206 | 0.0204 | 0.0211 | 0.0204 | 0.0200 | 0.0207 | 0.0206 | 0.0213 | 0.0213 | 0.0200 | 0.0004 | 2.13 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.1016 | 0.1008 | 0.1012 | 0.1023 | 0.1004 | 0.1024 | 0.1025 | 0.1017 | 0.1025 | 0.1004 | 0.0008 | 0.82 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0050 | 0.0051 | 0.0050 | 0.0052 | 0.0049 | 0.0051 | 0.0049 | 0.0051 | 0.0052 | 0.0049 | 0.0001 | 1.76 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0497 | 0.0496 | 0.0506 | 0.0498 | 0.0499 | 0.0502 | 0.0493 | 0.0486 | 0.0506 | 0.0486 | 0.0006 | 1.27 |
| 样品编号 | 镉（Cd） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0001 | 0.0002 | 0.0002 | 0.0001 | 0.0000 | 2.93 |
| 1#-1 | 0.0100 | 0.0101 | 0.0103 | 0.0101 | 0.0099 | 0.0102 | 0.0097 | 0.0099 | 0.0103 | 0.0097 | 0.0002 | 2.06 |
| 2# | - | - | - | - | - | - | - | - | — | — | — | — |
| 2#-1 | 0.0205 | 0.0204 | 0.0206 | 0.0205 | 0.0207 | 0.0204 | 0.0205 | 0.0205 | 0.0207 | 0.0204 | 0.0001 | 0.57 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.1010 | 0.1006 | 0.1014 | 0.1019 | 0.1002 | 0.1006 | 0.1007 | 0.1015 | 0.1019 | 0.1002 | 0.0006 | 0.61 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0052 | 0.0049 | 0.0050 | 0.0050 | 0.0050 | 0.0052 | 0.0053 | 0.0053 | 0.0049 | 0.0002 | 2.97 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0513 | 0.0512 | 0.0502 | 0.0518 | 0.0513 | 0.0519 | 0.0509 | 0.0519 | 0.0519 | 0.0502 | 0.0006 | 1.24 |
| 样品编号 | 铬（Cr） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0000 | 9.30 |
| 1#-1 | 0.0102 | 0.0104 | 0.0104 | 0.0103 | 0.0100 | 0.0100 | 0.0103 | 0.0102 | 0.0104 | 0.0100 | 0.0002 | 1.76 |
| 2# | 0.0012 | 0.0011 | 0.0013 | 0.0013 | 0.0010 | 0.0011 | 0.0014 | 0.0012 | 0.0014 | 0.0010 | 0.0001 | 11.80 |
| 2#-1 | 0.0209 | 0.0208 | 0.0213 | 0.0209 | 0.0209 | 0.0206 | 0.0210 | 0.0209 | 0.0213 | 0.0206 | 0.0002 | 1.01 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0954 | 0.0956 | 0.0975 | 0.0964 | 0.0947 | 0.0952 | 0.0943 | 0.0944 | 0.0975 | 0.0943 | 0.0012 | 1.24 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0049 | 0.0051 | 0.0051 | 0.0053 | 0.0050 | 0.0051 | 0.0052 | 0.0053 | 0.0049 | 0.0001 | 2.79 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0500 | 0.0508 | 0.0493 | 0.0514 | 0.0514 | 0.0499 | 0.0484 | 0.0490 | 0.0514 | 0.0484 | 0.0012 | 2.38 |
| 样品编号 | 铜（Cu） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0642 | 0.0646 | 0.0639 | 0.0638 | 0.0640 | 0.0641 | 0.0647 | 0.0643 | 0.0647 | 0.0638 | 0.0003 | 0.54 |
| 1#-1 | 0.0752 | 0.0754 | 0.0748 | 0.0751 | 0.0750 | 0.0753 | 0.0754 | 0.0754 | 0.0754 | 0.0748 | 0.0002 | 0.30 |
| 2# | 0.0471 | 0.0466 | 0.0468 | 0.0478 | 0.0469 | 0.0470 | 0.0472 | 0.0475 | 0.0478 | 0.0466 | 0.0004 | 0.90 |
| 2#-1 | 0.0681 | 0.0680 | 0.0676 | 0.0687 | 0.0673 | 0.0678 | 0.0687 | 0.0687 | 0.0687 | 0.0673 | 0.0006 | 0.88 |
| 3# | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0000 | 9.08 |
| 3#-1 | 0.1049 | 0.1050 | 0.1058 | 0.1047 | 0.1044 | 0.1044 | 0.1058 | 0.1045 | 0.1058 | 0.1044 | 0.0006 | 0.59 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0052 | 0.0052 | 0.0051 | 0.0052 | 0.0051 | 0.0053 | 0.0053 | 0.0052 | 0.0053 | 0.0051 | 0.0001 | 2.01 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0500 | 0.0505 | 0.0502 | 0.0505 | 0.0499 | 0.0497 | 0.0496 | 0.0499 | 0.0505 | 0.0496 | 0.0004 | 0.70 |
| 样品编号 | 铁（Fe） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0101 | 0.0103 | 0.0100 | 0.0102 | 0.0100 | 0.0100 | 0.0100 | 0.0101 | 0.0103 | 0.0100 | 0.0001 | 1.26 |
| 2# | 0.0047 | 0.0046 | 0.0048 | 0.0048 | 0.0047 | 0.0047 | 0.0046 | 0.0047 | 0.0048 | 0.0046 | 0.0001 | 1.45 |
| 2#-1 | 0.0249 | 0.0242 | 0.0248 | 0.0250 | 0.0254 | 0.0254 | 0.0246 | 0.0251 | 0.0254 | 0.0242 | 0.0004 | 1.74 |
| 3# | 0.0010 | 0.0010 | 0.0011 | 0.0010 | 0.0011 | 0.0009 | 0.0011 | 0.0011 | 0.0011 | 0.0009 | 0.0001 | 7.77 |
| 3#-1 | 0.1026 | 0.1020 | 0.1026 | 0.1022 | 0.1015 | 0.1051 | 0.1011 | 0.1037 | 0.1051 | 0.1011 | 0.0014 | 1.34 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0049 | 0.0049 | 0.0048 | 0.0049 | 0.0052 | 0.0049 | 0.0050 | 0.0048 | 0.0052 | 0.0048 | 0.0001 | 2.92 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0502 | 0.0504 | 0.0489 | 0.0502 | 0.0510 | 0.0500 | 0.0504 | 0.0505 | 0.0510 | 0.0489 | 0.0007 | 1.30 |
| 样品编号 | 锰（Mn） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0101 | 0.0104 | 0.0102 | 0.0099 | 0.0102 | 0.0100 | 0.0101 | 0.0101 | 0.0104 | 0.0099 | 0.0001 | 1.37 |
| 2# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0000 | 2.33 |
| 2#-1 | 0.0201 | 0.0205 | 0.0198 | 0.0201 | 0.0201 | 0.0205 | 0.0202 | 0.0195 | 0.0205 | 0.0195 | 0.0004 | 1.81 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0972 | 0.0973 | 0.0964 | 0.0967 | 0.0972 | 0.0966 | 0.0981 | 0.0982 | 0.0980 | 0.0964 | 0.0007 | 0.72 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0050 | 0.0051 | 0.0051 | 0.0049 | 0.0049 | 0.0052 | 0.0050 | 0.0050 | 0.0052 | 0.0049 | 0.0001 | 2.15 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0500 | 0.0497 | 0.0495 | 0.0501 | 0.0502 | 0.0503 | 0.0502 | 0.0500 | 0.0503 | 0.0495 | 0.0003 | 0.60 |
| 样品编号 | 镍（Ni） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0051 | 0.0053 | 0.0054 | 0.0050 | 0.0049 | 0.0052 | 0.0050 | 0.0050 | 0.0054 | 0.0049 | 0.0002 | 3.54 |
| 1#-1 | 0.0160 | 0.0162 | 0.0158 | 0.0159 | 0.0163 | 0.0157 | 0.0162 | 0.0160 | 0.0163 | 0.0157 | 0.0002 | 1.27 |
| 2# | 0.0011 | 0.0010 | 0.0011 | 0.0011 | 0.0010 | 0.0011 | 0.0011 | 0.0011 | 0.0011 | 0.0010 | 0.0000 | 4.40 |
| 2#-1 | 0.0209 | 0.0206 | 0.0210 | 0.0209 | 0.0208 | 0.0210 | 0.0210 | 0.0206 | 0.0210 | 0.0206 | 0.0002 | 0.83 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0988 | 0.0977 | 0.0988 | 0.0995 | 0.1005 | 0.0981 | 0.0970 | 0.1004 | 0.1005 | 0.0970 | 0.0014 | 1.37 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0050 | 0.0053 | 0.0051 | 0.0050 | 0.0051 | 0.0050 | 0.0050 | 0.0053 | 0.0050 | 0.0001 | 2.56 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0500 | 0.0489 | 0.0508 | 0.0486 | 0.0500 | 0.0507 | 0.0500 | 0.0508 | 0.0508 | 0.0486 | 0.0009 | 1.85 |
| 样品编号 | 铅（Pb） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0009 | 0.0009 | 0.0009 | 0.0009 | 0.0010 | 0.0009 | 0.0009 | 0.0009 | 0.0010 | 0.0009 | 0.0000 | 2.92 |
| 1#-1 | 0.0101 | 0.0098 | 0.0100 | 0.0101 | 0.0102 | 0.0101 | 0.0100 | 0.0102 | 0.0102 | 0.0098 | 0.0001 | 1.25 |
| 2# | 0.0005 | 0.0005 | 0.0005 | 0.0004 | 0.0005 | 0.0005 | 0.0004 | 0.0005 | 0.0005 | 0.0004 | 0.0000 | 3.44 |
| 2#-1 | 0.0208 | 0.0201 | 0.0203 | 0.0211 | 0.0205 | 0.0215 | 0.0211 | 0.0214 | 0.0215 | 0.0201 | 0.0005 | 2.63 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0983 | 0.0987 | 0.0976 | 0.0980 | 0.1008 | 0.0981 | 0.0969 | 0.0980 | 0.1008 | 0.0969 | 0.0012 | 1.24 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0052 | 0.0055 | 0.0050 | 0.0055 | 0.0050 | 0.0049 | 0.0052 | 0.0055 | 0.0055 | 0.0049 | 0.0003 | 5.29 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0495 | 0.0485 | 0.0498 | 0.0494 | 0.0489 | 0.0505 | 0.0491 | 0.0504 | 0.0505 | 0.0485 | 0.0008 | 1.52 |
| 样品编号 | 锌（Zn） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0139 | 0.0137 | 0.0136 | 0.0137 | 0.0140 | 0.0147 | 0.0137 | 0.0143 | 0.0147 | 0.0136 | 0.0004 | 2.98 |
| 1#-1 | 0.0241 | 0.0239 | 0.0242 | 0.0239 | 0.0241 | 0.0242 | 0.0242 | 0.0240 | 0.0242 | 0.0239 | 0.0001 | 0.59 |
| 2# | 0.0006 | 0.0007 | 0.0006 | 0.0006 | 0.0006 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0006 | 0.0000 | 5.58 |
| 2#-1 | 0.0207 | 0.0209 | 0.0208 | 0.0206 | 0.0205 | 0.0208 | 0.0207 | 0.0204 | 0.0209 | 0.0204 | 0.0002 | 0.85 |
| 3# | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0000 | 9.04 |
| 3#-1 | 0.1005 | 0.1011 | 0.1000 | 0.0983 | 0.1005 | 0.1028 | 0.1008 | 0.1003 | 0.1028 | 0.0983 | 0.0014 | 1.35 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0052 | 0.0052 | 0.0051 | 0.0052 | 0.0053 | 0.0053 | 0.0050 | 0.0051 | 0.0053 | 0.0050 | 0.0001 | 2.26 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0503 | 0.0510 | 0.0502 | 0.0501 | 0.0503 | 0.0507 | 0.0491 | 0.0505 | 0.0510 | 0.0491 | 0.0006 | 1.20 |

表A.9 验证单位九方法精密度实验

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 样品编号 | 平均值 | 样品含量mg/mL | | | | | | | | | | |
| 铝（Al） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0000 | 6.33 |
| 1#-1 | 0.0101 | 0.0100 | 0.0102 | 0.0100 | 0.0101 | 0.0102 | 0.0102 | 0.0102 | 0.0102 | 0.0100 | 0.0001 | 1.10 |
| 2# | 0.0023 | 0.0023 | 0.0023 | 0.0022 | 0.0023 | 0.0021 | 0.0023 | 0.0023 | 0.0023 | 0.0021 | 0.0001 | 3.79 |
| 2#-1 | 0.0214 | 0.0219 | 0.0208 | 0.0222 | 0.0211 | 0.0219 | 0.0210 | 0.0210 | 0.0222 | 0.0208 | 0.0006 | 2.70 |
| 3# | 0.0004 | 0.0005 | 0.0004 | 0.0004 | 0.0004 | 0.0005 | 0.0004 | 0.0004 | 0.0005 | 0.0004 | 0.0000 | 12.03 |
| 3#-1 | 0.1029 | 0.1047 | 0.1017 | 0.1010 | 0.1035 | 0.1037 | 0.1047 | 0.1013 | 0.1047 | 0.1010 | 0.0016 | 1.55 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0051 | 0.0051 | 0.0051 | 0.0051 | 0.0051 | 0.0052 | 0.0050 | 0.0052 | 0.0050 | 0.0001 | 1.37 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0510 | 0.0513 | 0.0501 | 0.0507 | 0.0509 | 0.0514 | 0.0515 | 0.0509 | 0.0515 | 0.0501 | 0.0005 | 0.89 |
| 样品编号 | 铍（Be） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0103 | 0.0103 | 0.0103 | 0.0103 | 0.0103 | 0.0104 | 0.0103 | 0.0102 | 0.0104 | 0.0102 | 0.0001 | 0.52 |
| 2# | - | - | - | - | - | - | - | - | — | — | — | — |
| 2#-1 | 0.0195 | 0.0195 | 0.0194 | 0.0190 | 0.0198 | 0.0197 | 0.0201 | 0.0193 | 0.0201 | 0.0190 | 0.0004 | 1.86 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.1002 | 0.1015 | 0.1011 | 0.0995 | 0.0987 | 0.1001 | 0.1006 | 0.1000 | 0.1015 | 0.0987 | 0.0010 | 0.95 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0049 | 0.0050 | 0.0048 | 0.0050 | 0.0049 | 0.0052 | 0.0049 | 0.0048 | 0.0052 | 0.0048 | 0.0001 | 2.55 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0501 | 0.0492 | 0.0508 | 0.0509 | 0.0505 | 0.0499 | 0.0499 | 0.0495 | 0.0509 | 0.0492 | 0.0007 | 1.31 |
| 样品编号 | 镉（Cd） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0000 | 1.30 |
| 1#-1 | 0.0101 | 0.0103 | 0.0099 | 0.0105 | 0.0105 | 0.0097 | 0.0099 | 0.0097 | 0.0105 | 0.0097 | 0.0003 | 3.37 |
| 2# | - | - | - | - | - | - | - | - | — | — | — | — |
| 2#-1 | 0.0202 | 0.0205 | 0.0202 | 0.0205 | 0.0199 | 0.0200 | 0.0202 | 0.0200 | 0.0205 | 0.0199 | 0.0002 | 1.11 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0999 | 0.0999 | 0.1001 | 0.0996 | 0.0997 | 0.0997 | 0.0998 | 0.1003 | 0.1003 | 0.0996 | 0.0003 | 0.26 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0052 | 0.0052 | 0.0051 | 0.0051 | 0.0053 | 0.0051 | 0.0049 | 0.0053 | 0.0049 | 0.0001 | 2.25 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0506 | 0.0503 | 0.0513 | 0.0514 | 0.0508 | 0.0500 | 0.0497 | 0.0507 | 0.0514 | 0.0497 | 0.0007 | 1.30 |
| 样品编号 | 铬（Cr） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0000 | 4.07 |
| 1#-1 | 0.0102 | 0.0099 | 0.0103 | 0.0104 | 0.0100 | 0.0102 | 0.0102 | 0.0103 | 0.0104 | 0.0099 | 0.0002 | 1.66 |
| 2# | 0.0011 | 0.0011 | 0.0010 | 0.0009 | 0.0010 | 0.0011 | 0.0010 | 0.0012 | 0.0012 | 0.0009 | 0.0001 | 9.32 |
| 2#-1 | 0.0211 | 0.0212 | 0.0215 | 0.0214 | 0.0210 | 0.0207 | 0.0210 | 0.0212 | 0.0215 | 0.0207 | 0.0003 | 1.28 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0969 | 0.0956 | 0.0985 | 0.0989 | 0.0987 | 0.0969 | 0.0948 | 0.0949 | 0.0989 | 0.0948 | 0.0018 | 1.89 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0050 | 0.0052 | 0.0050 | 0.0053 | 0.0052 | 0.0053 | 0.0049 | 0.0053 | 0.0049 | 0.0002 | 3.51 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0498 | 0.0499 | 0.0497 | 0.0509 | 0.0491 | 0.0488 | 0.0501 | 0.0498 | 0.0509 | 0.0488 | 0.0007 | 1.35 |
| 样品编号 | 铜（Cu） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0643 | 0.0647 | 0.0641 | 0.0645 | 0.0640 | 0.0643 | 0.0640 | 0.0647 | 0.0647 | 0.0640 | 0.0003 | 0.49 |
| 1#-1 | 0.0752 | 0.0749 | 0.0751 | 0.0755 | 0.0753 | 0.0753 | 0.0751 | 0.0752 | 0.0755 | 0.0749 | 0.0002 | 0.26 |
| 2# | 0.0475 | 0.0476 | 0.0476 | 0.0474 | 0.0471 | 0.0479 | 0.0475 | 0.0477 | 0.0479 | 0.0471 | 0.0003 | 0.53 |
| 2#-1 | 0.0677 | 0.0684 | 0.0673 | 0.0679 | 0.0674 | 0.0671 | 0.0687 | 0.0675 | 0.0687 | 0.0671 | 0.0006 | 0.89 |
| 3# | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0000 | 7.84 |
| 3#-1 | 0.1042 | 0.1039 | 0.1044 | 0.1043 | 0.1048 | 0.1038 | 0.1042 | 0.1041 | 0.1048 | 0.1038 | 0.0003 | 0.33 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0049 | 0.0052 | 0.0049 | 0.0052 | 0.0052 | 0.0051 | 0.0051 | 0.0052 | 0.0049 | 0.0001 | 2.43 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0498 | 0.0498 | 0.0501 | 0.0497 | 0.0490 | 0.0500 | 0.0503 | 0.0499 | 0.0503 | 0.0490 | 0.0004 | 0.82 |
| 样品编号 | 铁（Fe） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0102 | 0.0103 | 0.0102 | 0.0100 | 0.0104 | 0.0103 | 0.0103 | 0.0102 | 0.0104 | 0.0100 | 0.0001 | 1.25 |
| 2# | 0.0047 | 0.0047 | 0.0046 | 0.0048 | 0.0047 | 0.0047 | 0.0048 | 0.0047 | 0.0048 | 0.0046 | 0.0001 | 1.49 |
| 2#-1 | 0.0249 | 0.0247 | 0.0249 | 0.0249 | 0.0250 | 0.0246 | 0.0249 | 0.0254 | 0.0254 | 0.0246 | 0.0003 | 1.02 |
| 3# | 0.0010 | 0.0009 | 0.0010 | 0.0010 | 0.0010 | 0.0011 | 0.0010 | 0.0010 | 0.0011 | 0.0009 | 0.0000 | 4.66 |
| 3#-1 | 0.1038 | 0.1035 | 0.1031 | 0.1047 | 0.1048 | 0.1033 | 0.1034 | 0.1038 | 0.1048 | 0.1031 | 0.0007 | 0.66 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0052 | 0.0051 | 0.0052 | 0.0053 | 0.0053 | 0.0052 | 0.0051 | 0.0051 | 0.0053 | 0.0051 | 0.0001 | 1.82 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0501 | 0.0511 | 0.0514 | 0.0488 | 0.0500 | 0.0491 | 0.0492 | 0.0509 | 0.0514 | 0.0488 | 0.0011 | 2.12 |
| 样品编号 | 锰（Mn） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0102 | 0.0100 | 0.0104 | 0.0101 | 0.0101 | 0.0103 | 0.0102 | 0.0101 | 0.0104 | 0.0100 | 0.0001 | 1.21 |
| 2# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0000 | 2.92 |
| 2#-1 | 0.0201 | 0.0198 | 0.0199 | 0.0202 | 0.0196 | 0.0209 | 0.0200 | 0.0206 | 0.0209 | 0.0196 | 0.0005 | 2.26 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0975 | 0.0975 | 0.0966 | 0.0982 | 0.0983 | 0.0965 | 0.0974 | 0.0976 | 0.0983 | 0.0965 | 0.0007 | 0.70 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0052 | 0.0052 | 0.0051 | 0.0052 | 0.0052 | 0.0051 | 0.0052 | 0.0052 | 0.0052 | 0.0051 | 0.0001 | 1.03 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0502 | 0.0509 | 0.0499 | 0.0504 | 0.0507 | 0.0500 | 0.0503 | 0.0494 | 0.0509 | 0.0494 | 0.0005 | 1.02 |
| 样品编号 | 镍（Ni） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0051 | 0.0049 | 0.0049 | 0.0049 | 0.0050 | 0.0051 | 0.0055 | 0.0053 | 0.0055 | 0.0049 | 0.0002 | 4.51 |
| 1#-1 | 0.0161 | 0.0164 | 0.0164 | 0.0160 | 0.0163 | 0.0160 | 0.0158 | 0.0159 | 0.0164 | 0.0158 | 0.0002 | 1.46 |
| 2# | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0011 | 0.0010 | 0.0010 | 0.0011 | 0.0010 | 0.0000 | 4.13 |
| 2#-1 | 0.0210 | 0.0208 | 0.0213 | 0.0208 | 0.0210 | 0.0207 | 0.0211 | 0.0211 | 0.0207 | 0.0207 | 0.0002 | 1.09 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0993 | 0.0992 | 0.1003 | 0.0992 | 0.0993 | 0.0994 | 0.0971 | 0.1003 | 0.1003 | 0.0971 | 0.0011 | 1.07 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0052 | 0.0054 | 0.0055 | 0.0050 | 0.0049 | 0.0051 | 0.0055 | 0.0050 | 0.0055 | 0.0049 | 0.0003 | 5.29 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0507 | 0.0510 | 0.0511 | 0.0505 | 0.0502 | 0.0500 | 0.0506 | 0.0511 | 0.0511 | 0.0500 | 0.0004 | 0.88 |
| 样品编号 | 铅（Pb） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0010 | 0.0009 | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0009 | 0.0010 | 0.0009 | 0.0000 | 4.21 |
| 1#-1 | 0.0101 | 0.0101 | 0.0104 | 0.0101 | 0.0103 | 0.0099 | 0.0100 | 0.0103 | 0.0104 | 0.0099 | 0.0002 | 1.94 |
| 2# | 0.0005 | 0.0005 | 0.0004 | 0.0005 | 0.0005 | 0.0004 | 0.0004 | 0.0004 | 0.0005 | 0.0004 | 0.0000 | 6.64 |
| 2#-1 | 0.0201 | 0.0211 | 0.0194 | 0.0200 | 0.0213 | 0.0195 | 0.0191 | 0.0201 | 0.0213 | 0.0191 | 0.0008 | 4.14 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0990 | 0.1010 | 0.0969 | 0.0970 | 0.0997 | 0.0975 | 0.1004 | 0.1003 | 0.1010 | 0.0969 | 0.0018 | 1.81 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0053 | 0.0053 | 0.0054 | 0.0055 | 0.0054 | 0.0052 | 0.0053 | 0.0049 | 0.0055 | 0.0049 | 0.0002 | 3.48 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0508 | 0.0496 | 0.0504 | 0.0509 | 0.0513 | 0.0509 | 0.0514 | 0.0512 | 0.0514 | 0.0496 | 0.0006 | 1.24 |
| 样品编号 | 锌（Zn） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0135 | 0.0134 | 0.0136 | 0.0137 | 0.0134 | 0.0130 | 0.0138 | 0.0135 | 0.0138 | 0.0130 | 0.0003 | 2.04 |
| 1#-1 | 0.0243 | 0.0245 | 0.0243 | 0.0240 | 0.0241 | 0.0245 | 0.0243 | 0.0245 | 0.0245 | 0.0240 | 0.0002 | 0.81 |
| 2# | 0.0007 | 0.0006 | 0.0006 | 0.0007 | 0.0006 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0006 | 0.0000 | 7.30 |
| 2#-1 | 0.0207 | 0.0208 | 0.0207 | 0.0208 | 0.0206 | 0.0207 | 0.0206 | 0.0204 | 0.0208 | 0.0204 | 0.0001 | 0.60 |
| 3# | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0000 | 6.26 |
| 3#-1 | 0.1003 | 0.0977 | 0.1031 | 0.1011 | 0.0989 | 0.0987 | 0.1022 | 0.1004 | 0.1031 | 0.0977 | 0.0020 | 1.96 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0049 | 0.0052 | 0.0050 | 0.0053 | 0.0053 | 0.0050 | 0.0053 | 0.0053 | 0.0049 | 0.0002 | 3.26 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0506 | 0.0514 | 0.0512 | 0.0509 | 0.0496 | 0.0513 | 0.0507 | 0.0489 | 0.0514 | 0.0489 | 0.0010 | 1.89 |

表A.10 验证单位十方法精密度实验

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 样品编号 | 平均值 | 样品含量mg/mL | | | | | | | | | | |
| 铝（Al） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0000 | 8.75 |
| 1#-1 | 0.0102 | 0.0101 | 0.0104 | 0.0102 | 0.0100 | 0.0101 | 0.0101 | 0.0103 | 0.0104 | 0.0100 | 0.0001 | 1.31 |
| 2# | 0.0022 | 0.0022 | 0.0021 | 0.0021 | 0.0022 | 0.0023 | 0.0021 | 0.0022 | 0.0023 | 0.0021 | 0.0001 | 3.79 |
| 2#-1 | 0.0219 | 0.0221 | 0.0225 | 0.0213 | 0.0220 | 0.0211 | 0.0220 | 0.0221 | 0.0225 | 0.0211 | 0.0005 | 2.30 |
| 3# | 0.0004 | 0.0004 | 0.0005 | 0.0004 | 0.0005 | 0.0004 | 0.0004 | 0.0004 | 0.0005 | 0.0004 | 0.0001 | 12.97 |
| 3#-1 | 0.1045 | 0.1058 | 0.1034 | 0.1024 | 0.1041 | 0.1069 | 0.1071 | 0.1020 | 0.1071 | 0.1020 | 0.0021 | 1.98 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0050 | 0.0049 | 0.0051 | 0.0051 | 0.0050 | 0.0050 | 0.0049 | 0.0051 | 0.0051 | 0.0049 | 0.0001 | 1.40 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0505 | 0.0512 | 0.0495 | 0.0509 | 0.0497 | 0.0509 | 0.0498 | 0.0511 | 0.0512 | 0.0495 | 0.0007 | 1.42 |
| 样品编号 | 铍（Be） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0102 | 0.0101 | 0.0102 | 0.0104 | 0.0102 | 0.0101 | 0.0102 | 0.0103 | 0.0104 | 0.0101 | 0.0001 | 1.00 |
| 2# | - | - | - | - | - | - | - | - | — | — | — | — |
| 2#-1 | 0.0213 | 0.0218 | 0.0219 | 0.0212 | 0.0200 | 0.0210 | 0.0212 | 0.0220 | 0.0220 | 0.0200 | 0.0007 | 3.36 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.1004 | 0.0988 | 0.1018 | 0.1013 | 0.0993 | 0.1015 | 0.0992 | 0.1013 | 0.1018 | 0.0988 | 0.0013 | 1.28 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0050 | 0.0048 | 0.0052 | 0.0049 | 0.0051 | 0.0050 | 0.0048 | 0.0052 | 0.0052 | 0.0048 | 0.0002 | 3.27 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0500 | 0.0503 | 0.0508 | 0.0496 | 0.0498 | 0.0488 | 0.0494 | 0.0509 | 0.0509 | 0.0488 | 0.0008 | 1.54 |
| 样品编号 | 镉（Cd） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0000 | 2.51 |
| 1#-1 | 0.0101 | 0.0097 | 0.0099 | 0.0102 | 0.0099 | 0.0105 | 0.0104 | 0.0103 | 0.0105 | 0.0097 | 0.0003 | 2.96 |
| 2# | - | - | - | - | - | - | - | - | — | — | — | — |
| 2#-1 | 0.0203 | 0.0207 | 0.0199 | 0.0204 | 0.0201 | 0.0202 | 0.0201 | 0.0207 | 0.0207 | 0.0199 | 0.0003 | 1.64 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.1010 | 0.1008 | 0.1010 | 0.1013 | 0.1009 | 0.1016 | 0.1015 | 0.0999 | 0.1016 | 0.0999 | 0.0006 | 0.55 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0052 | 0.0052 | 0.0052 | 0.0053 | 0.0050 | 0.0051 | 0.0052 | 0.0053 | 0.0053 | 0.0050 | 0.0001 | 1.80 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0511 | 0.0508 | 0.0516 | 0.0515 | 0.0514 | 0.0497 | 0.0514 | 0.0511 | 0.0516 | 0.0497 | 0.0007 | 1.31 |
| 样品编号 | 铬（Cr） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0000 | 7.70 |
| 1#-1 | 0.0101 | 0.0100 | 0.0101 | 0.0100 | 0.0104 | 0.0101 | 0.0102 | 0.0102 | 0.0104 | 0.0100 | 0.0001 | 1.21 |
| 2# | 0.0011 | 0.0009 | 0.0012 | 0.0011 | 0.0010 | 0.0011 | 0.0011 | 0.0010 | 0.0012 | 0.0009 | 0.0001 | 9.21 |
| 2#-1 | 0.0211 | 0.0214 | 0.0213 | 0.0212 | 0.0206 | 0.0211 | 0.0208 | 0.0213 | 0.0214 | 0.0206 | 0.0003 | 1.40 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0970 | 0.0972 | 0.0964 | 0.0951 | 0.0949 | 0.0990 | 0.0987 | 0.0979 | 0.0990 | 0.0949 | 0.0016 | 1.68 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0050 | 0.0049 | 0.0048 | 0.0048 | 0.0050 | 0.0051 | 0.0051 | 0.0050 | 0.0051 | 0.0048 | 0.0001 | 2.90 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0496 | 0.0504 | 0.0487 | 0.0486 | 0.0489 | 0.0507 | 0.0495 | 0.0504 | 0.0507 | 0.0486 | 0.0009 | 1.77 |
| 样品编号 | 铜（Cu） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0640 | 0.0639 | 0.0640 | 0.0642 | 0.0639 | 0.0638 | 0.0641 | 0.0643 | 0.0643 | 0.0638 | 0.0002 | 0.26 |
| 1#-1 | 0.0752 | 0.0752 | 0.0751 | 0.0753 | 0.0751 | 0.0755 | 0.0751 | 0.0752 | 0.0755 | 0.0751 | 0.0001 | 0.17 |
| 2# | 0.0469 | 0.0465 | 0.0467 | 0.0473 | 0.0466 | 0.0466 | 0.0471 | 0.0474 | 0.0474 | 0.0465 | 0.0004 | 0.76 |
| 2#-1 | 0.0678 | 0.0670 | 0.0689 | 0.0688 | 0.0672 | 0.0686 | 0.0668 | 0.0674 | 0.0689 | 0.0668 | 0.0009 | 1.34 |
| 3# | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0000 | 1.85 |
| 3#-1 | 0.1041 | 0.1033 | 0.1045 | 0.1026 | 0.1045 | 0.1049 | 0.1045 | 0.1042 | 0.1049 | 0.1026 | 0.0008 | 0.79 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0052 | 0.0053 | 0.0053 | 0.0052 | 0.0053 | 0.0053 | 0.0052 | 0.0051 | 0.0053 | 0.0051 | 0.0001 | 1.66 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0505 | 0.0514 | 0.0500 | 0.0509 | 0.0501 | 0.0502 | 0.0507 | 0.0505 | 0.0514 | 0.0500 | 0.0005 | 0.98 |
| 样品编号 | 铁（Fe） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - | - | - | - | - | - | - | - | — | — | — | — |
| 1#-1 | 0.0100 | 0.0099 | 0.0101 | 0.0101 | 0.0100 | 0.0101 | 0.0100 | 0.0102 | 0.0102 | 0.0099 | 0.0001 | 0.99 |
| 2# | 0.0047 | 0.0046 | 0.0047 | 0.0047 | 0.0047 | 0.0046 | 0.0047 | 0.0047 | 0.0047 | 0.0046 | 0.0001 | 1.25 |
| 2#-1 | 0.0247 | 0.0251 | 0.0254 | 0.0246 | 0.0247 | 0.0240 | 0.0240 | 0.0253 | 0.0254 | 0.0240 | 0.0006 | 2.31 |
| 3# | 0.0011 | 0.0011 | 0.0010 | 0.0011 | 0.0011 | 0.0011 | 0.0010 | 0.0012 | 0.0012 | 0.0010 | 0.0001 | 6.12 |
| 3#-1 | 0.1033 | 0.1034 | 0.1028 | 0.1036 | 0.1029 | 0.1051 | 0.1028 | 0.1024 | 0.1051 | 0.1024 | 0.0009 | 0.87 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0052 | 0.0050 | 0.0053 | 0.0052 | 0.0052 | 0.0051 | 0.0053 | 0.0050 | 0.0053 | 0.0050 | 0.0001 | 2.44 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0497 | 0.0498 | 0.0500 | 0.0495 | 0.0489 | 0.0501 | 0.0505 | 0.0492 | 0.0505 | 0.0489 | 0.0006 | 1.11 |
| 样品编号 | 锰（Mn） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | - |  |  |  |  |  |  |  | — | — | — | — |
| 1#-1 | 0.0101 | 0.0101 | 0.0100 | 0.0101 | 0.0101 | 0.0100 | 0.0099 | 0.0102 | 0.0102 | 0.0099 | 0.0001 | 0.92 |
| 2# | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0000 | 2.77 |
| 2#-1 | 0.0205 | 0.0200 | 0.0204 | 0.0203 | 0.0205 | 0.0208 | 0.0208 | 0.0206 | 0.0208 | 0.0200 | 0.0003 | 1.36 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0979 | 0.0985 | 0.0986 | 0.0975 | 0.0980 | 0.0983 | 0.0969 | 0.0976 | 0.0986 | 0.0969 | 0.0006 | 0.63 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0052 | 0.0052 | 0.0051 | 0.0050 | 0.0050 | 0.0052 | 0.0050 | 0.0052 | 0.0050 | 0.0001 | 2.10 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0503 | 0.0508 | 0.0497 | 0.0500 | 0.0503 | 0.0509 | 0.0499 | 0.0502 | 0.0509 | 0.0497 | 0.0004 | 0.88 |
| 样品编号 | 镍（Ni） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0051 | 0.0053 | 0.0052 | 0.0051 | 0.0049 | 0.0051 | 0.0049 | 0.0052 | 0.0053 | 0.0049 | 0.0001 | 2.84 |
| 1#-1 | 0.0159 | 0.0161 | 0.0160 | 0.0158 | 0.0162 | 0.0163 | 0.0155 | 0.0157 | 0.0163 | 0.0155 | 0.0003 | 1.65 |
| 2# | 0.0010 | 0.0012 | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0010 | 0.0012 | 0.0010 | 0.0001 | 5.98 |
| 2#-1 | 0.0213 | 0.0212 | 0.0211 | 0.0215 | 0.0214 | 0.0214 | 0.0215 | 0.0212 | 0.0215 | 0.0211 | 0.0001 | 0.66 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0986 | 0.0984 | 0.0983 | 0.0985 | 0.0997 | 0.0977 | 0.0991 | 0.0987 | 0.0997 | 0.0977 | 0.0006 | 0.63 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0051 | 0.0049 | 0.0053 | 0.0051 | 0.0052 | 0.0049 | 0.0052 | 0.0053 | 0.0049 | 0.0002 | 3.08 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0497 | 0.0501 | 0.0492 | 0.0501 | 0.0493 | 0.0496 | 0.0497 | 0.0498 | 0.0501 | 0.0492 | 0.0003 | 0.69 |
| 样品编号 | 铅（Pb） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0009 | 0.0009 | 0.0009 | 0.0010 | 0.0010 | 0.0009 | 0.0010 | 0.0010 | 0.0010 | 0.0009 | 0.0001 | 6.62 |
| 1#-1 | 0.0102 | 0.0100 | 0.0099 | 0.0101 | 0.0102 | 0.0102 | 0.0104 | 0.0104 | 0.0104 | 0.0099 | 0.0002 | 1.89 |
| 2# | 0.0005 | 0.0005 | 0.0005 | 0.0004 | 0.0004 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0004 | 0.0000 | 3.69 |
| 2#-1 | 0.0201 | 0.0187 | 0.0202 | 0.0199 | 0.0212 | 0.0204 | 0.0188 | 0.0211 | 0.0212 | 0.0187 | 0.0010 | 4.95 |
| 3# | - | - | - | - | - | - | - | - | — | — | — | — |
| 3#-1 | 0.0986 | 0.0973 | 0.1007 | 0.0977 | 0.0985 | 0.0972 | 0.0988 | 0.1002 | 0.1007 | 0.0972 | 0.0014 | 1.37 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0053 | 0.0049 | 0.0052 | 0.0055 | 0.0050 | 0.0052 | 0.0050 | 0.0055 | 0.0049 | 0.0002 | 3.66 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0503 | 0.0502 | 0.0486 | 0.0503 | 0.0500 | 0.0513 | 0.0509 | 0.0511 | 0.0513 | 0.0486 | 0.0009 | 1.79 |
| 样品编号 | 锌（Zn） | 1 | 2 | 3 | 4 | 5 | 6 | 7 | MAX | MIN | STD | RSD |
| 1# | 0.0135 | 0.0132 | 0.0136 | 0.0132 | 0.0137 | 0.0136 | 0.0137 | 0.0137 | 0.0137 | 0.0132 | 0.0002 | 1.70 |
| 1#-1 | 0.0243 | 0.0244 | 0.0244 | 0.0240 | 0.0242 | 0.0243 | 0.0245 | 0.0243 | 0.0245 | 0.0240 | 0.0002 | 0.68 |
| 2# | 0.0007 | 0.0006 | 0.0007 | 0.0007 | 0.0007 | 0.0007 | 0.0006 | 0.0006 | 0.0007 | 0.0006 | 0.0001 | 8.93 |
| 2#-1 | 0.0206 | 0.0206 | 0.0206 | 0.0205 | 0.0207 | 0.0206 | 0.0208 | 0.0204 | 0.0208 | 0.0204 | 0.0001 | 0.63 |
| 3# | 0.0003 | 0.0002 | 0.0002 | 0.0002 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0002 | 0.0000 | 8.52 |
| 3#-1 | 0.1002 | 0.1019 | 0.0999 | 0.0986 | 0.1019 | 0.1019 | 0.0983 | 0.0989 | 0.1019 | 0.0983 | 0.0017 | 1.65 |
| 4# | - | - | - | - | - | - | - | - | — | — | — | — |
| 4#-1 | 0.0051 | 0.0051 | 0.0052 | 0.0050 | 0.0052 | 0.0052 | 0.0050 | 0.0050 | 0.0052 | 0.0050 | 0.0001 | 1.96 |
| 5# | - | - | - | - | - | - | - | - | — | — | — | — |
| 5#-1 | 0.0499 | 0.0507 | 0.0495 | 0.0496 | 0.0514 | 0.0498 | 0.0496 | 0.0485 | 0.0514 | 0.0485 | 0.0010 | 1.91 |

附 录B

（资料性）

推荐分析谱线波长和仪器工作参数

B.1 测试元素推荐分析谱线波长

使用电感耦合等离子体原子发射光谱仪，其测定银，金，铱，钯，铂的谱线如表B.1。

表B.1 测试元素推荐分析谱线波长

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 波长  nm | 元素 | 波长  nm |
| Al | 309.271 | Fe | 259.937 |
| Be | 313.041 | Mn | 257.606 |
| Cd | 226.502 | Ni | 231.605 |
| Cr | 283.565 | Pb | 220.352 |
| Cu | 327.393 | Zn | 213.855 |

B.2 仪器测量参数

使用电感耦合等离子体原子发射光谱仪，其测定银，金，铱，钯，铂的仪器测量参数如表B.2。

表B.2 仪器测量参数

|  |  |  |  |
| --- | --- | --- | --- |
| 工作参数 | 设定值 | 工作参数 | 设定值 |
| 功率  冷却气（Ar）  辅助气（Ar）接口  雾化器流速（Ar）  进样泵速 | 1200W  12.0L/min  1.0L/min  0.8L/min  12rpm | 积分时间  进样冲洗时间  稳定时间  观测位高度  观测方式  积分方式 | 5s  15s  30s  8mm  双向（轴）  峰面积 |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_