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Experimental investigation of improved tolerance for concentration mismatch in potassium isotopeanalysis on a hexapole collision cell MC-ICP-MS(Nu Sapphire)

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The collision cell multi-collector inductively coupled plasma mass spectrometry (CC-MC-ICP-MS) has made routine high precision potassium (K) isotope analysis possible using sample-standard bracketing. However, as reported in previous studies, strict concentration match between sample and bracketing standard (<2% tolerance reported from most labs worldwide) is often required to avoid analytical bias. This small tolerance for concentration mismatch would naturally lead to low analytical efficiency. To better characterize and potentially improve this, we conducted a series of experiments on the hexapole parameters of the Nu Sapphire CC-MC-ICP-MS. Results reveal that RF Ref. (the voltage of the RF alternating current applied to the hexapole rods) is the primary parameter that controls the concentration mismatch effect. For a set RF Bias Ref value (the potential for the hexapole) of -0.8 V, the optimal RF Ref. value of 1.05 V identified by the flattest part in the $^{41}K/^{39}K$ ratio versus RF Ref. plot has increased the tolerance for K concentration mismatch to 30% from 4% at RF Ref. of 1.5 V. Cell gas flow rate is another important parameter and optimal values of 2 sccm and 5 sccm are recommended for He and H_2, respectively. A much higher tolerance for concentration mismatch using optimized parameters has greatly improved the efficiency of high precision K isotope analyses using CC-MC-ICP-MS.