Sodium Interference in Lithium Isotope Ratio Analysis by Inductively Coupled Plasma Mass Spectrometry

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Introduction: Naturally occurring lithium consists of two stable isotopes, ^{6}Li (7.591%) and ^{7}Li (92.409%) and have applications in nuclear technology, pharmaceutical, automotive and geological research. Enriched ^{7}Li isotope in LiOH form has been used as a pH regulator for Pressurized Water Reactor (PWR) reducing corrosion in the primary water circuit [1-3]. The determination of lithium isotopic composition was analyzed by Inductively Coupled Plasma Mass Spectrometry after ion exchange processes, which has been considered a promising technique for the separation of Li isotopes. One of the concerns in ICP-MS analysis is sodium interference. The presence of sodium in the lithium-containing sample has potential implications for the accuracy of isotopic ratio measurements. For this reason, a method is described for the study of sodium interference in ^{7}Li 295,88‰ and 303,30‰ enriched solutions.

Methods: For this study, the reference standard L-SVEC was used, it has an isotopic abundance of 92.409% for ^{7}Li and 7.591% for ^{6}Li ($^{6}Li/^{7}Li$ ratio = 0.08251) and solutions enriched at 295,88‰ ($^{6}Li/^{7}Li$ ratio = 0.06661) and 303,30‰ ($^{6}Li/^{7}Li$ ratio = 0.06810) of ^{7}Li. Concentrations of 50 μg L^{-1} of lithium were maintained for the solutions used and it was evaluated with the addition of 50, 100, 300, 450 and 1000 μg L^{-1} of sodium on the enriched samples suffered significant changes in their isotopic ratio. The ICP-MS used for the sample analysis was a PerkinElmer SCIEX Elan 6000. For the isotopic ratio measurement the parameters used was nebulizer gas flow of approximately 0.94 L min^{-1} , Radio Frequency (RF) 600 W, gas flow rate 1.2 L min^{-1} , Peak Hopping mode, dwell time 80 and 480 ms for ^{6}Li and ^{7}Li respectively, 50 sweeps per reading, 1 read per replicate and 10 replicates.

Results: For this study, 24 samples were analyzed being divided into four sets of samples with 6 samples each set. The sets were composed of samples without addition of sodium and samples with addition of 50, 100, 300, 450 and 1000 μg L^{-1} of sodium. The first set of samples, composed of the 295,88‰ enriched sample, had a standard deviation of 3.59×10^{-4}. The second set of samples, composed of the 303,30‰ enriched sample, had a standard deviation of 2.63×10^{-4}. The third and fourth set of samples, composed of aliquots of the L-SVEC standard, obtained a standard deviation of 2.22×10^{-4} e 2.54×10^{-4}, respectively. Showing that the addition of sodium did not significantly interfere in the ratio of lithium isotopes 6 and 7 according to standard deviation.

Conclusions: Through the results obtained from the experiment, it was observed that the variation in the ratio between isotopes 6 and 7 of lithium was not significant for the results of analysis in ICP-MS. However, it should be noted that for the purposes of lithium isotope separation processes

using ion exchange resins, the interference of sodium in the chromatographic separation needs to be evaluated.

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