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Neutron activation analysis of mercury in petroleum distillates

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In liquefied natural gas (LNG) plants and nitrogen rejections units (NRU) that utilize aluminum heat exchangers, mercury (Hg) contaminates can result in corrosion of equipment, poisoning of catalysts, mechanical failure, and gas leakage. The purity of the product streams from these plants is also important due to the fact that many of the resulting products such as naphtha are used as feedstock for ethylene production and various solvents. Analytical methods such as chemical extractions (CE), combustion/trap (CT), atomic fluorescent spectrometry (AFS), and inductively coupled plasma optical emission spectrometry (ICP-OES) have been used to measure mercury in petroleum distillates. These methods require extensive sample preparation. A mercury analytical method that can be applied to distillates in routine operation that minimizes mercury loss from sampling preparation is needed. Neutron Activation Analysis (NAA) is a sensitive analytical technique that can be applied to samples as received. The objective of this work was to develop a NAA procedure for testing Hg in naphtha. Virgin naphtha samples were spiked with Hg at concentrations of 20, 50, 200, 500, 1000 and 1500 ng/g. One set of samples were prepared 3 days prior to irradiation and the second set was prepared and irradiated the same day. Analysis of the samples proved that even at small samples sizes (~800 µl) concentrations of 50 to 1500 ng/g of mercury in naphtha are easily detected and give a linear response. Samples that were prepared and irradiated on the same day showed less Hg loss than those prepared 3 days prior to irradiation. Analysis of multiple (n=5) 200 ng/g samples yielded a precision of 9% RSD. The minimum detectable amount of Hg using this technique is 5 ng.