Development of A Resin Column System for A Sampler to Collect Dry Atmospheric Deposits of Mercury

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Abstract: Many previous studies for detecting the atmospheric mercury from wet deposition have been reported. In comparison, little effort has been made in studying mercury from dry deposition. There is currently no sampler which collects atmospheric mercury dry deposits. A new mercury dry deposition sampler has been designed conceptually. It employs a moving sheet of water to passively collect dry deposits of mercury. The water will be drained into a reservoir and recirculated through a resin column that is capable of retaining the mercury deposits. In this report, an adsorption-separation process is proposed for collecting and analyzing dry atmospheric mercury deposits, through development of a Chelex 100 resin column system. When the water flows continually through the resin column, the mercury deposits will be adsorbed by the resin. After the sampling process, the mercury can then be separated from the resin through application of an acidic solution. The extracted solution that contains the separated mercury is then analyzed through a cold-vapor mercury analyzer. In this study, hydrochloric acid, nitric acid and sulfuric acid, were tested. Chelex 100 resin (Sigma Chemical Co., St. Louis) was tested under laboratory conditions using solutions of known mercury concentration in order to determine its efficiency in adsorption and separation. The results indicate that Chelex 100 resin could adsorb more than 95% of the mercury in the test solutions with a pH range from 1.65 to 11.45. Sulfuric acid was found to have better overall performance than hydrochloric acid and nitric acid in extracting (desorbing) the mercury from the resin column. Desorption rates of 104.3% and 102.7% were obtained with the use of 8 N H_2SO_4 for mercury solutions of pH 4.55 and 11.45, respectively. In addition, a satisfactory desorption rate (95.2%) was achieved with 4 N H_2SO_4 for a mercury solution of pH 5.90. Development of the adsorption-separation process and identification of the optimal system conditions provide scientific bases for designing the sampler.

Key words: Mercury; adsorption; desorption; atmospheric dry deposits; Chelex 100 resin; sampler.