Introduction: In soil environments, arsenic and mercury can be stabilized through the Ca-As precipitation and the forming of mercuric sulfide. Because calcium sulfate fertilizer contains high amounts of Ca and S, it might be an effective amendment for stabilizing arsenic and mercury contaminated soils. In this study, we assessed the application of calcium sulfate fertilizer as an amendment for arsenic and mercury contaminated soil in an abandoned mine through a pot experiment for lettuce growth.

Methods: The pots used in this experiment were 9 cm in height and 9 cm in diameter and contained 400 g of dried soil. In the amended condition, the soil was mixed with calcium sulfate fertilizer, produced by Namhae chemical corp., in a ratio of 5%(w/w). Approximately 40 seeds of lettuce were sown in each pot. During the growth period, pots were irrigated with tap water when needed. Samples of the aerial parts of lettuce and soils in the pot were collected 34 days after seeding. Control and amended samples were collected in triplicate.

Results and Conclusions: The arsenic and mercury uptakes of lettuce grown in the amended pots were decreased by 74% and 86%, respectively compared with the control pots. The lower uptakes of lettuce in the amended soil were due to the Ca and S from the fertilizer that had reacted with arsenic and mercury in the soil. These reactions resulted in Ca-As precipitation and insoluble chemicals as mercuric sulfide. Therefore, in the amended soils the increase in Ca-As precipitation and mercuric sulfide could decrease the mobilities of arsenic and mercury. The results suggest that calcium sulfate fertilizer could be used as an effective amendment for stabilizing arsenic and mercury contaminated soil.

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3. Soil Security and Human Health
Poster Presentation

Keywords: plastic mulching, persistent pollutant, extraction of microplastics, soil texture, density separation

A Sedimentation Method with Sieving for Measurement of Different Particle Size Fractions of Microplastics in Farmland Soils

Zi-Yi Chen[1], Wan-Ting Chiao[1], Hsiao-Pei Hsu[1], Yen-Cheng Chen[1], Bo-Ching Chen[2], Kai-Wei Juang[1]

[1]Department of Agronomy, National Chiayi University, Chiayi City, Taiwan; [2]Department of Natural Biotechnology, Nanhua University, Chiayi County, Taiwan

Microplastics (MPs) has become a common persistent pollutant in the environments. It is difficult to completely extract MPs from a terrestrial medium (i.e. soil) to measure the deposition of MPs. In this study, a sedimentation method with sieving was proposed to separate MPs from a soil suspension and to collect different particle size fractions of MPs for measurement by weighing. Three plastic materials, low-density polyethylene (LDPE), high-density polyethylene (HDPE) and polypropylene (PP) were used to exam the extraction recoveries of MPs from three Taiwan farmland soils (i.e. Pinchen, Tapaisa, and Chaikongtso). The soil textures are classified into clayey, sandy and silty loams, respectively. Two size fractions (i.e. 5-2 and 2-0.15 mm) of MPs were added in each soil to prepare the treated soil samples with 1% MPs, respectively. For each soil, there were 6 treated soil samples and one control without MPs addition. Ten grams of soil sample and 1 L of distilled water were placed into a glass 1-L cylinder and then the soil suspension in the cylinder was stir up and down to prompt MPs floating on the suspension surface. Let it stand still at least for 2 hr during soil particles (< 0.15 mm) settling down. Then, pour out the top suspension and floating MPs and sequentially pass 10- and 100-mesh sieves to collect the two size fractions (5-2 and 2-0.15 mm) of MPs. Each fraction of collected MPs was air dried and measured by weighing to calculate recovery rates. For the two size fractions of LDPE, HDPE, and PP from the three soils, the extraction recoveries all were close to 100%. The recoveries for the fraction of 2-0.15 mm MPs from the three soils all were slightly lower than those for the fraction of 5-2 mm MPs. Thus, the sedimentation method with sieving is promising for measurement of the MPs with particle size bigger than 0.15 mm in the soils with a wide range of texture classes. Extraction of smaller size fraction of MPs from soil by sedimentation and associated with MPs measurement by weighing would meet a lower recovery and higher variation.

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