Study on the impacts of Antimony-bearing mine wastes on surrounding environments in antimony mining areas

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Antimony (Sb) is a useful element, it is widely used in people's daily life because of its flame retardancy, such as textiles, papermaking, plastics, electronic products, automobile brake pads and so on. Sb is also a toxic element, the threshold of Sb in the environment is strictly limited because of its toxicity. Sb is really a global dilemma[1]. Recently, with the awareness of Sb pollution, the exploitation of Sb resources has been gradually restricted. However, a large amount of mine wastes produced in the early Sb mining process has to become the most significant source of Sb pollution. This study investigated the Sb concentrations in mine waste samples from several typical Sb mine areas, combined with the water soluble Sb leaching experiments, and revealed the distribution and migration of Sb in Sb-bearing mine wastes, and then indicated environmental impacts of mine wastes on the surrounding rivers and soil-plant systems. Some of conclusions are as follows:

The higher dissolved Sb contents were found with the higher pH of mine wastes, indicating that a greater mobility of Sb in alkalescent than in acid mine wastes. Moreover, some of mine wastes we collected were actually distributed in the riverbed or along the riverbank during the dry season. Once the season is full of rain, they are drowned in the river. According to our study results, it showed that near-neutral circumstance combined with wet-dry cycle forms the favorable condition for the release of Sb from the mine wastes. Those mine dumps abandoned in the river course could release Sb into the rivers with the influence of season. Sb is oxidized and accumulated on the surface of mine wastes in dry season. Once it is washed by rains or surface runoffs, it will carry a large amount of dissolved Sb into the downstream river environment.

Regarding the Sb enrichment in plants growing in soil containing mine wastes, the concentrations of Sb in plant parts are in the order of roots > leaves > shoots. Plant samples have a low ability to transport Sb from the roots to the epigeal parts, which means that Sb in epigeal parts, especially in leaves, may come from the influence of atmospheric deposition. This needs further study on the mechanism of Sb uptake by plants.

[1] Herath et al. (2017) Environ. Pollut., 223, 545-559.