Determination of (Bio)-available mercury in soils: A review

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Despite the mercury (Hg) control measures adopted by the international community, Hg still poses a significant risk to ecosystem and human health. This is primarily due to the ability of atmospheric Hg to travel intercontinentally and contaminating terrestrial and aquatic environments far from its natural and anthropogenic point sources. The issue of Hg pollution is further complicated by its unique physicochemical characteristics, most noticeably its multiple chemical forms that vary in their toxicity and environmental mobility. This meant that most of the risk evaluation protocols developed for other metal(loid)s are not suitable for Hg. Soil is a major reservoir of Hg and a key player in its global cycle. To fully assess the risks of soil Hg it is essential to estimate its bioavailability and/or availability which are closely linked to its toxicity. However, the accurate determination of the (bio)-available pools of Hg in soils is problematic, because the terms 'bioavailable' and 'available' are ill-defined. In particular, the term 'bioavailable pool', representing the fraction of Hg that is accessible to living organisms, has been consistently misused by interchanging with other intrinsically different terms e.g. mobile, labile, reactive and soluble pools. A wide array of physical, chemical, biological and isotopic exchange methods were developed to estimate the (bio)-available pools of Hg in soil in an attempt to offer a plausible assessment of its risks. Unfortunately, many of these methods do not mirror the (bio)-available pools of soil Hg and suffer from technical drawbacks. In this review, we discuss advantages and disadvantages of methods that are currently applied to quantify the (bio)-availability of Hg in soils. We recommended the most feasible methods and give suggestions how to improve the determination of (bio)-available Hg in soils.

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