

Arsenic Occurrence, Ecotoxicity and its Potential Remediation

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Abstract

Arsenic levels in water, sediments, and biota of the estuaries and coastal ecosystems have been well documented. Natural and anthropogenic activities such as industrial offshore oil spills and groundwater pollution have increased its levels in natural water systems. This brief review provides a clear view on arsenic occurrence, ecotoxicity and its potential remediation. Both humans and biota were affected from arsenic contamination. The development of substitute materials for arsenic applications in the agricultural and forestry industries and controls of arsenic emissions from the coal industry may be possible strategies to significantly decrease arsenic pollution sources

the atmosphere which leads to acid mine drainage. Acid mine drainage is currently a main pollutant of surface water. It is caused when water flows over or through sulfur-bearing materials forming solutions of net acidity. Acid mine drainage results in loss of aquatic life and restricts stream use for recreation, public drinking water and industrial water supplies.

Approximately one-third of the atmospheric flux of arsenic is of natural origin [9]. Volcanic eruption is one of the most important natural sources of arsenic. The presence of inorganic arsenic is found in groundwater used as drinking-water for a non-amended soil. Arsenic in

with -3 oxidation state, (2) Metalloid arsenic with 0 oxidation state, (3) Arsenite trivalent compound with 3 oxidation state, and Arsenate pentavalent with 5 oxidation state [1]

A better understanding of the chemistry of arsenic is needed to identify its toxic properties and its effects on humans and natural environment. Oxidation states affect many properties of arsenic such as soil adsorption, soil solubility and toxicity to animals. Trivalent arsenic was dominant in the reducing conditions in flooded soils while pentavalent arsenic at oxidizing conditions in drained soils. Inorganic forms of arsenic are highly toxic compared to organic arsenic [5]. Organic arsenic includes methylated metabolites in three forms- monomethylarsonic acid (MMA), dimethylarsinic acid (DMA) and trimethylarsine oxide. Inorganic forms of arsenic are trivalent arsenite and pentavalent arsenate. Volcanic eruptions, soil erosion and anthropogenic activities are some examples that result in arsenic environmental pollution [3]. Arsenic may also be found in surface water, groundwater and drinking water in the United States [1]. This review provides a brief analysis of the occurrence, toxicity of arsenic, remediation and its implications on contaminated groundwater.

amended soil was mainly in the residual fraction (72% of total), which is generally considered the least bioavailable fraction. However, arsenic in poultry waste samples was primarily water soluble (5.3-25.1 mg kg⁻¹), representing 36-75% of the total As.

The chemical forms and oxidation states of arsenic are more significant in regards to its toxicity. Many factors such as physical state, gas, solution, exposure and the rate of absorption into cells affect the level of toxicity. Methylation has known to be a principal detoxication

Arsenic may be associated with sulphur, iron and oxygen to form a combination of different elements [7]. Arsenic is present in more than 200 mineral species and the most common is arsenopyrite. However, these minerals are relatively rare in the natural environment. Among the most common occurrences in ore zones are arsenian pyrite (Fe(SAs)₂), arsenopyrite (FeAsS), realgar (AsS), orpiment (As₂S₃), cobaltite (CoAsS) and niccolite (NiAs) [8]. Arsenopyrite is an iron arsenic sulfide (FeAsS). Minerals are naturally-occurring inorganic produced solids which form a definite crystal structure. Due to mining, arsenopyrite is exposed into

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input in world arable surface in 2000 was 2.18 mg arsenic kg⁻¹, which is 1.2 times those in the lithosphere. The development of substitute materials for arsenic applications in the agricultural and forestry industries and controls of arsenic emissions from the coal industry may be possible strategies to significantly decrease arsenic pollution sources and dissipation rates into the environment. At the same, to develop cost effective green remediation technology for cleaning As in water and soils is essential.

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