

Modelling of Critical Loads for Heavy Metals in Terrestrial Ecosystem in Slovenia

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In Slovenia a modelling application of As, Cd, Co, Cr, Cu, Hg, Mo, Ni, Pb and Zn critical loads in soil were performed. The calculation in the Salek Valley involved 30 research areas in the town Velenje area on a 500 x 500 m grid, where the chemical analyses of precipitation and soil were made.

The aim was application of theoretical models for determination the maximum critical levels of heavy metals in terrestrial ecosystem with empirical data. The basis for calculation was an effect-based approach, which limits are based on adverse effects on the ecosystem and the heavy metal concentrations should stay below those limits. As receptor was used a human health through the eco toxicological risks with use of ground water for drinking water and/or consume crops that are grown on the soil. The simple model based on dynamic mass balance of heavy metals in soil was used for calculation. It was estimated that the critical time well illustrates the acute danger of soil pollution and is recommended as the draft estimation of actual condition in soil which could be valued with few data.

Two different soil conditions at the actual atmospheric input were used in calculation: unpleasant and average. The unpleasant condition was simulated for the surface soil to depth of 5 cm, and the advanced to soil depth of 20 cm and density of 1.500 kg/m³. The critical time for both conditions is calculated for As, Cd, Co, Cr, Cu, Hg, Mo, Ni, Pb, Zn. The comparison between heavy metals indicates high accumulation of As and Hg, and thus their quit fast approach to the critical loads. In second rang of atmospheric input are Cd, Pb and Zn which are accumulated much slowly, followed by Mo, Ni, and Co, and the slowest progress make Cr. The estimated periods to reach the permitted Slovene limits in surface soil are calculated for As, Hg 100, Cd 140, Pb 230, Zn 350, Cu 830, Mo 1.700, Ni 1.800, Co 1.900, and for Cr 6.000 years.

Keywords: heavy metals, soil, contamination, modelling