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基于盲数理论的城市表土与灰尘重金属污染健康风险评价模型

Uncertainty model for the health risk of heavy metals in urban topsoil and dust based on blind number theory

关键词: [健康风险评价](#) [重金属](#) [盲数](#) [地表灰尘](#) [铜陵市](#)

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作者 单位

李如忠 合肥工业大学资源与环境工程学院,合肥 230009

潘成荣 安徽省环境科学研究院,合肥 230071

陈婧 合肥工业大学资源与环境工程学院,合肥 230009

姜艳敏 合肥工业大学资源与环境工程学院,合肥 230009

丁贵珍 合肥工业大学资源与环境工程学院,合肥 230009

摘要: 基于环境健康风险评价系统多种不确定性共存的特点,将盲数引入健康风险评价中,构建了城市表土和灰尘重金属污染环境健康风险评价盲数模型,并提出了风险等级判别模式.同时,选取Pb、Zn、Cr、As、Cu、Ni和Cd为评价因子,将上述模型和方法应用于铜陵市表土和灰尘重金属污染健康风险评价,得到了致癌和非致癌风险的各种可能值及其相应的可信度.结果表明,7种重金属非致癌总风险盲数均值高达2.036,远超过安全阈值1.0;特别是As,仅由手-口直接摄取途径导致的非致癌风险均值就达1.438.总体上,7种重金属的非致癌风险均值大小排序为:As>Cr>Pb>Cu>Cd>Ni>Zn.就致癌风险来看,As经由手-口直接摄取途径的致癌风险相对最大,其均值为 5.195×10^{-4} ,已远超过美国环保局(USEPA)推荐值上限 1.0×10^{-4} ;皮肤接触途径的致癌风险相对也很高,均值为 3.964×10^{-5} ,接近国际防辐射委员会(ICRP)推荐的最大可接受风险值 5.0×10^{-5} .

Abstract: Based on the characteristics of concomitancy of multiple uncertainties in environmental health risk system, the blind number theory was introduced to the assessment of human health risk. Blind number models were developed to calculate exposure dose and characterize the health risk of heavy metals, and a classification model for cancer risk was put forward as well. As a case study, the models established were applied for health risk assessment of Pb, Zn, Cr, As, Cu, Ni and Cd in urban topsoil and dust of Tongling City. And possible values and their corresponding credible degrees of cancer and non-cancer risks were calculated simultaneously for the measured heavy metals. The results showed that the total expected value of non-cancer risk for the seven metals reached 2.036, far exceeding the safety threshold value 1.0. Especially for As, the non-cancer risk through ingestion of dust particles approached 1.438. In general, the expected value of non-carcinogenic risk for the measured seven metals decreases in the order of As>Cr>Pb>Cu>Cd>Ni>Zn. Regarding carcinogen effects, the highest risk for As is associated with ingestion of dust particles and its overall expected value reached 5.195×10^{-4} , far exceeding the upper limit (1.0×10^{-4}) recommended by the United States Environmental Protection Agency (USEPA). In addition, the carcinogen risk for As through dermal contact with dust particles was also high, expected as 3.964×10^{-5} close to the highest acceptable risk value 5.0×10^{-5} proposed by the International Radiation Protection Association (ICRP).

Key words: [health risk assessment](#) [heavy metals](#) [blind number](#) [urban dust](#) [Tongling City](#)

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服务热线：010-62941073 传真：010-62941073 Email: hjkxxb@rcees.ac.cn

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