Evaluation of solubility in simulated lung fluid of metals present in the slag from a metallurgical industry to produce metallic zinc

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Keywords: solubility, simulated lung fluid, heavy metal, slag, hazardous waste.

The objective of this study was to determine the solubility parameters (rapid and slow dissolution rates, rapid and slow dissolution fractions) for nickel, cadmium, zinc and manganese compounds present in a pile of slag accumulated under exposure to weathering.
This slag was generated by a metallurgical industry that produced zinc and zinc alloys from hemimorphite (Zn4(OH)2Si2O7.H2O) and willemite (Zn2SiO4) minerals. A static dissolution test *in vitro* was used to determine the solubility parameters and Gamble's solution was used as the simulated lung fluid (SLF), on a time basis ranging from 10 min to 1 year. The metal concentrations in the slag samples and in the SLF were determined using Particle Induced X-rays Emission (PIXE). There are significant differences in terms of solubility parameters among the metals. The results indicated that the zinc, nickel, cadmium and manganese compounds present in the slag were moderately soluble in the SLF. The rapid dissolution fractions of these metals are associated with their sulfates. In conclusion, this study confirms the harmful effects on the neighboring population of the airborne particles containing these metals that came from the slag [1].

References

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Uranium oxide solubility in simulated lung fluids

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The purpose of this study was to determine the dissolution parameters (rate of absorption from the lungs to the blood) for the uranium oxide (UO) produced in a Brazilian nuclear fuel factory (pellet plant). A static dissolution test in vitro was used to determine solubility parameters, and Gamble's solution was used as the simulated lung fluid (SLF). The specific dissolution parameters for the uranium oxide produced in the fuel factory were (rapid dissolution fraction) fr = 0.19, (rapid dissolution rate) sr = 0.47 d−1, and (slow dissolution rate) ss = 0.0019 d−1. Considering the default values, the ratios were in the range of 15.0 and 24.3, minimum and maximum values of uranium concentration in workers´ urine, respectively. However, the ratios between the predicted values considering the specific dissolution parameters for the fuel factory were 2.1 and 3.5, respectively. In conclusion, the use of specific parameters allowed a more realistic representation of the kinetic behavior of uranium inside the human body and, consequently, a more realistic assessment of the worker's risk due to inhalation of airborne particles containing uranium [1].

References

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