Resum de Tesi Doctoral

Oficina de Doctorat
UNIVERSITAT POLITÈCNICA DE CATALUNYA

DNI/NIE/Passaport	43455818D
Nom i cognoms	Cristina Yacoub López
Títol de la tesi	Developing tools to evaluate the environmental statuts of Andean basins with mining activities
Unitat estructural	Departament d'Enginyeria Química. Institut de Sostenibilitat.
Programa	Enginyeria Ambiental
Codis UNESCO	250814 | 120326 | 230318 | 250811

(Mínim 1 i màxim 4, podeu veure els codis a http://doctorat.upc.edu/doc/impresos/impres_codunesco2.pdf)

Resum de la tesi de 4000 caràcters màxim (si supera els 4000 es tallarà automàticament)

The water quality status of an Andean river basin was characterised and the pressures from anthropogenic activities were evaluated to enhance the available knowledge of the environment within an ecosystem in Peru. This investigation was conducted to assess the environmental status of the basin as a first step to introducing river management plans and specific water quality programmes. A continuous simulation model and an environmental monitoring program were developed, taking into account the European water framework directive (WFD) requirements.

To prioritise the integrated water resources management (IWRM), an applied environmental model, the Soil and Water Assessment tool (SWAT) was used. The model was calibrated and validated for the Jequetepeque river basin using the SCE-UA algorithm and a relatively small amount of data (11 years). Five different cases of sub-basin discretisation were evaluated with and without a slope criterion. Very good hydrographs and statistics (NSE, RSR and PBIAS) were obtained for all cases.

Environmental monitoring methods and tools for water quality evaluation were developed. The sources of contamination were identified and levels of contamination were quantified to evaluate pollution emissions. The degree of pollution by different substances, the associated risks, and the potential effects on aquatic life and human health were considered in the development of the tools and environmental monitoring methods.

Water monitoring, sediment monitoring, and ecological monitoring, including a complementary effort to collect available data at the basin scale, were conducted in this study. The concentrations of trace elements were determined from the results of four water and sediment monitoring campaigns conducted between November 2008 and June 2010, and an ecological survey was evaluated. The results obtained from analysis of the water and sediment data indicated trace element pollution near mine sites, enabling us to quantify the impact of the mines on the Jequetepeque basin.

Analysis of the water samples indicated that the most polluted water in the basin was located downstream from the Sipán SL Mine. The levels of Cr and As indicated adverse effects, whereas the levels of Al, Cd, Cu, Fe and Pb indicated significant effects on human health, mainly near the mining areas. Considering the lack of water facilities and trace element remediation in the region, special attention should be paid to regulatory policies and palliative countermeasures. Analysis of the sediment samples indicated that the most polluted sediment was located downstream from the Yanacocha Mine site and poses a significant threat to the environment in terms of Cd, Zn, Pb, and As pollution, regardless of the season. The sequential extraction analysis indicated higher mobility for Cd, Cu, Hg, Ni, and Zn. Those trace elements are released to the water column depending on the environmental conditions.

The kinetics of the most prevalent trace elements in the basin were also evaluated. A diffusion model and two first-order models were used successfully to describe the kinetic extraction of Cu, Pb, and Zn. These trace elements can be significant only under extremely acidic conditions (pH≤1); this should be taken into account in the potential scenario of acid mine drainage.

The Ecological Status of Andean Rivers protocol was used to assess the upper part of the Jequetepeque river basin. At all the reference sites, the water quality status was very good or good. Only the sites located near mines exhibited alterations in the water quality, confirming the trends observed in the water and sediment monitoring. This protocol, which is an easy-to-use and economical qualitative tool, has proven to be very useful in assessing significant trends in ecological pollution of the basin.

Lloc: Barcelona Data: 10-02-2013

Signatura