

## Environmental impact on surface water, stream sediments and macrophytes from a mining area: the case study of the Água Forte and Roxo streams at the Aljustrel mine (Portugal)

<sup>a</sup>Alvarenga P, <sup>b</sup>Guerreiro N, <sup>c</sup>Palma P

Aljustrel is a mining district located in Portugal, at the SW sector of the Iberian Pyrite Belt. The exploitation started during the Roman occupation and the environmental impacts of that activity are evident in the area. The main potential problem comes from the tailings deposited at the site that contain large concentrations of trace elements (namely As, Cu, Pb and Zn) and are prone to reaction with oxygen and water at the surface. Rainwater circulates and percolates easily over and through the deposited materials, causing the production of acid mine drainage (AMD) which will reach the downstream areas affecting the quality of surface water, groundwater and stream sediments. That impact is evident at Água Forte stream, which receives the drainage water from the Aljustrel mine area.

The aim of the study was: a) to evaluate the extent of pollution in stream waters and sediments at Água Forte and at Roxo, which receives water from Água Forte stream, and b) to assess the potential of the macrophyte *Scirpus holoschoenus*, collected along the stream banks, for phytoremediation of AMD.

Three sampling sites were selected at Água Forte stream and four sampling sites at Roxo stream; two upstream from the confluence of the Água Forte stream and two downstream from that confluence. Water quality was assessed considering physico-chemical characteristics and ecotoxicological parameters (luminescence inhibition of *Vibrio fischeri* and 48-h immobilization/mortality assay with *Daphnia magna*). Sediment samples were analyzed considering general physico-chemical characteristics and a sequential extraction procedure was used to assess trace element pool in the sediments. *Scirpus holoschoenus* samples were analyzed in order to assess trace element concentrations in the aboveground plant material.

Both surface water and sediments were extremely acidic at Água Forte stream, with pH values <2.92 for surface water and <3.32 for sediment samples. Surface water at Roxo stream presented pH values >7.26, apparently not affected by the confluence of the Água Forte stream, but the same was not true when considering the pH values of the sediment.

Ecotoxicological bioassays evidenced that water samples collected at the Água Forte stream were extremely toxic, with very low EC<sub>50</sub> values. Interestingly, when the pH of the water was corrected to neutrality, the same toxic response is eliminated, evidencing the high contribution of the acidity to the toxic response. Although high As, Cu, Pb and Zn concentrations were found at Água Forte stream, the same was not true

in Roxo stream. Trace element content (As, Cu, Pb and Zn) in water, sediments and *Scirpus holoschoenus* samples was analyzed and correlated in order to ascertain if this particular macrophyte, which seems adapted to the extreme conditions found at Água Forte stream, can be potentially used for metal removal in constructed wetlands to treat AMD.

<sup>a</sup> DTCA - Instituto Politécnico de Beja, Escola Superior Agrária, Rua Pedro Soares, 7800-295 Beja, Portugal (paula.alvarenga@ipbeja.pt)

<sup>b</sup> DTCA - Instituto Politécnico de Beja, Escola Superior Agrária, Rua Pedro Soares, 7800-295 Beja, Portugal

<sup>c</sup> DTCA - Instituto Politécnico de Beja, Escola Superior Agrária, Rua Pedro Soares, 7800-295 Beja, Portugal