

Bioadsorption in remediation of metal mine drainage: the use of dealginated seaweed in the BIOMAN project

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Dealginated seaweed (DS) is a waste product from the industrial extraction of alginates. Dealginated seaweed has ion exchange properties which can be exploited to remove potentially harmful elements (PHEs) from aqueous solutions. Laboratory scale tests demonstrate that DS shows optimum adsorption of PHEs at near neutral pH and with a contact time of at least 10 minutes. The tests show that DS has preferential adsorption of zinc, cadmium and lead over major cations in solution. Furthermore the tests reveal that the DS can be regenerated by washing with dilute acid and re-used as many as ten times.

Field trials of a prototype mine water treatment system have been successfully completed at two mine sites in mid-Wales where Pb/Zn mines were abandoned over 100 years ago. In the mid-Wales orefield the mine drainage is typically circum-neutral which is ideal for treatment with the DS systems. At Bwlch mine 1 Lmin⁻¹ of water was treated and the Zn was reduced from 27 to 0.4 mgL⁻¹, the Cd from 60 to 0.8 µgL⁻¹ and the Pb from 733 to 20 µgL⁻¹. After 24 hours the adsorption of Zn diminished but Pb continued to be removed for 20 days.

Dealginated seaweed from one supplier gave a pH of > 12 when mixed with water. The fine-grained portion of this material has been used to treat acid mine drainage (AMD) from former Cu mines in Italy. Waters draining these mines have a pH of 2.6 and an Fe content of 550 mgL⁻¹. Laboratory tests show that DS powder generates stable Fe precipitates which reduce Fe to 5 mgL⁻¹, Cu from 125 to 3 mgL⁻¹, Zn from 33 to 2.6 mgL⁻¹ and Al from 180 to 5 mgL⁻¹. This precipitation stage is proposed as an initial treatment of the mine water before the bioadsorption using the prototype DS systems. This combination should remove the PHEs from these mine waters.

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