

## Overview

C-Cure offers a range of unique patent protected products with full technical support for the treatment of metal contaminated mine soils, spoils and sediments. Our products have a number of both primary and secondary benefits:

### Primary benefit

- Allows rapid re-vegetation on heavy metal impacted deposits.
- Significantly reduces operational mine restoration timeframe as part of mine closure plans
- Promotes strong plant root growth on contaminated soils
- Prevents fugitive dust release
- Prevents long term leaching of heavy metals as part of an engineered solution

### Secondary benefits

- Creates a bio-diverse restoration habitat
- Reduces the social and environmental impacts of mining activities
- Earns carbon credits as part of site closure works to Gold Plus standards
- Generates low-carbon renewable energy
- Promotes afforestation and aids implementation of better

forest management in and around your sites

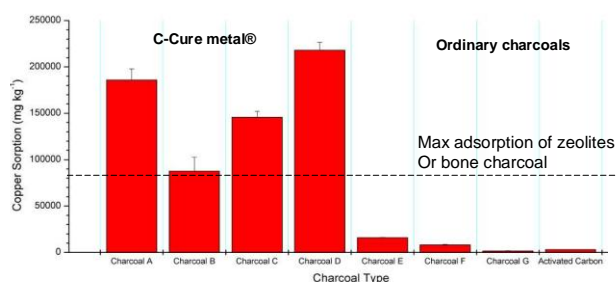
## Metal stabilisation in Tailings and Sediments

C-Cure has developed a range of patent protected products to stabilise heavy metals and arsenic in mine tailings and sediments.

### C-Cure-Metal

#### *Principal Benefits*

- C-Cure-Metal is made from selective natural charcoals which are capable of taking up to 30% of their own weight in metals.
- C-Cure metal is simply mixed with the contaminated soil, spoil or waste
- Metal adsorption is exceptionally fast with almost immediate detoxification



**Figure 1: Comparison of C-Cure metal with other metal adsorbent materials and bio-chars**

A primary advantage of C-Cure-Metal is that as contaminants are adsorbed, plant nutrients are released from the charcoal. This makes the product perfect for

situations where vegetation establishment on the treated substrate is desired e.g. as part of landscaping or habitat restoration project.

## **C-Cure-Metal+**

This product has additional benefits to the C-Cure Metal product:

- A patented product based on modified charcoals with an exceptionally high metal adsorption capacity.
- C-Cure-Metal+ will bind metals at very low pH conditions (pH 2.5+)

## **How the products work**

C-Cure-Metal is derived from selective biomass materials, with an emphasis on identifying sustainable indigenous species, which when charred create a charcoal with a high metal adsorption potential. Furthermore, the charcoal particles have a very high pH buffering capacity. These properties mean that soluble heavy metals within soils, spoils and tailings are trapped by the charcoal. The charcoal then holds in the metal securely giving good stability under a wide range of environmental conditions.

As heavy metal contaminants are adsorbed into the charcoal, plant nutrients such as potassium, calcium and magnesium are released. This makes C-Cure-Metal perfect for

applications which require the remediation of contaminated soils or mine tailings, whilst providing conditions required to establish a vegetative cover and strong root growth. Re-vegetation of soils and spoils prevents wind and water erosion, dust migration and desertification, reduces water run-off and ingress, whilst returning sites to productive habitat.



**Figure 2: Root development in mine tailings treated with 1% (wt/wt) C-Cure-Metal compared to un-amended control.**

## **Tailings Amendment**

C-Cure products are mixed into the impacted spoil or sediment material at typically <1% by weight. The products immediately begin to adsorb the leachable metal fraction, thus breaking the pathway by which metals reach surface and groundwaters, whilst detoxifying the tailings allowing their re-vegetation.

## **Mine Closure and Legacy**

We believe that in many circumstances the use of our products could significantly reduce the restoration cycle of mine sites,

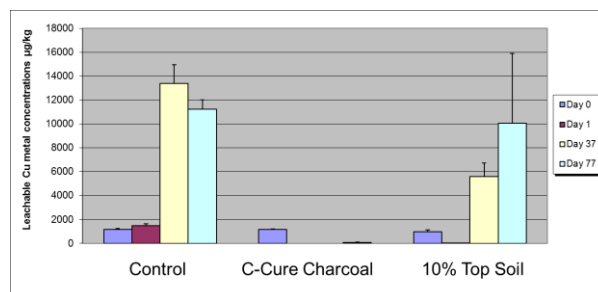
and so significantly reduce time and costs of mine closure operations and services.

Areas recovered per year will be dependent on the volume of charcoal products produced per year but a small scale charcoal production facility could achieve over 100 ha per year of restored site. If you want the site restored quicker we simply produce more product.

## Tailing Treatment Case Study

C-Cure-Metal was used to treat mine tailings within the Henwaith Settlement Ponds at the site of the former copper mine, Parys Mountain, Anglesey, UK. The tailings had high levels of copper, lead, zinc and cadmium which were leaching to surface and ground waters, whilst also preventing vegetative growth. The absence of a vegetative cover meant that the site was exposed to wind erosion causing contaminated dusts to be generated and impact local inhabitants.

Addition of C-Cure-Metal to the tailings adsorbed the metal contaminants and prevented their leaching (Figure 3). The addition of C-Cure-Metal facilitated conditions to establish a grass sward which prevented the further generation of windblown dusts (Figure 4).



**Figure 3: Leachable copper concentrations in the tailings of Henwaith Settlement Ponds, Parys Mountain of untreated controls, C-Cure-Metal treatment, and a 10% Topsoil treatment.**

Notes:

- 1) The C-Cure-Metal treatment had adsorbed all of the leachable copper within the tailings after only 1 day.
- 2) The site was naturally flooded with acid mine drainage on day 30 of the trial. After this event the leachable copper levels in the un-amended control plots increased dramatically. Despite having initially removed the copper, the topsoil treated material began leaching metal. In contrast, the C-Cure-Metal amended tailings had no leachable metals.



**Figure 4a: Control plot on heavy metal impacted tailings at the Henwaith Settlement Ponds showing no vegetation despite fertiliser addition.**



**Figure 4b: Plots treated with C-Cure metal+ showing restoration of plant growth on heavy metal impacted sediment at the Parys Mountain mine site.**

## **Pyrolysis Technology**

C-Cure uses modern pyrolysis technology in the production of its charcoal product range. Such facilities also generate significant heat which can be harnessed for direct use (often for cooling systems) or if necessary to generate electrical energy, which can be utilised on the mine facility or to service local needs.

Post restoration, the charring plant could be retained to produce charcoals for cooking or to produce biochars to help increase food production.

## **Afforestation**

C-Cure offers a service to mining clients to promote better forest management of remaining forest areas while promoting afforestation

of areas that have been de-forested. This provides renewable biomass whilst restoring the forest habitat and securing long-term socio-economic and ecological benefits to local inhabitants.

## **Carbon Offsets**

The charring process releases >70% of the biomass' gross calorific value, whilst retaining >50% of its carbon as charcoal. The application of our product to land acts as a carbon sink meaning that our projects are eligible for carbon off-sets. The precise value of these carbon offsets will be on a case by case basis but the other benefits of the C-Cure products ensures that Gold Plus standards can be achieved.

## **Mine Water Treatment**

C-Cure offers a range of water treatment products to the mining sector. Contact us for further information.