Removing toxic metals from tannery waste

Removing hexavalent chromium from industrial effluents, particularly untreated tannery waste, will become easier and more efficient thanks to the work by a team of researchers from the Indian Institute of Chemical Biology (CSIR-IICB), Kolkata. Importantly, the heat-dried fungal biomass converts Cr(VI) — which is neurotoxic, genotoxic and a carcinogen — to a non-toxic trivalent form of chromium, thus eliminating the problems of disposing Cr(VI)-containing waste. Cr(VI) is found in very high concentration in tannery waste. The results were published in the journal, *Scientific Reports.*

A team led by Sucheta Tripathy from the Structural Biology and Bio-Informatics Division at IICB isolated a fungus, *Arthrinium malaysianum*, and used the fungus biomass to remove Cr(VI). In experiments carried out in the lab using potassium dichromate solution, the adsorption capacity of the biomass was found to be as high as over 100 mg per gram of dry weight. In the case of untreated tannery waste, the fungal biomass was able to remove over 70% of Cr(VI). It can also remove other toxic metals such as lead and arsenic, which are normally found in tannery waste.

The positively charged functional groups found on the surface of the fungus binds to Cr(VI) ions. These groups were found intact even after heat drying. The functional groups have more ability to adsorb the negatively charged Cr(VI) through strong electrostatic attraction in acidic conditions. “Though the tannery waste is slightly alkaline, the fungus was still able to adsorb heavy metals,” says Rajib Majumder from the Structural Biology and Bio-Informatics Division at IICB and the first author of the paper. Once Cr(VI) gets adsorbed, the reducing functional groups found on the fungus converts it to Cr(III), which is not toxic. “The efficiency of conversion of Cr(VI) to Cr(III) was unaffected even when the concentration of Cr(VI) was increased 10 times,” he adds.

Besides adsorbing and converting the toxic form of chromium to a non-toxic form, the fungus biomass can also be reused by removing the adsorbed material. “We were able to reuse the biomass three times efficiently, beyond which it became unusable,” says Mr. Majumder.

Having tested the ability of the heat-dried fungus biomass in removing chromium and other heavy metals, the team is working to immobilise the biomass on a glass or ceramic substrate. “We are trying to produce a biomaterial to increase the surface area for real-time applications,” Dr. Tripathy explains.

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President’s plan

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