E2-39: Environmental fate of chromium discharged from tanneries in Sri Lanka

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Sri Lanka has about 11 small and medium-sized tanneries. Of these 6 tanneries are engaged in chrome tanning.

Basic chromium (III) sulphate (in one bath process) or sodium or potassium dichromate (in 2 bath process) is used in chrome tanning. Once tanned the unfixed chromium could be collected and recycled or recovered. If not it will enter the environment as effluent or sludge.

This study investigates the type of chromium compounds used in chrome tanning and attempts to pinpoint the cycle of unfixed chromium in and around the tanneries in Sri Lanka to assess its effect on the immediate environment.

A survey of tanneries in Sri Lanka was conducted with a view to determining : (i) Compounds used for chrome tanning. (ii) End use of unfixed chromium used in tanning process. (iii) Treatment of effluent. (iv) Discharge of effluent.

Soil samples were collected at selected areas near the discharge point of effluent and analysed for the following:

(i) Total, soluble and acid extractable (Solutions of HNO_3 used for acid extraction were of pH 1, 3 and 5) chromium by atomic absorption spectrophotometry. (ii) pH. (iii) Organic matter content.

Ground and surface water samples were collected around the tanneries and were tested for total chromium by atomic absorption spectrophotometry.

All tanneries in Sri Lanka except one in the Central province are situated in suburbs of Colombo. Therefore a central chromium recovery plant is advisable. This is done in Italy.

Only basic chromium (III) sulphate is used for chrome tanning. Sodium or potassium dichromate which has toxic hexavalent chromium is not in use in Sri Lanka.

The unfixed chromium in the effluent from the tanning drum is not recycled or recovered in Sri Lankan tanneries.

In the majority of tanneries the effluent is discharged to a marshy land (adjoining the tannery) or river together with other effluent without any treatment.

Two tanneries which have treatment plants remove the chromium in the effluent as hydroxide using hydrated lime and discharge the treated effluent to the Kelani river.

Soil samples from where effluent is discharged had very high levels of total chromium ranging from 3,800 to 8,300 ppm, but acid soluble chromium was very low.

Well water samples and also the surface water samples around this effluent discharge had very low chromium concentration (0 -15 ppb).

The pH of the soil was alkaline (pH 7.7 - 9.3).

Organic matter content of these soils was high generally in the range of 40 to 67%.

The chromium was not leached out from the top soil. Since the soil pH was alkaline, one may expect chromium to precipitate. However only a very small fraction of chromium was acid soluble. Therefore the most possible mechanism for its immobility might have been attributed by its complexing with organic matter, which has so far prevented contamination of well waters in the area. Despite this, chromium discharge into the environment should be minimized as the long term effects are not known, not only to the aquifer but also the vegetation in the areas some of which are used for human consumption.