



JAJMAU INDUSTRIAL AREA, KANPUR: HUB OF CHROMIUM IN THE WORLD

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The rapid and uncontrolled industrialization has led to deterioration in the quality of soil and a number of other environmental problems in India. In fact, soil is considered to be contaminant when the concentration of few essential elements is high. Chromium (Cr) is one of the pollutant elements enters into the agricultural soils through industrial wastes mainly metal, chemical and tanning industries. India,

being the second largest producer of footwear, second largest exporter of leather garments and fifth largest exporter of leather goods country's tannery sector contribute nearly 2 percent to the GDP. India's footwear market showed an excellent growth from \$10.6 billion in 2019 to \$15.5 billion by 2022 (<https://newsonair.com>). Various industrial sources and forms of Cr in agricultural soils are shown in Table.1 and 2.

Table1. Various industrial sources of Cr(VI) contamination in India(Source: <http://www.cpcb.nic.in>)

Site Location	Polluter	Main Product	Type of Waste generated	Quantity of Waste
Vadodara	Hema chemicals unit- II	Basic Chrome Sulphate (BCS)	Chromium residue	77000 tonnes of waste
Ranipet	Tamil Nadu chromates and chemicals Ltd.	BCS, Sodium dichromate	Chromium residue	2.2 lakh tonnes of waste
Kanpur Nauraiya, Kheda	Ashoka chemicals Pvt. Ltd.	-	Mostly BCS containing heavy metals	15000 tonnes of waste
Kanpur juiBahuraiya	Kanpur chemicals	-	Mostly BCS containing heavy metals	10000 tonnes of waste
Sundargarh	Konarkrome chemicals & lotus chemicals	Sodium dichromate	Leached residue	-
Mayurbhanj	Kerbs & Cie	Sodium dichromate	Leached residue	15000 MT of waste

Table2. Various sources of Cr (III) and Cr (VI)

Source	Forms of chromium	Environmental matrices
Emission from burning of fuel and oil, steel production	Cr (III)	Air
Welding of stainless steel, Manufacturing of chemicals, Use of chromium containing compounds	Cr (VI)	Air
Waste stream from electroplating	Cr (VI)	Water
Leather tanning, Textile Industries, Dyes and Pigments Industries	Cr (III) and Cr (VI)	Water
Disposal of waste containing chromium from industries and coal ash from electric utilities	Cr (III) and Cr (VI)	Soil



FORMS OF CHROMIUM IN SOIL

The composition and condition of soils are important parameters which affect chromium mobility. Chromium is abundantly present in soils in its most stable trivalent form [Cr(III)] that is weakly soluble in high acid and alkaline soils (immobile) and hexavalent form Cr(VI)] which dissolves very well in both condition. The hazard caused by Cr (III) is low or negligible due to its low acute and chronic toxicity. Besides, it promotes the action of insulin hence, intake is essential for the human body. On the contrary, Cr (VI) is toxic, mutagenic and even carcinogenic nature at high doses.

INDUSTRIES IN JAJMAU

More than 2500 tanneries of India are located in the Uttar Pradesh state and around 80 percent of them are involved in the chrome tanning process. Jajmau (Kanpur) is one of the prominent leather processing centres of the state with more than 400 tanning industries. This makes Kanpur, the eighth largest metropolis in India situated on the left bank of river Ganga and the right bank of its tributary river Pandu is the hot spot region of pollution in the Ganga Plain because of maximum number of leather industries. Also, it has and considered as a severe chronic polluted area as 99 percent of industries are performing chrome tanning process. The area where discharge waste are collected and the dumping site of Jajmau tannery industry (Figure 1a & 1b) are highly polluted with chromium. It is the oldest city and has the biggest leather tanneries which generate revenue of 15000cr every year and

accounting for 30% of Indian Export. These tanneries specialize in processing hides into heavy leather and are the only location in India where saddlery products are manufactured. Single tannery can cause pollution of soil around the radius of 7-8 km.

During the process of leather manufacturing, several chemicals are used which are enriched with chromium and iron, copper, magnesium, sodium salts. The waste water discharge from these industries contains high concentration of chromium and sodium salts. The tannery waste has colour reddish dull brown to brown with high pH, high BOD and high total dissolved salts. The untreated industrial effluent contain primarily Cr (III) less toxic form which later oxidizes and convert to more harmful Cr (VI) ions. The waste water released from tanneries is 10-15 times rich in heavy metals, when used for irrigation purpose contaminates the soil and vegetables/crops which in turn cause severe health problems to the consumer. Tannery waste water plays a significant role in degrading the soil quality by leaching process.



Figure1 (a) Discharge waste collection from CETP, Jajmau (b) Dumping site of Jajmau Tannery Industry



ENTER IN HUMAN FOOD CHAIN

Vegetables have a positive effect on human health as they play a very vital role in preventing many chronic diseases. Crops and vegetables grown near the contaminated sites take up high amounts of essential and toxic metals from the soils (Figure 2 and 3). The essential nutrients are required for the growth and development of plants in small quantities and the presence of excessive concentration of certain metals may cause toxicity. The uptake of chromium from soils depends on soil pH, solubility of ions, soil texture and the presence of organic matter. The accumulation of toxic elements in edible parts of plants has harmful effect to human beings by entering the food chain.



Figure 2 Untreated brackish waste water of Industries used for irrigation

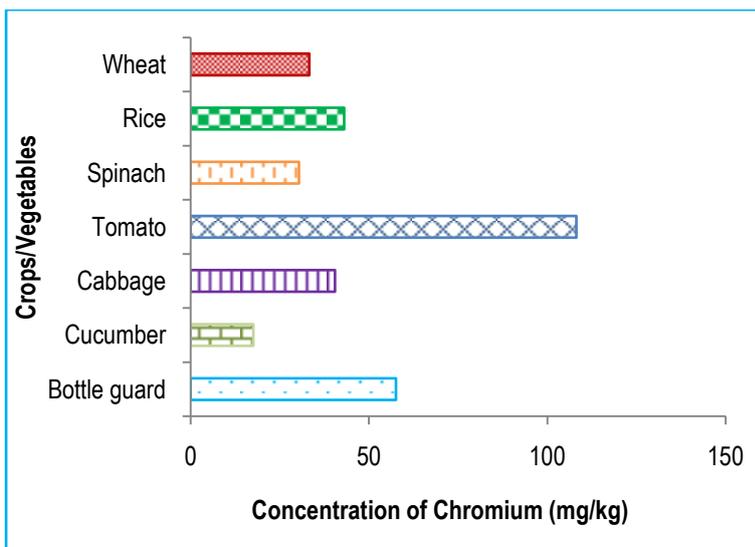


Figure 3. Concentration of Chromium in different crops/vegetables in Jajmau (Source: Gupta and Sinha, 2006)

Many researchers studied the impact of effluent on crops, ground water and agricultural soils irrigated by untreated waste water by using conventional techniques. Scientists of Indian Institute of Soil Science trying to explore the advance technology of spectroscopy in this dominant chromium affected region Jajmau, Kanpur. In this area, Central Effluent Treatment Plant (CETP) is working for treatment of waste water. The treated waste water is used for irrigating the agricultural soils of nearby villages for last four decades.

CONCLUSION

The effluent discharge from industries of Jajmau mainly tannery contains significant levels of heavy metals which are mostly much higher than the standards considered to be the major cause of soil pollution. To study the spatial distribution of chromium in agricultural soils of Jajmau and its spectral study can help to delineate highly contaminated zones and suggest proper management practices to reduce the toxicity by following various remediation processes like bio-remediation, phyto-remediation etc. There is also a need to check after treatment of the effluent to ensure the toxic elements are not released to the adjoining water bodies or soil.

REFERENCES

<https://newsonair.com/2021/07/10/indias-footwear-industry-expected-to-grow-8-times-by-2030>.
