



# A Case Study on CETP Processing in Leather Units of Kanpur

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*This work was carried out in collaboration between both authors. Author ID designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript and managed the analyses of the study. Author MS she is the major guide of my master's thesis from which this paper is generated. Both authors read and approved the final manuscript.*

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## ABSTRACT

In Kanpur, CETP units have been installed to treat the enormous effluents discharge from various leather processing units. Researcher collects the data in terms of its location area, year of establishment and number of units attached for treatment effluents and their effluent treatment capacity per day. Result of the study indicate that Majority of leather units were connected to CETP of Bajidpurin Jajmau area of Kanpur. Some remaining large scale leather units were and involved in combined units have their own Chromium effluent treatment plant (CETP).

**Keywords:** Waste treatment; CETP; leather processing unit.

## 1. INTRODUCTION

The main purpose of CETP is to decrease the treatment price for individual units though caring for the environment. Further, as a communal entity, CETP can get the subsidies from Central

and State Govt., which are otherwise deprived for establishment of the individual effluent treatment plant.

The release of crude tannery effluents and other wastes is a matter of high worry to the society.

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Various NGO and citizen forums in states where leather clusters are found started showing their disapproval against detrimental effects of the effluents on human health and environment. There is need to implement proper treatment technology for the tannery effluents.

([http://shodhganga.inflibnet.ac.in/bitstream/10603/156680/9/09\\_chapter%203.pdf](http://shodhganga.inflibnet.ac.in/bitstream/10603/156680/9/09_chapter%203.pdf)) [1].

Schjolden [2] remarked that in Kanpur, the number of tanneries has doubled over the past 15 years. Most of the tanners in Jajmau Area Has expanded their production capacity. Initially They Started Only With Leather Tanning. Almost half of them have expanded to production non leather, leather components and products, like shoe uppers or shoes, bags, saddlery and harness goods. The diversification of production is also more common amongst the medium and large firms. Here, 100% have engaged in the production of leather products of some kind, either directly in the same company as the tannery, or a separate unit owned by the same family or group.

In Kanpur, leather tanning particularly blossomed during British colonial rule, when many cantonments were located in this area, and the need for boots, saddlery and harness equipment is high. Most the tanneries are located in Jajmau, an area south - east of the city, close to the military cantonment area, and on the southern bank of the river Ganges. Today, the area of Jajmau is crowded, not only with tanneries, but also with the houses of the people living there, mostly the saree tannery workers who suffers from various health problems. Chromium from leather tanning can make its way into air, soil, food and water and the most common forms of exposure are through inhalation of dust or fumes and ingestion of or contact with contaminated water. Workers in tanning facilities can inhale airborne chromium and can also be exposed through dermal contact.

Common Effluent Treatment Plant (CETP) is the concept of treating effluents by means of a collective effort mainly for a cluster of small-scale industrial units.

The main objectives of CETP is –

- To reduce the treatment cost for individual units while protecting the environment.
- To minimize the problem of lack of technical assistance and trained

personnel as less plants require less people.

- To solve the problem of deficiency of space as the centralized facility can be planned in advance to ensure that suitable space is vacant.
- To reduce the problems of viewing for the pollution control boards.
- To organize the disposal of treated wastes and mud and to advance the reprocessing and recycle options.

## 2. METHODS

The study was carried out in Kanpur city because it is known as third largest tanning center in India. The researcher purposively identified and prepared a list of 10 leather processing industries within Kanpur which have been registered since last 20 years and have CETP for waste recovery. Prior permission was taken from the respective head of the selected leather industry to allow to do survey for the study.

The survey method was used to elicit desired information about CETP through structured interview schedule. The obtained data was statistically analyzed and presented in terms of frequency and percentage. The developed schedule was pre-tested on ten non sample subjects. The collected data was analyzed for statistical treatment in the light of objective of study [3].

## 3. RESULTS AND DISCUSSION

In Kanpur, CETP units have been installed to treat the enormous effluents discharge from various leather processing units.

Table 1 presents the data regarding details of CETPs installed in terms of its location area, year of establishment and number of units attached for treatment effluents and their effluent treatment capacity per day. It can be seen from the table that first unit of common effluent treatment plant (CETP) was established in the year 1994 at, Bajidpur in Jajmau area of Kanpur and its treating capacity is 36 million liter per day (MLD). Jajmau is the main area where there are more than 400 tannery units. Another CETP was established in 2004 at Banthar area in Unnao in which 25 units are attached, its capacity is 4.15 MLD. It was also found that few leather unit have installed their own CETP, one of them is Mirza International Ltd. Kanpur, which

established its CETP in the year 2013 and its effluent treatment capacity is 1.65 MLD.

Majority of leather units (66.67%) selected by researcher for survey work were connected to CETP of Bajidpurin Jajmau area of Kanpur. Remaining leather units (33.33%) which were large scale and involved in both leather processing and production units have their own Chromium effluent treatment plant (CETP) [3].

### 3.1 Land Area Details of CETPs

It is apparent from Table 2 that total area covered under TPs (42 MLD, including all the three CETP reported in Table 1) is 120.58 acres, Salt & Sludge Area (12.45 acres), Common Chrome Recovery Plant, CCRU - (11.52 acres) and Green Area, Admin Building, Future expansion and Substation covered 42.95, 11.37, 17.0 and 10.02 acres respectively.

### 3.2 Raw Materials/Chemicals Required for Effluent Treatment

Regarding raw materials required for tannery effluent treatment, Table 3 depicts that lime, alum, polyelectrolyte and soda ash are main chemicals needed.

### 3.3 Composition of the Feed to the Treatment Plant

The feed consist of leather effluent of different parameters (pH, COD, BOD etc.) from different leather processing units.

### 3.4 Parameters of Effluent Treated Water

Table 4 clearly shows the detail of various parameters of effluent treated water in terms of estimated values of PH, BOD, COD, TSS, TD Sand total chrome. The PH value of treated water was observed as 6.5 to 9.5, BOD 1000 to

1800 mg per litre, COD 2000 to 4000 mg per litre and TSS as 2000 to 3000 mg per litre.

### 3.5 Effluent Treatment Process

The effluent treatment plant has primary, secondary and tertiary treatment systems. The primary treatment system includes Pretreatment Chamber, Equalization Tank, Flash Mixture Tank and Clariflocculator and the secondary treatment system consists of Aeration Tank - I, Clarifier - I, Aeration Tank - II and Clarifier - II. The tertiary treatment is carried out in two units, namely Pressure Sand Filter and Activated Carbon Filter.

### 3.6 Plant Operation

The effluent is collected through open drain from various processing unit at one place, is called CETP inlet and treated by following stages.

**Screen chamber:** The waste water passes through the screen chamber which comprises of mild steel bars. The purpose of installation of screen is to arrest large floating materials, plastic pieces, rags etc. so that these do not entangled with pump impellers and other machinery of the plant. This is a manually cleaning screen & should be cleaned as often as required to prevent surcharging of waste water in the drain.

**Sump well:** The raw waste water passing through the screen gets collected in the wet well of the pump house. In the dry well of pump house centrifugal pump have been installed to pump the raw wastewater to the equalization tank to equalize the wastewater characteristics and to neutralize the pH of waste effluent.

**Tilted plate separator:** The waste water pumped from sump well is lifted to the tilted plate separator to remove any oil and grease from the waste water. Then oil less waste water transfers to the equalization tank.

**Table 1. Establishment year, capacity of CETPs, and units attached \***

Area	Year of establishment	Unit attached	Capacity (Million liter/day)
Bajidpur, Jajmau, Kanpur	1994	260 UNIT	36 MLD
Banthal, Unnao, Kanpur	2004	25 UNIT	4.15 MLD
Magarwara, Unnao, Kanpur	2013	Only Mirza units(private plant)	1.65 MLD

\*Source: <http://www.banthalpollutioncontrol.org/technicaloverview.html> [4]

**Table 2. Land area details of CETPs**

Land use	Area (in Acre)
CETP 42 MLD area	120.58
Salt & Sludge Area	12.45
Common Chrome Recovery Plant (CCRU)	11.52
Green Area	42.95
Admin Building	11.37
Future Expansion	17.0
Sub station	10.02
Other	9.51

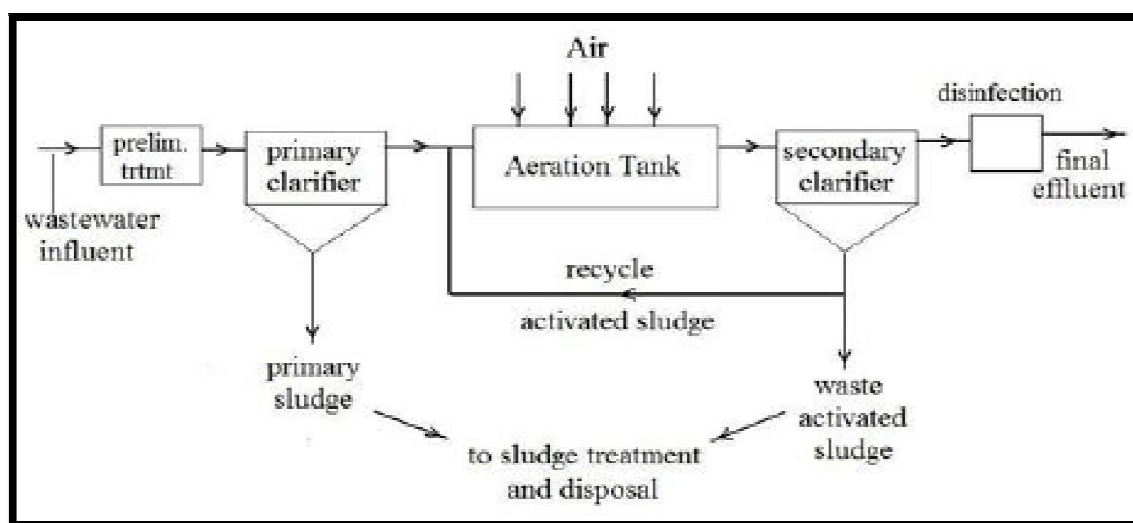
**Table 3. Raw materials required for tannery effluent treatment**

Material	Unit	Quantity
Lime	Tons/day	186
Alum	Tons/day	117
Polyelectrolyte	Kg/day	158
Soda Ash	Tons/day	128

**Table 4. Parameters of effluent treated water**

Parameters	Estimated values*
PH	6.5-9.5
BOD	1000 – 1800 mg/l
COD	2000 – 4000 mg/l
TSS	2000 - 3000 mg/l
Total Cr	40—100 ppm
TDS	5000-10000 mg/l

\*Source: <http://www.bantharpollutioncontrol.org/technicaloverview.html> [5]



**Fig. 1. Flow chart of common effluent treatment plant**

\*Source: [https://www.researchgate.net/publication/287643591\\_Dairy\\_wastewater\\_treatment\\_plant\\_in\\_removal\\_of\\_organic\\_pollution\\_a\\_case\\_study\\_in\\_Sanandaj\\_Iran/figures?lo=1](https://www.researchgate.net/publication/287643591_Dairy_wastewater_treatment_plant_in_removal_of_organic_pollution_a_case_study_in_Sanandaj_Iran/figures?lo=1) [6]

**Equalization tank:** The effluents pH vary from 8 to 12 hours in the equalization tank. Jet air blower has time to time. The effluents are stored for 8 to 12 hours in the equalization tank for

homogenous mixing of effluent and neutralization by acid ( $H_2SO_4$  or  $HCl$ ) dosing to decrease the BOD load.

**Flash Mixer:** Effluent with pH 8-9 is transferred to chemical dosing house for chemicals dosing, where coagulants are added to the effluents.

These are- Lime (450 - 500 ppm) – to raise the pH up to 8-9. Ferrous sulphate (800 – 900 ppm) – to remove colour. Anionic Polyelectrolyte (1-2 ppm) – to settle the suspended matter.

**Clariflocculator:** This chemical dosed effluent is transferred to clariflocculator. In the clariflocculator, the water is circulated continuously by stirrer. This is also known as primary clarifier. Overflowed water is taken out to the aeration tank. The solid particles are allowed to settle down, and collected separately in chemicals sludge tank which is then passed to sludge holding tank for thickening.

**Aeration tank:** Chemically treated effluent from clariflocculator, flows to Aeration tank for biological treatment. Biological treatment removes organic matter from the waste water. For effective treatment of waste water, oxygen required for growth of microorganisms as also for mixing in the aeration tank, floating type of mechanical aeration have been provided. The

Detention Period in Aeration Tank 17 hrs. During this time a healthy flocculent sludge is formed which brings about oxidation of the dissolved organic matter. BOD removal to the extent of 99% could be achieved with efficient operation.

**Secondary clarifier:** Biological sludge is collected here and treated effluent is disposed safely.

**Centrifuge (Sludge thickener):** The effluents are taken to centrifuge for thickening & solidification. Centrifuge action, to separate the solids and liquids with a polyelectrolyte (cationic type) dosing. The sludge thickener centrifuge reduced the water content in the effluent waste. The effluent is then reprocessed and sludge is collected at the bottom and disposed at the dumping site.

### 3.7 Case Study of CETP at Mirza International Ltd

Some of the leather units like Mirza International Limited (Tannery Division) Unnao, Kanpur has installed its own Effluent Treatment Plant in the year 2013 to treat the tannery waste water. The plant is designed to treat the effluent at the rate of 1.65 ML per day. Fig shows the flow diagram of ETP [3].



Fig. 2. Flow diagram of ETP

**Table 5. Treated value and standard (permissible value) of tannery effluents**

Effluent after treatment	Treated value	Standard
Chrome <sup>+3</sup>	0.3 mg /l	1.0 mg /l
BOD	25 mg/l	30 mg/l
COD	180 mg/l	250 mg/l

To prevent contamination of ground water and air, in ETP of Mirza International, tannery discharge is treated biologically. The free discharge meets the country's pollution Board Standards.

Table 5 highlights the treated values of tannery waste after being treated at CETP which is much lower than the permissible standard values as per environment norms and treated water can safely be discharged in river, for agriculture purpose or for cleaning wash rooms and floor etc [7].

#### 4. CONCLUSION

Their chrome recovery unit is also very efficient as stated by them. It recovers more than 99.5% chromium that would otherwise be discharged as waste. The recovered chromium is re-used with BCS resulting in safeguarding the environment and reducing cost.

In response to the question asked about the approximate amount of the treated effluent disposed per day, it was reported by the respondent of private CETP owner of selected leather unit as 12.60 K.L. Further, it was confirmed by them that the capacity of CETP at their leather unit is sufficient to treat the waste water.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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