WASTE MANAGEMENT IN LEATHER INDUSTRY

by

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ABSTRACT

In this thesis, the works and regulations in the world and Turkey about waste of Leather Industry have been scrutinized and comparisons and evaluations were made by being predicated on 2 leather facilities. The facilities are Company A operating in the Menemen Free Leather Zone and Company B operating in Torbalı. The process followed from raw material or semi finished form of material, the waste created during the operation process, the recovery processes subjected to the waste and the results are examined separately.

Keywords: waste, industry, leather, recovery.

DERİ ENDÜSTRİSİ ATIKLARININ YÖNETİMİ

ÖZ

Bu tez kapsamında, Deri Endüstrisi atıkları hakkında Dünya ve Türkiye’ daki yönetmelikler ve yapılan çalışmalar incelemiş ve seçilen 2 deri İşletmesi esas alınarak karşılaştırmalar ve değerlendirmeler yapmıştır. İncelemede yer alan tesisler Menemen Serbest Deri Bölgesi’nde halen faaliyette bulunan A Kuruluşu ve Torbalı’ da faaliyette bulunan B Kuruluşu’dur. Bu tesislerde derinin ham ya da yarı işlenmiş halinden itibaren elde edilen son ürünü kadar uygulanan işlemler, işletim aşamasında meydana gelen atıklar, atıklara uygulanan artış prosesleri ve sonuçları ayrı ayrı incelenmiştir.

Anahtar Kelimeler: Atık, endüstri, deri, geri dönüşüm.
1. Introduction

Today leather production is advancing due to the increase in meat consumption. Even though many animal leathers are used, the most used one is calf leather.

These leathers are used as raw material in many sectors. These sectors are:

- Shoe industry,
- Bag industry,
- Clothing industry, and
- Furnishing and decoration.

Leathers are turned into final products of desirable quality after applying many chemical processes. There are four operating processes applied to leather until it becomes a final product, these are;

- Pretanning Operation (Beamhouse Operation)
- Tanning Operation
- Wet-Finishing Operation
- Finishing Operation

In terms of the chemicals used and the tanning method, a lot of pollution is caused during each operating level. These pollution parameters can be classified as solid, liquid and gas. BOD, COD, sulfide caused by the hair-removing process and Cr (III) caused by chrome tanning method, which is used as an alternative method to alternative and vegetative methods, seriously affect the treatment process.

It is possible to minimize the pollution during the treatment process by applying environment-friendly technologies and methods as an alternative to these treatment levels.
In this thesis, researches have been carried on the issues such as the processes that are applied until the raw leather becomes a final product, waste products that is produced during these processes, the treatment and/or disposal of these waste products, and environment-friendly (clean) technologies that can be used in leather industry. Two different leather industries have been compared in terms of operation and treatment according to the regulations.

2. Introduction Of Leather Process

The production processes in a tannery can be split into four main categories;

a. Pretanning (hide and skin storage and beamhouse operations)
b. Tanning (tanyard operation)
c. Wet Finishing (post-tanning operations), and
d. Finishing Operations

An overview on the steps of leather processing is given in Figure 2.1.

2.1 Pretanning (Beamhouse Operations)

Cleaning and conditioning hides and skins produce the biggest part of the effluent load.

2.1.1 Soaking

The preserved raw hides regain their normal water contents. Dirt, manure, blood, preservatives (sodium chloride, bactericides), etc. are removed.
2.1.2 Fleshing and Trimming

Extraneous tissue is removed. Unhairing is done by chemical dissolution of the hair and epidermis with an alkaline medium of sulfide and lime. When after skinnning at the slaughterhouse the hide appears to contain excessive meat, fleshing usually precedes unhairing and liming. Liming and unhairing produce the effluent stream with the highest COD value.

2.1.3 Deliming and Bating

The unhaired, fleshed and alkaline hide are neutralised with acid ammonium salts and treated with enzymes, similar to those found in the digestive system, to remove hair remnants and to degrade proteins. During this process hair roots and pigments are removed. This results in the major parts of the ammonium load in the effluents.

2.1.4 Pickling

Pickling increases the acidity of the hide to a pH value of 3 by addition of acid liquor and salts, enabling chromium tannins to enter the hide. Salts are added to prevent the hide from swelling. For preservation purposes, 0.03-2% by weight of fungicides and bactericides are usually applied.

2.1.5 Degreasing

Normally performed together with soaking, pickling or after tanning, degreasing is performed by organic solvents or surfactants, leading to a higher COD value in the effluent. [Ecology and Environment in the Leather Industry-Technical Handbook, (1995)]
2.2 Tanning (Tanyard Operation)

(Environmental, Health, and Safety Guidelines for Tanning and Leather Finishing, (2007)) Tanning allows stabilization of the collagen fiber through a cross-linking action. The tanned hides and skins are tradeable intermediate products (wet-blue). Tanning agents can be categorized in three main groups namely mineral (chrome) tanning agent; vegetable tanning agents; and alternative tanning agents (e.g., Syntans, aldehydes, and oil tanning agents).

2.2.1 Chrome Tanning (CT)

CT is the most common type of tanning in the world. After pickling, when the pH value is low, chromium (III) salts are added. To fixate the chromium, the pH is slowly increased through addition of a base. The process of chromium tanning is based on the cross-linkage of chromium ions with free carboxyl groups in the collagen. It makes the hide resistant to bacteria and high temperature. Chrome tanned leather are characterized by top handling quality, high hydro-thermal stability, user-specific properties and versatile applicability. Waste chrome from leather manufacturing, however, poses a significant disposal problem.

2.2.2 Vegetable Tanning (VT)

VT is usually accomplished in a series of vats with increasing concentrations of tanning liquor. [Ecology and Environment in the Leather Industry- Technical Handbook, (1995)] (Environmental, Health, and Safety Guidelines for Tanning and Leather Finishing, (2007)) Vegetable tanning produces relatively dense, pale brown leather that tends to darken on exposure to natural light. Vegetable tanning is frequently used to produce sole leather, belts, and other leather goods. Unless specifically treated, however, vegetable tanned leathers have low hydrothermal stability, limited water resistance, and are hydrophilic.
Vegetable tannins are polyphenolic compounds of two types;

- Hydrolysable tannins (i.e. chestnut and myrobalam) which are derivatives of pyrogallols, and

- Condensed tannins (i.e. hemlock and wattle) which are derivatives from catechol.

2.2.3 Alternative Tanning

Tanning with organic tanning agents, using polymers or condensed plant polyphenols with aldehydic cross-linkers, can produce mineral-free leather with high hydrothermal stability similar to chrome-tanned leather. However, organic-tanned leather usually is more filled (e.g. leather with interstices filled with a filler material) and hydrophilic than chrome-free leather, with equally high hydrothermal stability. This tanning process is carried out with a combination of metal salts, preferable but not exclusively aluminum (III), and a plant polyphenol containing pyrogallol groups, often in the form of hydrolysable tannins.

2.3 Wet Finishing (Post-Tanning)

Post-tanning operations involve neutralization and bleaching, following by retanning, dyeing, and fatliquoring. These processes are mostly undertaken in a single processing vessel.

Specialized operations may also be performed to add certain properties to the leather product (e.g. Water repellence or resistance, oleophobicity, gas permeability, flame retardancy, abrasion resistance, ad anti-electrostatic properties).
2.4 Finishing

(Ecology and Environment in the Leather Industry- Technical Handbook, (1995)), The crust that results after retanning and drying is subjected to a number of finishing operations. The purpose of these operations is to make the hide softer and to mask small mistakes. The hide is treated with an organic solvent on water based dye and varnish. Environmental aspects are mainly related to the finishing chemicals which can also reach effluent water.
Figure 2.1 An overview on the steps of leather processing
3. Processing Chemicals

A variety of chemicals, from common salts (sodium chloride) to the fine finishing chemicals, are used in Leather sector. About 130 different types of chemicals are applied in leather manufacturing, depending on the type of raw material and the end product of the industry. These chemicals are divided into four major classes, described below, as per their use.

3.1 Pre-Tanning Chemical

These chemicals are used to clean and to prepare the skins for the tanning processes. These chemicals do not react with the skins’ fiber, therefore are not retained by the skins. These chemicals after performing their respective functions are discharged with the wastewater.

3.2 Tanning Chemicals

These tanning chemicals react with the collagen fibers of the skin and convert them into leather. As these chemicals react with the fiber, therefore, a considerable quantity is retained by the fiber. Nevertheless, a significant amount remains unused and is discharged with the wastewater. Basic chrome sulphate is the tanning chemical, which most widely used in local tanneries. This is an expensive chemical and also poses a serious environmental threat. Besides environmental problems, its discharge into wastewater is also a financial loss. Vegetable tanning materials are also used in local tanneries but their use is not common as compare to chromium.

3.3 (Wet) Finishing Chemicals

These chemicals are used to impart certain properties, e.g. appearance, softness, flexibility, colour strength, etc. as per the requirement of the finished product. These chemicals also react with the collagen fibers of the tanned leather
and again a maximum quantity of the applied chemicals is retained by the skins. Whereas un-reacted or residual chemical is discharged with the wastewater of the process.

3.4 Finishing Chemicals

Finishing chemicals are applied as surface coating material to impart the desired surface finish to the leather. Most of the applied quantity is retained by the surface of the leather. However, due to limitations of the application procedure some quantity does go into the waste.

[The Leather Sector, (1998)]

The tanning industry gives rise to two types of hazard involving chemicals. These are, firstly, those concerning particular chemicals used in the various tanning processes, and secondary, chemical substances produced as by-products by the chemical reactions occurring when a hide undergoes the tanning process.

The first type of hazard includes the vast majority of chemicals to be found in tanning. It is possible to divide these materials into groups based either on the particular degree of hazard they present, or on their chemical nature (e.g. acids, alkalis, etc.).

In the second hazard type defined above the major by-product which presents a chemical hazard to workers is hydrogen sulfide.

In terms of toxicity and potential to cause a hazard it is a relatively straightforward task to divide a typical list of chemicals used in tanning into three groups representing major, moderate, and minor potential hazards that are given in Table 3.1.

[Chemical Handling in Leather Industry, (2004)]
Table 3.1 Major, Moderate and Potential Hazard in Leather Industry

<table>
<thead>
<tr>
<th>High Potential Hazard Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic Acid</td>
</tr>
<tr>
<td>Hydrogen peroxide</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Moderate Potential Hazard Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium sulphate (as lacquer constituents)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low Potential Hazard Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alums</td>
</tr>
<tr>
<td>Casein</td>
</tr>
<tr>
<td>Ferrous acetate</td>
</tr>
<tr>
<td>Lecithin</td>
</tr>
<tr>
<td>Sodium acetate</td>
</tr>
<tr>
<td>Sodium nitrite</td>
</tr>
<tr>
<td>Titanium salts</td>
</tr>
</tbody>
</table>
4. Pollutants In Tannery Effluents

This research is given by M. Bosnic, J. Buljan and R. P. Daniels (2000), in some instances, liquid waste is discharge into sewage systems (indirect discharge) where it undergoes full-scale treatment before being returned to the environment via surface water.

Where effluent is discharged direct into streams and rivers, it needs to be of higher quality as the environment is sensitive and highly susceptible to damage. The greater the volume of the effluent compared to the volume of surface water, the higher the quality of the effluent demand by the environment. Pollutants in tannery effluent is shown in Table 4.1. [M. Bosnic, Buljan, J., Bosnic, M., and Daniels, R. P., (2000)]

<table>
<thead>
<tr>
<th>Table 4.1 Pollutants in Tannery Effluent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solids</strong></td>
</tr>
<tr>
<td>Suspended Solids</td>
</tr>
<tr>
<td>Solid with A Rapid Settling Rate</td>
</tr>
<tr>
<td>Semi-Colloidal Solids</td>
</tr>
<tr>
<td>Settleable Solids</td>
</tr>
<tr>
<td>Gross Solids</td>
</tr>
<tr>
<td>Oxygen Demand</td>
</tr>
<tr>
<td>Biological Oxygen Demand (BOD)</td>
</tr>
<tr>
<td>Chemical Oxygen Demand (COD)</td>
</tr>
<tr>
<td>Nitrogen Compounds</td>
</tr>
<tr>
<td>Total Kjeldahl Nitrogen (TKN)</td>
</tr>
<tr>
<td>Ammonium Content As Nitrogen (N)</td>
</tr>
<tr>
<td>Sulfides</td>
</tr>
<tr>
<td>Neutral Salts</td>
</tr>
<tr>
<td>Sulphate</td>
</tr>
<tr>
<td>Chlorides</td>
</tr>
<tr>
<td>Oil and Grease</td>
</tr>
<tr>
<td>pH</td>
</tr>
<tr>
<td>Chrome (Trivalent Chrome, Chrome III)</td>
</tr>
<tr>
<td>Other Metals</td>
</tr>
</tbody>
</table>
5. Waste Treatment of Tannery

Tanning industry is one of the oldest industries of the world and the problem of treatment and disposal of these wastes is probably as old as the industry itself.

Tanneries wastewater effluent is treated in many different ways. There are situations in which an individual tannery applies all the below-described wastewater treatment steps on site. In other situations an individual tannery may apply (on site) only pre-treatment or no treatment at all, sending the effluent to a centralized effluent treatment plant. Nevertheless, a treatment is necessary due to the wide range of toxic effects on the environment caused by untreated tannery effluents and sludges.

The following treatment steps are necessary and will be described in more detail afterwards;

- Mechanical treatment
- Effluent treatment
- Post-purification, sedimentation and sludge handling [Treatment of Tannery Wastewater, (2002)]

6. Environmentally Clean Technologies

(The Leather Sector, 1998) A number of cleaner technologies can be applied for the manufacturing of finishing leather. The implementation of cleaner production processes and pollution prevention measure can provide both economic and environmental benefits. However, the applicability of these technologies vary from tannery to tannery due to the varying nature of raw material, processing conditions and the type of finishing leather.
6.1 Reuse Of Chrome

Quite a few options are available for the reuse of the chrome discharged in the tanning effluent. These technologies do not completely eliminate the chromium being discharged through the effluent or sludge. However, it can be seen as apart of a general environmental plan of the tannery, since it reduces the necessary amount of chromium being discharged into the environment, thus facilitating the treatment and disposal of small amounts of chromium containing sludge. Chrome reuse option also provides financial benefits.

6.2 Direct Recycling Of Chrome Tanning Float

This is the easiest method of chrome reuse. In this method after collection and sufficiently fine screening, the float is controlled and the chromium amounts used in the previous cycle are replaced by fresh chromium salts. Depending on the tanning technology in use, the degree of exhaustion reached for each cycle may vary. The recycling method may be repeated several times on the same float. However, it is limited by the occurrence of quality problems with delicate hides and by the need to control residual float. This technology is suitable for small tanneries.

6.3 Recycling Of Chrome After Precipitation

This allows collection of the tanning float with the rinses, that sometimes occur at the end of the tanning and the effluent from various post-tanning stages (washing, dripping, sammying, etc). After collection, screening and storage, the floats are precipitated with different types of alkalis and bases including sodium hydroxide, sodium carbonate, magnesium oxide and even with lime. The reuse of sludge after simple settling and acidification has been experimented and practiced. Schematic diagram of a typical chrome recovery and reuse plant is shown in Figure 6.1. Large plants have operated under this scheme for many years in Germany, Italy, South America and France.[Office for Official Publication of The European Communities,( 2003)]
7. Environmental Impact of Tannery Wastes

The effluent from the tanning industry are often adversely affecting human life, agriculture, and livestock. The residents, especially the tannery workers, have been the victims of this pollution, which has led to severe ailments such as eye diseases, skin irritation, kidney failure, and gastrointestinal problems. Chromium, extensively used in the tanning process, is carcinogenic. Cancer found as a cause of death in some cases can be linked to chromium pollution in the groundwater.

Water with a low pH is corrosive to water-carrying systems and in unfavorable circumstances, can lead to the dissolution of heavy metals in the wastewater. The high pH in tannery wastewater is produced by lime because it is used in excess quantities and this causes scaling in sewers. Whereas, low pH of wastewater is
caused by use of acids in different tannery processes. A large fluctuation in pH exerts stress on aquatic environment which may kill some sensitive species of plant and animals living there.

Large quantities of proteins and their degraded products form the largest single constituent group in the effluent. They effect the environment which can be expressed by two composite parameters; Biological Oxygen Demand (BOD5) and suspended solids.

BOD is a measure of the oxygen consuming capacity of water containing organic matter. Organic matte by itself does not cause direct harm to aquatic environment, but it exerts an indirect effect there by depressing the dissolved oxygen content of the water. The oxygen content is an essential water quality parameter and its reduction causes stress on the ecosystem. As an extreme example, a total lack of dissolved oxygen as a result of high BOD can kill all natural life in an effected area.

The Chemical Oxygen Demand (COD) is a measure of oxygen equivalent to that portion of the organic matter in a sample which is susceptible to oxidation by a strong chemical oxidant. It is an important, rapidly measured parameter for stream and industrial waste studies and for control of waste treatment plants.

Along with the organic compounds immediately available to the stream organism, it also determines biological compounds that are not a part of immediate biochemical load on the oxygen assets of the receiving water.

Due to sulfide discharged from the unhairing process, hydrogen sulfide is released at a pH value lower than 8.5. This gas has an unpleasant smell even in trace quantities and is highly toxic to many forms of life. In higher concentrations, fish mortality may occur at a sulfide concentration of 10 mg/l. Sulfide in public sewer can pose structural problems due to corrosion by sulphuric acid produced as
a result of microbial action. Sewage contains sulfide in the range of 15-20 mg/l. and composite tannery wastewater contains 290 mg/l.

Suspended solids, apart from being societal nuisance, have their main effect when they settle. The layer so formed on the bottom of the watercourse, covers the natural fauna on which aquatic life depends. This can lead to a localized depletion of oxygen supplies in the bottom waters. A further secondary effect is the reduced light penetration and consequent reduction in photosynthesis due to the increased turbidity of water.

The sodium chloride used in the tannery produces no effect when discharged into estuaries or the sea, but effects fresh water life when its concentration in a stream or lake becomes too high. There is no economically viable way of removing salt from the effluent. A similar problem also exists for sulphate used as the chrome tanning salt. Sulphate in addition causes corrosion to concrete structures.

Finishing chemicals like acetic acid, formaldehyde, ethylene glycol, etc. are used in the tannery processes. The vapors of these chemicals are very dangerous and can affect the health of workers severely. [The Leather Sector, (1998)]

8. Company A

8.1 Wastes Of Company A

The water getting out of Company A is sent to the plant the pre-recovery is followed, through three different channels differentiate according to their characteristics.

These channels, in accordance with the characteristics of the waste water are;

1. The waste water upgraded from the channel to the plant is coming out of these units below.
- Soaking
- Unhairing and liming

2. The waste water upgraded from the channel to the plant is coming out of these units below.
- Deliming
- Degreasing and bating
- Pickling
- Tanning
- Basification

3. The waste water upgraded from the channel to the plant is coming out of these units below.
- Sammying
- Retanned
- Dyeing
- Fixation

The measured parameters of the waste water are given for their characteristics in the Table 8.1 and the Table 8.2. There are two wastes that are originated both liquid and solid. Account of these wastes:

Liquid Wastes;

<table>
<thead>
<tr>
<th>Plants of Factory</th>
<th>Household Wastes(m³/ d)</th>
<th>Wastes(m³/ d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Plant</td>
<td>50</td>
<td>1664</td>
</tr>
<tr>
<td>Second Plant</td>
<td>353</td>
<td>2990</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>403</strong></td>
<td><strong>4654</strong></td>
</tr>
</tbody>
</table>
Table 8.2 Amount of solid wastes in Company A

<table>
<thead>
<tr>
<th>Leather Process</th>
<th>Amount of Wastes (kg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanning</td>
<td>130</td>
</tr>
<tr>
<td>Shaving</td>
<td>200</td>
</tr>
<tr>
<td>Packing</td>
<td>120 (4-5 boxes)</td>
</tr>
<tr>
<td>Fleshing</td>
<td>120</td>
</tr>
<tr>
<td>Trimming</td>
<td>300</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1230</strong></td>
</tr>
</tbody>
</table>

9. Company B

9.1 Company B Waste Treatment

Company B’s firm firstly initiated the activities to establish a waste treatment plant for treatment of the waste water. Company B’s facility, operating since August 1989 without any interruption, consists of mechanical, chemical and biological treatment units which have daily 1000m³ for waste water recovery capacity.

To decrease the pollution mass coming through the recovery plant, the waters coming from the deliming stock are passed through hair binding equipments before being released to the channels.

The waste water is gathered through two different channel systems in the factory and transferred to the waste water treatment plant through two other different channels. Without mixing chromium wastewater and lime waste water with each other, they pass through coarse screening, grit chamber and micro screens in sequence. The waste water passed through chromium micro screening is taken to the equalization basin, the waste water passed through lime micro screenings is taken to the sulfur oxidation ponds. The waters purified from sulfur in sulfur oxidation pond flow to equilibration pond by the help of an inundation canal. The
waste water reaching enough homogeneity and airing is taken to chemical recovery unit. Here, by the help of the chemicals has been added, the materials which can be purified through chemical recovery through overbearing techniques and banished from the water. The materials banished from water called as treatment sludge is sent to the sludge dewatering unit. The waste water is sent to the biological treatment unit. The biological system is an extended aeration system, where through bacterial activity named activated sludge both carbon and nitrogen treatment is accomplished. The water passing to the clarification unit after a sufficient waiting period is disposed to recipient environment through the channels. The active sludge is recycled back to the biological treatment unit. The treatment sludge in the clarifier is dewatered by means of belt-press and made ready and sent for disposal. Discharge standards and diagram of wastewater treatment plant of second plant are shown Figure 9.1 and Table 9.1 below:

Figure 9.1 Wastewater Treatment Plant in Company B
Table 9.1 The discharged standards of Company B

<table>
<thead>
<tr>
<th>Unit</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>COD (mg/l)</td>
<td>168</td>
</tr>
<tr>
<td>SS (mg/l)</td>
<td>47</td>
</tr>
<tr>
<td>TKN (mg/l)</td>
<td>75</td>
</tr>
<tr>
<td>Oil/Grease (mg/l)</td>
<td>6.8</td>
</tr>
<tr>
<td>Sulphate (mg/l)</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Total Chrome (mg/l)</td>
<td>0.2</td>
</tr>
<tr>
<td>pH</td>
<td>7.76</td>
</tr>
</tbody>
</table>

10. Comparison

- Salting is applied in both facilities in order to protect the tanned leather until they arrive at the facility.

- Both sheep and goat leather and cattle leather is tanned in the second facility while, in the first facility, only sheep and goat leather is tanned.

- While waste products from snipping and trimming processes are not used as raw materials for another industry in the first facility, they are sold as raw materials in the second facility.

- In both facilities, dissolving with lime method is used for hair-removing process, so it is not possible to recycle the hair and in addition, the water is polluted more by the chemicals and leather leftovers. Especially COD and BOD loads are increased more in the water.

- In both facilities, chrome tanning method is used. This method is the optimum method in terms of the characteristics that the leather gains. In addition,
elevation and treatment processes are applied, which is different form other kinds of water.

- In the first facility, no treatment process is applied in the activity area, considering the characteristics of the process water in the facility, this water is discharged to sewer system after being elevated to the pre-treatment facility through three separate canals.

- In the second facility, there is a pre-treatment facility in the activity area.

- In both facilities, discharge to the sewer system is carried out in accordance with the Regulations for the Control of Water Pollution published in the Official Gazette No 25687 dated 31 December 2004. Discharging limits between Companies and Limit of Regulation in Turkey is given Table 10.1.

- In terms of the parameters for discharge to receptive environment stated in the Regulations for the Control of Water Pollution, it is observed that the output parameters are in accordance with the Regulations when the two facilities are compared. This regulation is shown in Appendix I. (Su Kirliliği Kontrolu Yonetmeligi, (2004))
Table 10.1 Discharge standards of facilities and Regulation limits in Turkey

<table>
<thead>
<tr>
<th>Parameters (mg/l)</th>
<th>Company A</th>
<th>Company B</th>
<th>Regulation of Turkey</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Composite Sample For 2 hours</td>
</tr>
<tr>
<td>COD (~ 250)</td>
<td>168</td>
<td>300</td>
<td>200</td>
</tr>
<tr>
<td>SSM</td>
<td>47</td>
<td>125</td>
<td>-</td>
</tr>
<tr>
<td>TKN (5- 10)</td>
<td>7.5</td>
<td>20</td>
<td>.15</td>
</tr>
<tr>
<td>Oil/Grease (30- 1)</td>
<td>6.8</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>S (0.002)</td>
<td>&lt; 0.1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Total Chrome (0. 22- 0. 25)</td>
<td>0.2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>pH (7. 7)</td>
<td>7. 76</td>
<td>6- 9</td>
<td>6- 9</td>
</tr>
</tbody>
</table>

11. Result

There are many salting methods today (drying, keeping in a temperature of -3 Celsius degree or putting in the ice bars). Even though keeping with salt method is applied since it is economically favorable, it causes an additional treatment cost to the facility. This salt can be detracted from the facility by whipping-by-hand method to a minimum degree. In addition, the slaughter houses are near the leather tanning facilities but this does not necessitate that the leathers should be immediately tanned or additional chemicals or technologies should be used. Since this factor is not considered during the foundation of the facilities, this alternative cannot be used in the process of decreasing the salt added into water.
In the first facility, waste products from snipping and trimming processes were used as raw material in other industries, but in time, these waste products caused additional pollution since the shipments expenses became costly because of the distance between the facilities. In the other facility, these waste products are sold. Waste products from fleshing process are used as raw material in neither facility.

Today the most easily applied method for hair-removing process is using chemicals such as lime, sodium sulfide (arsenic) and kaolin in liming closets, which does not require additional work force. But this method is one of the reasons for the increase of the pollution in the water. Another method is whitening method. In this method, a solution composed of arsenic, lime, sulfide hydrate and kaolin is applied on the sub-section of the leather, and the leather is left for 3 hours, then the hair is removed manually. This whitening method should not be ignored since in this method the process water is used and the chemicals and the pollution in the water are kept at a minimum level, in addition, it can be sold and most importantly this method helps energy saving.

Considering the physical characteristics of the leather achieved by the chrome tanning method, this method is used in both facilities for producing desirable quality leather. Vegetative tanning or alternative tanning methods can be used instead of this method. Even though we cannot completely extinguish the pollution that is caused by chrome tanning method, we can recycle chrome by making use of clean technologies to minimize it keeping the pollution of the environment and costs of the chemicals used at a minimum level. The process of minimizing the pollution by recycling chrome is applicable in both facilities without any area problem. This technology is perfect for the big or medium-seized facilities. But it is a fact that, considering the additional processes in the future and unplanned construction costs; the modification of the clean technologies should be subtracted.

Since the first facility is located in a free leather trade area, it is not required to construct a pre-treatment facility because there is a single treatment facility in this free trade area to minimize the wastes from all of the facilities in this area. But
wastes from liming and tanning are elevated to the facility in separate canals together with the process water and discharged in accordance with the rules stated in the Regulations.

In both facilities, for the control of the pollution, the most appropriate technologies can be preferred in both refining and operating processes by employing mass balance calculations, which is an additional indicator to the Regulations. The second facility has concentrated on this kind of an activity and is trying to get data for calculations.

References


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