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CAPO AND MOSHRAF FACTORIES WASTE WATER TREATMENT

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Abstract: **To study Capo and Moshraf factories waste water treatment, the primary objective was to determine their hydraulic and organic pollution loads. Field observations, associated with personnel interviews, parallel with laboratories analysis were conducted. The determined hydraulic, and organic loads were found relatively high for the two factories and disagreeable with that recommended by Khartoum North Local Order (1970) as well as SSMO (173/2008) Standards. The obtained detailed properties were presented in a table in the study with the analysis results for reference. No pretreatment inspection facilities, no flow measurement by KSSC usually needed in such study, were presented in both factories. However, pretreatment facilities presented in a second table in the study was recommended to fit and obey the regulations in Capo factory. The basic conclusion of the research is that the generated wastewater from both factories is excessive, and not control. That oil and grease adversely affect the municipal treatment plant. The recommendations indicated that monitoring the hydraulic and organic loads emanating from both factories must implement Khartoum North local order (1970)**

Keywords**: Hydraulic, organic, standards, pretreatment facilities.**

I. INTRODUCTION

The wastewater from industries varies so greatly in both flow and pollution strength [1]. So, it is impossible to assign fixed values to their constituents [2]. In general, industrial wastewaters may contain suspended, colloidal and dissolved (mineral and organic) solids [3]. In addition, they may be either excessively acidic or alkaline and may contain high or low concentrations of colored matter [4]. These wastes may contain inert, organic or toxic materials and possibly pathogenic bacteria [1,5]. These wastes may be discharged into the sewer system provided they have no adverse effect on treatment efficiency or undesirable effects on the sewer system [6]. It may be necessary to pre treat the wastes prior to release to the municipal system or it is necessary to a full treatment when the wastes will be discharged directly to surface or ground waters[7].

Whereas the nature of domestic wastewater is relatively constant, the extreme diversity of industrial effluents calls for an individual investigation for each type of industry and often entails the use of specific treatment processes [8]. Therefore, a thorough understanding of the production processes and the system organization is fundamental [9]. A long-term detailed survey' are usually necessary before a conclusion on the pollution impact from an industry can be reached. Typical pollutants and BOD range for a variety of industrial wastes are given in Table-1. The values of typical concentration parameters (BOD5, COD, suspended solids and pH)[5]. Industrial wastewaters are considerably diverse in their nature, toxicity and treatability[10], and normally require pre-treatment before being discharged to sewer[11]. Food processing in particular is very dissimilar to other types of industrial wastewater, being readily degradable and largely free from toxicity[12]. However, it usually has high concentrations of biological oxygen demand (BOD) and suspended solids **[13].**Compared to other industrial sectors, the food industry[14] uses a much greater amount of water for each ton of product **[15].** Industrial wastewater characteristics vary not only between the industries that generate them, but also within each industry[16]. The impact of such effluents on the water quality was studied in detail by monitoring selected physicochemical parameters monthly[17.4].

As the objective of this study is to determine the pollution loads (both hydraulic and organic) emanating from the factories under the study (food processing factories)., Samples were taken for BOD, COD, pH, TSS.The existing preliminary analysis of the two factories is as shown in table (1).

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Table No.(1): Existing Preliminary Analysis Of The waste water from Two Factories:

Sample tested results	Capco	Mosharf
pH	6.89	6.55
TSS	1000 mg/l	350 mg/l
BOD	4500 mg/l	5516 mg/l
COD	5650 mg/l	6825 mg/l
Oil & grease	150.100 mg/l	100 mg/l
Waste water flow	5000 m^3/day	74 m^3/day

Problems are:-

- Industrial wastewaters may contain suspended, colloidal and dissolved (mineral and organic) solids which may pollute surface water and groundwater.
- In general, wastes from the dairy processing industry contain high concentrations of organic material leading to contamination of milk as well as pesticides, antibiotics and other chemical residues..
- Essential treatment of wastewater prior to its discharge to the wastewater sanitary network.

Objectives are:-

The General Main Objective:-

Enable the dairy and sweets industries to enhance and conserve efficient, cost-effective wastewater treatment technology, envolving the present environmental regulations and legislations (Khartoum North local order (1971) and SSMO standard 174/2008).

The Specific Objectives are:-

- Identify the specific flow processing lines for each factory.
- Identify and analyze the liquid waste generated from the studied food industry quantitively and qualitatively.
- Design pretreatment facilities, so that the generated liquid waste lies within the allowable required discharge limits of sewer.

II. STUDY AREA

The first case study is **CAPO** Milk Factory Dal Group of Khartoum North industrial area. CAPO is Sudan favorite dairy brand producing a wide range of tasty and nutritious products. These include yoghurt, fresh milk, long life milk, cream, and mish. The second case study is El **Mosharf** Sweets Factory lies in block 8 in Khartoum North industrial area.(which accommodate the Khartoum North industrial area)

Khartoum North Town is located on the north bank of the Blue Nile and the east bank of the River Nile, near the confluence of the Blue Nile with the White Nile, connected with Khartoum by an old steel bridge. According to the last cencus in 2008 Khartoum North Town has a population of about 1012211 (one million). CAPO Milk factory Dal group is in Khartoum north industrial area. CAPO is Sudan favorite dairy brand producing a wide range of tasty and nutritious products, such as yoghurt, fresh milk and long life milk, cream, and mish. It is believed that their produced food is derived from natural sources, is fresher and of more nutrients.

CAPO has been a pioneer in the diary sector, producing the first ever packed yoghourt in the country, following that with a series of first in fresh milk pro-biotic yoghurt and low fat yoghurt. CAPO is striving to lead the market and bring new exciting experiences to Sudanese consumer.

In September 2010, Capo moved into new manufacturing facilities which included advanced equipment. This paved the road for their enhancing and sustaining reputation as the brand leading dairy in the Sudan.

In 2011 CAPO endovered more efforts forward towards promoting their standard that made them famous through introducing new products that pleased and surprised their valued customers.

Capo was established in 1997.Capo assets included 501 to 1000 employers, a head Quarter in Khartoum North Town.It lies in plot 15, block 4, east industrial area Khartoum North Sudan. where as

El Mosharf sweets factory lies in block 8 Khartoum North Town industrial area,established in 1986 as part of Kambal Group in Khartoum.To day it produces biscuitis and tahnia sweets.In 1992 it started to produce tahnia sweet of 600 ton / month used old traditions lines and biscuit capacity of 6 gram of 200000 packages per month.In 2000 El Mosharf company introduced new technology in the production lines and sales points.In 2006 El Mosharf extention was Amdro part under brand sweets lights added three new lines.In 2015 Kambal started muliti activities rehabilitation production lines,machines, building…etc.Turkey technologies were introduced in new lines.In 2017 new products and high quality products and trucks with different loads (3-15 tons).were introduced.

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III. DATA COLLECTION

There are two wastewater drainage networks and two end-of-pipe discharge points in the industry collected in two manholes in El Mosharf factory. One for industrial wastewater and the other for the domestic wastewater. The industrial wastewater end-of pipe discharge points include wastewater discharges .The domestic wastewater discharge points include wastewater discharges from the wastewater generated .Samples were taken from the process and end-of-pipe industrial wastewater and other point of industrial wastewaters discharge during the process activities to perform a preliminary assessment of the environmental status.

The design calculation for CAPO dairy factory Dal Group wastewater charicirerictics used for design pretreatment plant. is as given in table (2).

Table No (2): Results Of Raw Wastewater Characteristics CAPO

pH	----	6.89
TSS	Mg/l	800
BOD	Mg/l	4500
COD	Mg/l	5650
OIL and grease	Mg/l	150.100

As a results from the above analysis, indicating that there are three shifts , as shown in table (3). It is concluded that for pH analysis of the first two shifts is within the allowable limits, as for the third shift the pH is lower than the allowable limits. Similarly for the COD, the second shift sample is within the limits while samples of the other two shifts are not complying with the requirements. Oil and grease, samples of the first two shifts are within the stipulated limits, while sample for the third shift is not complying.(shown in the main research in long table).

Table No.(3): Industrial Wastewater Determined BOD&COD After Chiller Water Removal

Parameter	**Units**	**1st shift**	**2nd shift**	**3rd shift**	Limits
BOD	Mg/l	7264	1554	5516	600
COD	Mg/l	9822	1992	6825	1100

IV. METHODS MATERIAL USED AND EQUIPMENT:-

Because of the great variation in the quality and quantity of wastewater produced, a continuous monitoring program was carried out to identify the quality and quantity of wastewater discharged. Samples were taken from the process and end- of-pipe industrial wastewater and from other points of industrial wastewaters discharged during the process activities to perform a preliminary assessment of the environmental status of the facility.The importance of the methodology in any research study is that it paves the road to clearly reveal the problems and lead to the fulfillment of the objectives

V. RESULTS AND DISCUSSIONS:-

The proposed pretreatment unit designed for CAPO Plant parts is:

Q design = 208.33 m^3/d, BOD design load = 124 kg/d, design TSS load= 144 kg/d. Volume of lift station = 1000 m^3, manual bar screen length =1.2m, width = 0.5 m, height = 0.5 m. The Volume of aeration tank = 6944.44m^3. Table (4) presents the proposed pretreatment unit designed for CAPO with design waste water characteristics

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Table No.(4): Proposed Pretreatment Unit Designed For Capo.

Sample	**Capco**
pH	6.89
TSS	144mg/l
BOD	124 mg/l
Volume of lift station	1000 m^3
Manual bar screan length x width x height	$1.2\ m \times 0.5 \times 0.5$
Waste water flow	208.33 m^3/day

Samples were analysed to determine chemical oxygen demand for Water and Wastewater, Biological oxygen demand and total suspended solids. Test procedure is in accordance with IS: 3025 (Part 44) -Reaffirmed 2003.
In addition to the Indian Standards, and the procedures Stated in:
(1) APHA Standard Methods for the Examination of Water and Wastewater –20th Edition. Method 5210 B.
(2) Methods for Chemical Analysis of Water and Wastes, EPA - 600/4 – 79 - 020, USEPA, Method 405.1.
The determination of the BOD of wastes is useful in the design of treatment facilities. It is the only parameter, that give an idea of the biodegradability of sample and self-purification capacity of rivers and streams. The BOD test is among the most important methods in sanitary analysis to determine the polluting power, or strength of sewage,industrial wastes or polluted water. It serves as a measure of the amount of clean diluting water required for the successful disposal of sewage by dilution.
Pollutants in the domestic wastewater are expected to be lower than that of the industrial wastewater, accordingly mixing of the industrial and domestic wastewater is expected to dilute the pollutants discharged from the industrial wastewater.
Analysis of Grab Samples from Mixed Industrial and Domestic Wastewater were considered for the important parameters presented in a separate table.These were the pH, TSS, Total Nitrogen, Orthophosphorous, Settleable solids,in three shifts indicating units and limits.

VI. CONCLUSIONS AND RECOMMENDATION

Conclusions:

- Quantity of generated wastewater from both of the studied production facilities is excessive and uncontrolled.
- The characteristics of generated wastewater in terms of (BOD,COD, and TSS) exceed the recommended in the Khartoum North (local order 1970, SSMO standard 173/2008), neither of the two factories is having pretreatment facilities as recommended by standards.
- The oil and grease from these factories are adversely affecting the municipal treatment plant.
- No body seems to follow the quantity of the generated wastewater, this presents over loads to the municipal wastewater treatment plant.

Recommendations:

- Khartoum state sanitary cooperation (KSSC) should regularly monitor the hydraulic and organic loads emanating from factories according to Khartoum North local order (1970).
- The KSSC should in force the local order and standards so as to insure efficiency and safety of wastewater treatment plant.
- Install pretreatment / treatment units to control the quality of generated wastewater from both factories. It is recommended to install pretreatment facilities for the industrial wastewater in this plant, so as to be in line with the regulations
- Implement the designed pretreatment facilities for CAPO factory.

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