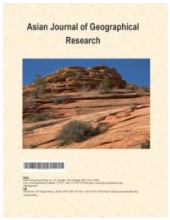

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# Physio-chemical Parameters of Wastewater from Food Industries of Faisalabad

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***Authors' contributions***

*This work was carried out in collaboration among all authors. Authors RS and MN designed the study. Authors NT, UH and MUM performed the statistical analysis. Authors RS, MN and MI wrote the protocol and wrote the first draft of the manuscript. Authors MW and MAA managed the analyses of the study. Authors MUM, RS, NT and MN managed the literature searches. All authors read and approved the final manuscript.*

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## ABSTRACT

Food waste or food loss is food that is unnecessary or lost uneaten. The reasons of food waste or loss are various and take place at the stages of production, processing, transaction and utilization. The main objective of this study was to access the quality of groundwater in Faisalabad city. From different food industries of Faisalabad water samples were collected to estimate their physicochemical parameters. The physiochemical parameters such as (pH, Electrical conductivity, Total dissolved solids, Calcium, Bi-carbonates, Total Hardness and chloride) were analyzed and their values were compared with the standard values. In the majority of the industries waste, water was not up to the mark. pH, TSS, EC and Chlorides values were out of range in most of the samples. On the completion of data physiochemical parameters of groundwater, statistical analysis was applied. Descriptive statistics were carried out to evaluate the significant differences between means of samples.

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*Keywords: Food; industries; wastewater; parameters.*

## 1. INTRODUCTION

Food waste or food loss is food that is unnecessary or lost uneaten [1]. The reasons of food waste or loss are various and take place at the stages of production, processing, transaction, and utilization [2]. Current estimation of global food loss and waste stuck between one-third and one-half of all food produced. Loss and wastage take place at all stages of the food supply chain or value chain. In low-income countries, most loss takes place during production, while in industrial countries more food – about 100 kilograms per person per year is exhausted at the consumption phase [3].

Usually, useless or lost uneaten food is food waste. Though the correct definition is contentious, often based on the situation. Professional bodies, concerning international organizations, state governments and secretariats may use their own definitions. Under the UN's Save Food scheme, the FAO, UNEP and stakeholders have established the consequent definition of food loss and waste [4].

In developed and developing countries which constrain either industrial or commercial agriculture, food loss occurs at most stages of the food industry and the amounts of food waste are unidentified, in subsistence agriculture but are likely to be unimportant by comparison, the narrow stages at which food loss can occur and know that food is developed for projected need as different to a global marketplace demand. However, losses in storage in rising countries, mainly in African countries, can be high while the exact nature of such wastage is much debated. Food loss continues in the post-harvest stage, but the quantity of post-harvest loss concerned are comparatively hard to estimate and unknown. In storage, significant losses can be recognized to micro-organisms and pests [5].

Food wastes formed by processing are hard to minimize without disturbing the quality of the end product [6]. Food safety regulations are able to argue foods that oppose standards before their arrival at markets. While this can disagreement with efforts to recycle food waste (as in animal feed), It makes sure the health of the consumer; they are important essential, especially in the dispensation of foodstuffs of animal origin (e.g. dairy and meat products), as impure products from these sources can lead to and are linked with chemical and microbiological hazards [7].

An estimating amount of energy content of food waste by comparing the US food provides data with the calculated food inspired by the US population required by us. Waste removal and by-product management in food preparation industry pose troubles in sustainability and environmental defense [8].

Huge quantities of both solid and liquid wastes are formed annually by the food dispensation industry. These wastes contain principally recyclable organic contents and their dumping creates grave environmental troubles. These by-products may allow an extensive burden of phenol components [9]. The management of these wastes biologically was creating a proficient way of dropping their early COD more than 90% [10,11].

Food waste products from the house and industry have high levels of proteins and carbohydrates. Now, food wastes from the industry are treated aerobically. Nevertheless, bio compost, lactic acid and energy from food wastes are important added strategies for the treatment of food wastes. The organic contents mostly carbohydrate in food wastes are the probable substrate for anaerobic hydrogen production. During the elimination of basic palm oil, liquid waste produced by mills, palm oil mill effluent (POME) Palm oil is the main cash crop in many tropical developing countries i.e. Malaysia, where palm oil is major revenue earner. During the extraction of crude palm oil (CPO), liquid waste generated by mills, namely palm oil mill effluent (POME) [12].

Keeping in view the effects of waste products of different food industries of Faisalabad. The present study was designed to evaluate the analysis and study of different waste products and their effects produced in the food industries of Faisalabad.

## 2. MATERIALS AND METHODS

### 2.1 Sample Collection

The present study was intended from different food industries of Faisalabad to estimate the water quality parameters. The sample was taken from wastewater channels of industries.

### 2.2 Preparation of Samples

In clean polythene bottles, the samples were collected deprived of any air foams. Before

sampling, the containers were washed and firmly closed after collection and tagged. The temperature of the samples was precisely determined in the field at the time of sample collection. Samples were kept at 4ºC in the freezer.

### 2.3 Analysis of Water Sample

Several water quality parameters were analyzed such as Total Alkalinity, Total Hardness, pH, TSS, Na, K, Sulphates, carbonates, and bicarbonates.

### 2.4 Statistical Analysis

On the complete data of the physicochemical parameters, Statistical analysis was applied. Suitable tables were arranged and means were assessed. Descriptive statistics were applied to check the difference at a certain level.

## 3. RESULTS AND DISCUSSION

**pH:** Fluctuations in pH of wastewater along with the normal value for different food industries shown in (Fig. 1). The prescribed range 7.5 for pH. The maximum value of pH was recorded for Pak Sweets and Beakers. 8 and the minimum value of pH 6.9 were recorded for the Dawn food industry. Aamir and Nirala food industries water samples a normal range of pH. Similar results of pH changes were endorsed in an analysis of physiochemical parameters of ground water in Faisalabad by Nasir et al. [13]. Wastewater analysis was carried out in an in and around Peenya industrial area of Bangalore, South India with parallel results of the current study [14].

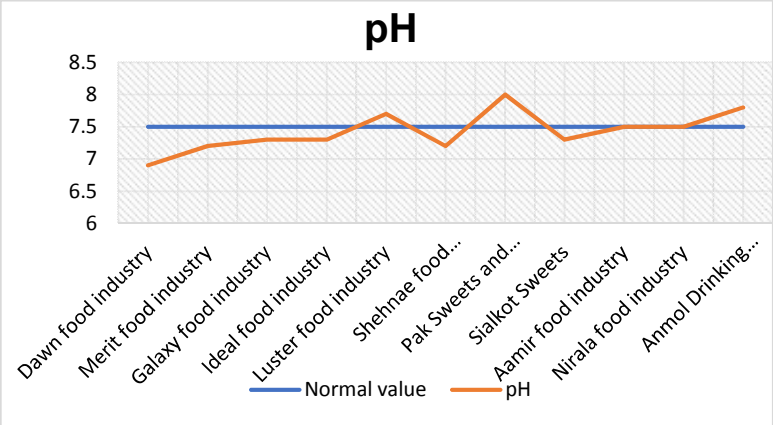


**Fig. 1. Wastewater PH of various food industries**

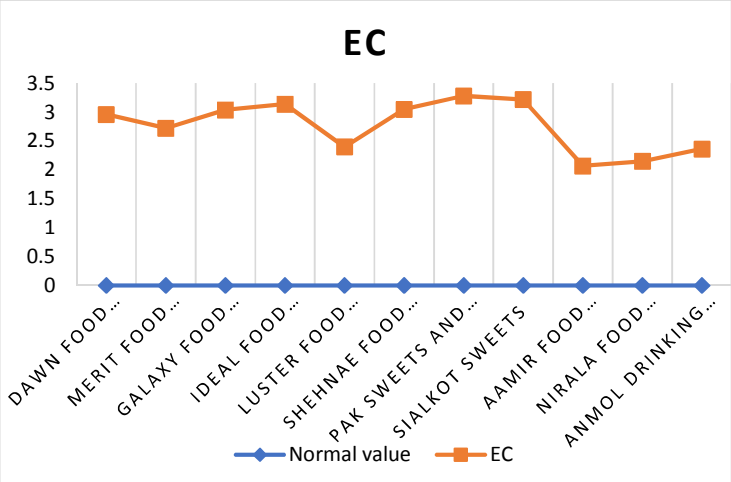


**Fig. 2. EC of various food industries wastewater**

**Table 1. Mean ± S.E of all the parameters and Tukey's test analysis**

| | pH | EC | TSS | Bicarbonates | Chloride (me/L) | Sulphate (me/L) | Total hardness(me/L) | Na (me/L) | K (me/L) |
|---|---|---|---|---|---|---|---|---|---|
| Dawn food | 6.97±0.07c | 2.94±0.01d | 1,894±0.32f | 8.03±0.03e | 15.83±0.44ab | 5.47±0.09a | 413.03±0.74d | 21.40±0.06d | 1.13±0.03bc |
| Merit food | 7.10±0.06bc | 2.73±0.01e | 1,742±0.29g | 8.50±0.06e | 15.70±0.06ab | 3.20±0.06c | 561.23±0.61a | 18.57±0.03e | 0.76±0.01h |
| Galaxy food | 7.20±0.06bc | 3.05±0.03cd | 1,947±0.60e | 12.10±0.06c | 14.33±0.09b | 4.20±0.06b | 387.60±0.32f | 22.50±0.06c | 0.98±0.01ef |
| Ideal food | 7.17±0.09bc | 3.13±0.01bc | 2,009±0.35c | 14.50±0.29b | 14.47±0.09b | 2.80±0.06d | 437.23±0.50bc | 22.57±0.03c | 1.08±0.01cd |
| Luster food | 7.60±0.06a | 2.40±0.06f | 1,536±0.76h | 8.50±0.29e | 15.00±0.58ab | 2.03±0.04fg | 436.13±0.33c | 15.50±0.06f | 0.75±0.01h |
| Shehnae food | 7.10±0.06bc | 3.05±0.03cd | 1,953±0.29d | 10.40±0.06d | 15.83±0.44ab | 4.17±0.04b | 407.57±0.15e | 22.33±0.09c | 1.03±0.01de |
| Pak Swts & Bkrs | 7.73±0.15a | 3.25±0.02a | 2,099±0.25a | 16.50±0.29a | 15.50±0.29ab | 1.80±0.06gh | 382.43±0.56g | 25.13±0.03a | 1.25±0.03a |
| Sialkot Sweets | 7.20±0.06bc | 3.23±0.01ab | 2,062±0.29b | 15.00±0.58b | 16.50±0.29a | 2.20±0.06ef | 385.33±0.19f | 24.47±0.12b | 1.20±0.03ab |
| Aamir food | 7.40±0.06ab | 2.07±0.01g | 1,325±0.44k | 8.17±0.17e | 10.30±0.06d | 2.50±0.06de | 387.50±0.70f | 12.73±0.09g | 0.93±0.01fg |
| Nirala food | 7.43±0.07ab | 2.15±0.01g | 1,376±0.44j | 8.80±0.06e | 11.30±0.06cd | 1.50±0.06h | 412.87±0.32d | 13.07±0.12g | 0.90±0.01fg |
| Anmol Dr.wtr | 7.70±0.06a | 2.35±0.01f | 1,511±0.32i | 8.33±0.33e | 12.33±0.33c | 3.47±0.09c | 439.17±0.17b | 15.23±0.09f | 0.89±0.01g |

**EC:** Oscillation of Electric conductivity recorded for various industrial wastewater was described in (Fig. 2). Recorded data showed great fluctuations in EC than the normal suggested range. The maximum value of EC (3.28 dS/cm) was plotted for Pak sweets and bakers and the lowest value recorded for the Aamir food industry that was (2.07 dS/cm). This suggested that the wastewater had the potency for EC that not meets the normal prescribed values. Manjare et al. [15] and Salve and Hiware [16] worked separately at different places to check the Physio-chemicals quality of water and reported the same results as mentioned in the current study [17].

**TSS:** The trend in TSS fluctuations for different industrial wastewater was described in Fig. 3. according to this maximum TSS, the amount was recorded from Sialkot sweets (2061 ppm) and minimum value against it was plotted for the Aamir food industry that was (1325 ppm). This suggested that values of documented data vary above and below the normal range that was 1750 ppm. Ram et al. [17] endorsed the parallel results, as described in present research work, in a study of physiochemical parameters of wastewater in different food industries.

The graphical representations of different chemical parameters of wastewaters were given

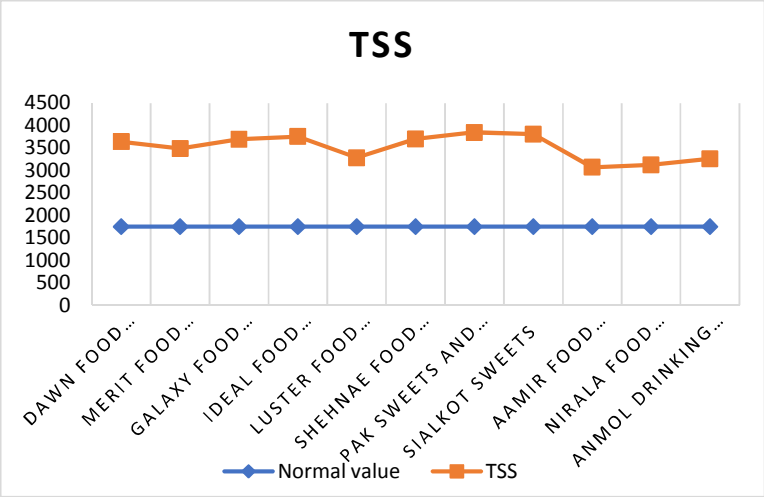


**Fig. 3. TSS of various food industries wastewater**

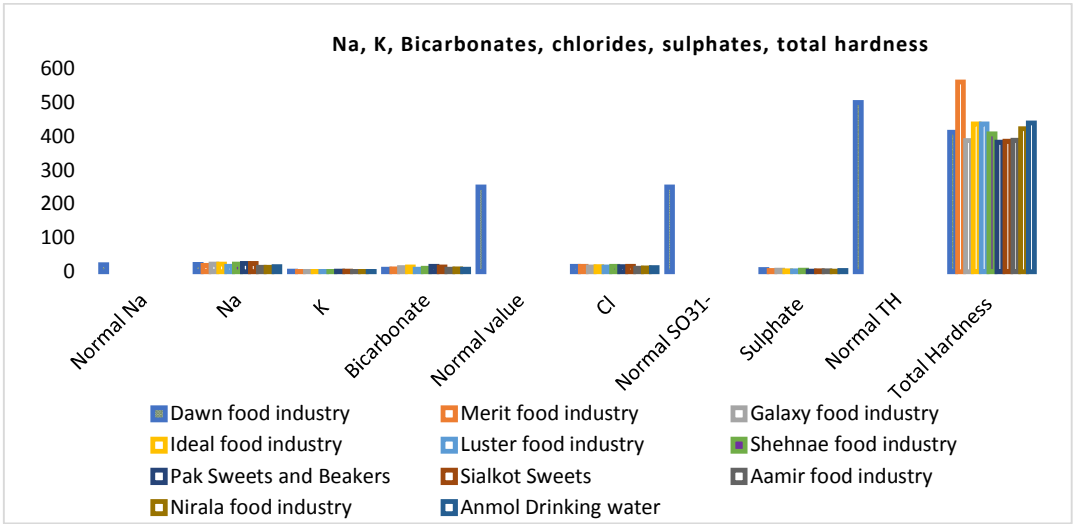


**Fig. 4. Na, K, Bicarbonates, chlorides, sulphates, total hardness of various food industries wastewater**

in Fig. 4. The exorbitant of sodium ions from wastewater was obtained 25 me/L from Pak sweets and bakers and a minimum of it was recorded for the Amir food industry. The number of bicarbonates was recorded 16 me/L in abundance from wastewater of Pak Sweets and Beakers and minimum amount 8 me/L logged for Dawn, Amir and Anmol food industries while, amount of sulphates, chlorides and potassium ions found as the needle in a haystack from the water samples. However, total hardness with its peak at 560 me/L reported for the merit food industry and minimum for Pak sweets and bakers 382 me/L. The above and below trend from normal recommended value was observed in chemical parameters analysis. [18] endorsed the same results with parallel fluctuations in chemical parameters in their research [19].

The statistical analysis of mean described means sharing similar letters in a column are statistically non-significant (P>0.05) and these results also coherent to with results published by Jindal and Sharma [20].

## 4. CONCLUSION

The assessment of the water quality parameters from different areas in the Faisalabad city revealed that pH and total hardness were within the permissible limits, but the other parameters were found to be high or below the standards described by WHO. Significantly less amount of the groundwater water samples were found to be useful for the regular domestic use but others were harmful to human health for drinking purpose. The results suggested that the groundwater quality of Faisalabad area cannot be used for the domestic and drinking purpose. The study suggests that proper treatments of groundwater should be applied before using can minimize the effects of the pollution and which is recommended for the sake of human health.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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