CHARACTERISTICS OF THE UNTREATED WASTEWATER PRODUCED BY FOOD INDUSTRY

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Abstract

The dairy industry is generally considered to be the largest source of food processing wastewater in many countries. As awareness of the importance of improved standards of wastewater treatment grows, process requirements have become increasingly stringent.

Although the dairy industry is not commonly associated with severe environmental problems, it must continually consider its environmental impact, particularly as dairy pollutants are mainly of organic origin.

Animal slaughter and processing produces very strong organic waste from body fluids, such as blood, and gut contents. Processing food for sale produces wastes generated from cooking which are often rich in plant organic material and may also contain salt, flavourings, colouring material and acids or alkali. Very significant quantities of oil or fats may also be present.

Key words: water, hygiene, wastewater.

INTRODUCTION

Compared to other industrials sectors, the food industry uses a much greater amount of water foreach ton of product. Wastewater generated from food operations has distinctive characteristics that set it apart from common municipal wastewater managed by public or private wastewater treatment plants throughout the world: it is biodegradable and nontoxic, but that has high concentrations of biochemical oxygen demand (BOD) and suspended solids (SS).

The constituents of food and wastewater are often complex to predict due to the differences in BOD and pH in effluents from vegetable, fruit, milk and meat products and due to the seasonal nature of food processing and postharvesting.

The dairy industry is generally considered to be the largest source of food processing wastewater in many countries. As awareness of the importance of improved standards of wastewater treatment grows, process requirements have become increasingly stringent.

The dairy industry is characterized by the multitude of products and therefore production lines. Plants can have as few as one or two production lines or all of them (pasteurized milk, cheese, butter, etc.).

Because dairy wastewaters are highly biodegradable, they can be effectively treated with biological wastewater treatment systems. Processing of food from raw materials requires large volumes of high grade water.

The pollution potential of meat-processing is due to dissolved pollutants. Blood, one of the major dissolved pollutants in meat processing wastewater, has a chemical oxygen demand (COD) of 375 000 mg/L (Tritt and Schuchardt 1992).

Wastewater from meat industry also contains high concentrations of suspended solids (SS), including pieces of fat, grease, hair, feathers, flesh, manure, grit, and undigested feed.

These insoluble and slowly biodegradable SS represented 50% of the pollution charge while another 25% originated from colloidal solids (Sayed 1988).

MATERIAL AND METHODS

The research was done in 2009 and 2010. The wastewater samples were collected from milk and a meat processing factories. The monitored food units are placed in Bihor County.

The wastewater from milk and meat processing factories was characterised before treatment at the plant.

The untreated wastewater was sampled after the screening or settling of coarser solids. Screens and primary settling tanks are usually located at the inlet of wastewater treatment areas, and it is difficult to sample before that point.

All samples were analysed in duplicate for COD, BOD, solid content, pH, chlorides, total nitrogen and phosphorus. Analyses were done according to methods outlined in G. D. 188/2002.

RESULTS AND DISCUSSION

In table 1 and 2 are presented the characteristic of wastewater from milk and meat processing factories. Degree of wastewater pollution was expressed according to mean values of pollution indicators: COD, BOD, total suspended solids, pH, chlorides, total nitrogen and total phosphorus.

Table 1

Characteristic of untreated wastewater from milk and dairy products factory

Crt. nr.	Pollution indicators	Unit of measure	Mean values
1	COD	mg/l	10251.2
2	BOD	mg/l	4840.6
3	Total suspended solids	mg/l	5802.6
4	pH	unit. pH	8.34
5	Chlorides	mg/l	616
6	Nitrogen	mg/l	663
7	Phosphorus	mg/l	153.6

Table 2

Characteristic of untreated wastewater from meat products factory

Nr. crt.	Pollution indicators	Unit of measure	Mean values
1	COD	mg/l	1683.6
2	BOD	mg/l	863.4
3	Total suspended solids	mg/l	640.2
4	pH	unit. pH	8.02
5	Chlorides	mg/l	382.6
6	Nitrogen	mg/l	2743.6
7	Phosphorus	mg/l	328.4

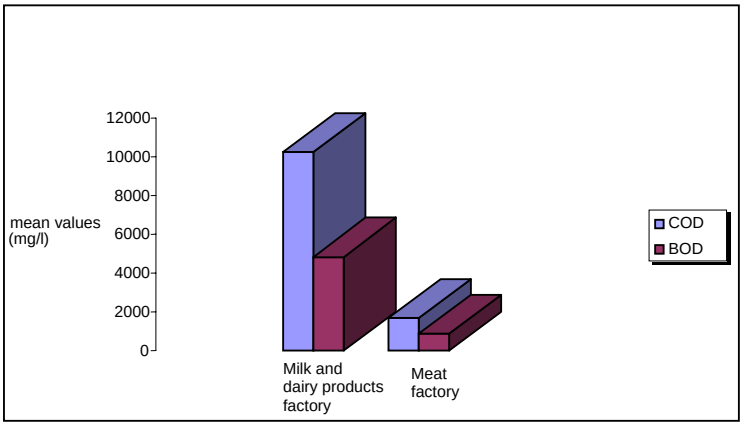

Fig. 1. Comparative analysis of average values of pollution indicators COD and BOD (mg/l) determined in wastewater collected before treatment of the wastewater treatment supply units

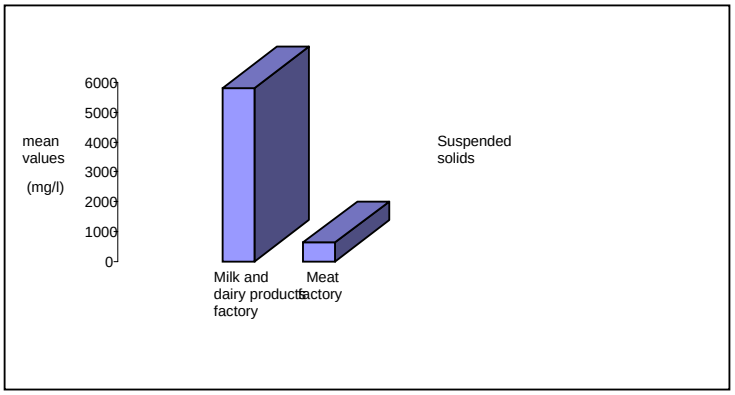

Fig. 2. Comparative analysis of average values of total suspended solids (mg/l) determined in wastewater collected before treatment of the wastewater tratment supply units

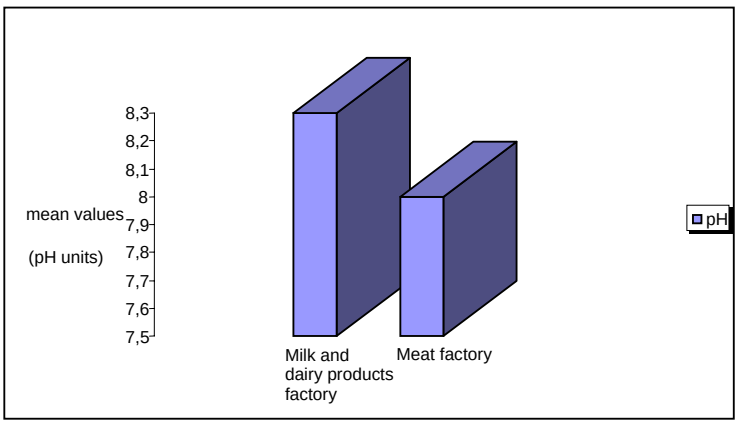

Fig. 3. Comparative analysis of average values of pH determined in wastewater collected before treatment of the wastewater tratment supply units

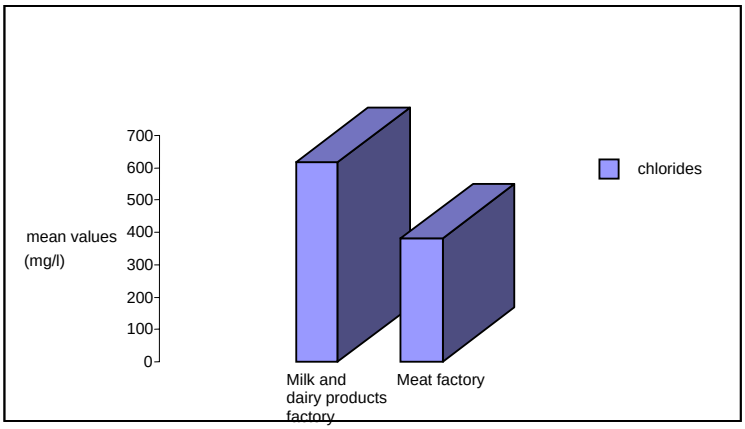

Fig. 4. Comparative analysis of average values of chlorides concentration (mg/l) determined in wastewater collected before treatment of the wastewater tratment supply units

All steps in the dairy chain, including production, processing, packaging, transportation, storage, distribution, and marketing, impact the environment. Owing to the highly diversified nature of this industry, various product processing, handling, and packaging operations create wastes of different quality and quantity, which, if not treated, could lead to increased disposal and severe pollution problems. In general, wastes from the dairy processing industry contain high concentrations of organic material such as proteins, carbohydrates, and lipids, high concentrations of suspended solids, chlorides, or high biological oxygen demand (BOD) and chemical oxygen demand (COD) (fig.1,2,3,4) comparative with the wastewater from meat industry wich contain high nitrogen and phosphorus concentrations (fig. 5,6).

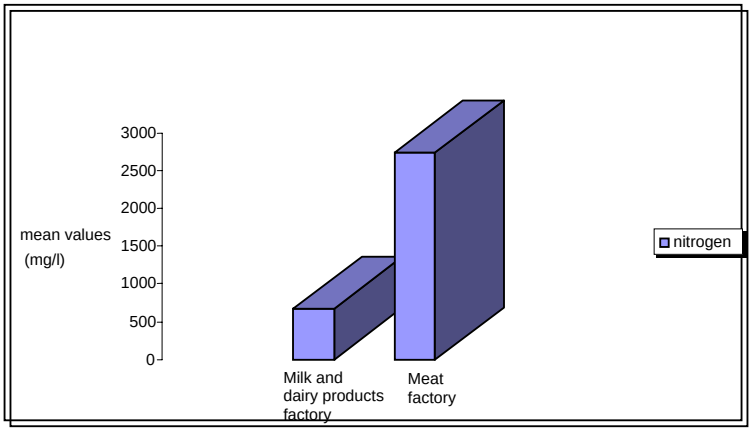

Fig. 5. Comparative analysis of average values of nitrogen concentration (mg/l) determined in wastewater collected before treatment of the wastewater tratment supply units

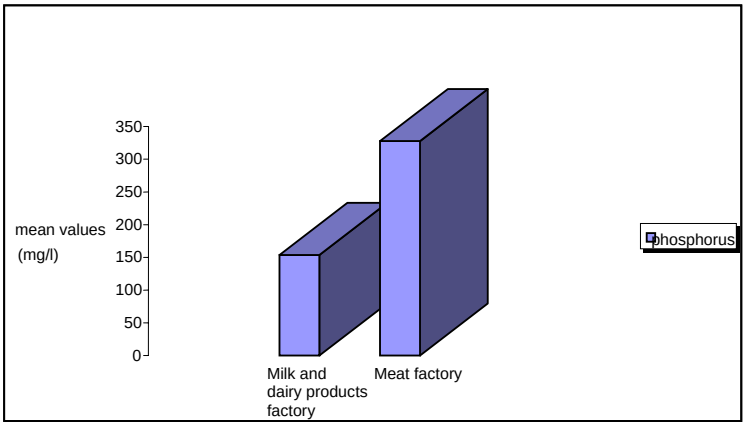

Fig. 6. Comparative analysis of average values of phosphorus concentration (mg/l) determined in wastewater collected before treatment of the wastewater tratment supply units

Phosphorus is a significant part of many food products and so any loss of product into the wastewater will increase the phosphorus concentration. Also, phosphorus is an ingredient in industrial strength cleaners. For example the dairy sector uses phosphoric acid as one step in cleaning pipelines, storage tanks and processing equipment. Best management practices include minimizing product loss to the sewer, choosing a substitute for high phosphorus cleaning chemicals and checking the composition of all processing materials to minimize the lose of those with high phosphorus.

Chloride ions in significant concentrations can be toxic to aquatic life. Chloride ions cannot be removed by any conventional wastewater treatment process. One significant source of chlorides is the waste of sodium chloride from salting the food product. Cheese is salted by spreading salt on the curds or dipping cheese blocks in salt brine tanks. Pollution prevention actions include precise application of salt to the curds, minimizing spills and drips when cheese blocks are lifted out of brine tanks and using brine as long as possible by filtering and sterilizing. High strength salt brine is used in processing cabbage into sauerkraut and cucumbers into pickles. Minimizing spills when moving product in and out of the processing tanks and reuse of brine by filtering and sterilization by heat are recommended practices.

CONCLUSIONS

Wastewater produced by monitored milk and meat processing factories contained high concentrations of degradable organics.

The volume, concentration, and composition of the effluents arising in food industry are dependent on the type of product being processed, the production program, operating methods, design of the processing plant, the degree of water management being applied, and subsequently the amount of water being conserved.

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