Food Science and Quality Management
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.31, 2014

Contribution to the Characterization of Liquid Waste of Poultry Slaughter

LABIOUI Hicham[1*] RHAIT Mohammed[1] Abdelaziz MAQBOUL[2] Rabia Aoujdad[2], Driouich Abdelhak[1] OUHSSINE Mohammed[1]
1. Biotechnology Laboratory, Environment and Quality. Faculty of Science BP 133 14000 Kenitra Morocco
2.Laboratory of Biodiversity and Natural ressources, Faculty of Sciences, Ibn Tofail University, BP 133, 14000 Kenitra, Morocco.
* E-mail of the corresponding author: labioui_h@yahoo.fr

Abstract
Protecting the environment occupies a prominent place in the strategy of many companies of food industry. This concern has led the company to implement a proactive policy aimed at curbing the impact of its industrial activity on the natural environment. The characterization of liquid discharges from slaughterhouses is an essential step to study their environmental impacts.In this regards, abattoir effluents were collected in the laboratory for physico-chemical and microbiological analyze in order to study its impact on the environment.According to the results, we noticed that the pH increases from the first sample to the third to reach a value of 8.02, against the values of COD, BOD5 decrease from the first sample to the_third, also the total nitrogen decreases with a slight variation from the first to the third sampling (from 42.03 to 42 mg /l). This decrease is due to the reduction of microbial load in the effluent resulting from the use of cleaning products. The valuation of this type of waste requires the choice of a suitable ferment, a good knowledge of the physico-chemical and microbiological process.
Keywords: liquid waste of slaughterhouses, characterization, valuation.

INTRODUCTION

The slaughterhouses of poultry meat in Morocco generate big quantities of solid and liquid waste. The discharge of theses dumps without treatment has negative consequences on the environment and the public health.
Water is a vital resource that must be preserved and it is our duty to ensure future generations' access to pure water. Its protection, its enhancement and development of the resource used in accordance with the natural balance are of the general interest. Water pollution, whether of the groundwater, of the river or of the sea, is a direct result of urban, agricultural or industrial discharges.

In fact, food industries produce effluents containing a high organic load when not properly treated, which might result the acceleration of the eutrophication of the watercourse.

To face these expectations; the companies have to integrate the environment in their daily management and placing in anticipation. This strategy also helps to get closer to the concept of sustainable development (Essandoubi et al, 2002).

MATERIALS & METHODS.

Presentation of the study site

Anonymous Society of palm (SAPAK) installed its production units in the city of Mohammedia. It mainly focuses its activities on the processing of halal meats, including poultry, the heart of its business. The group occupies leading position in Morocco thanks to a wide range of products ranging from cutting the processed products. Slaughter is an operation to obtain carcasses and abas, which may be marketed in the state or for further processing. This operation involves different stages.

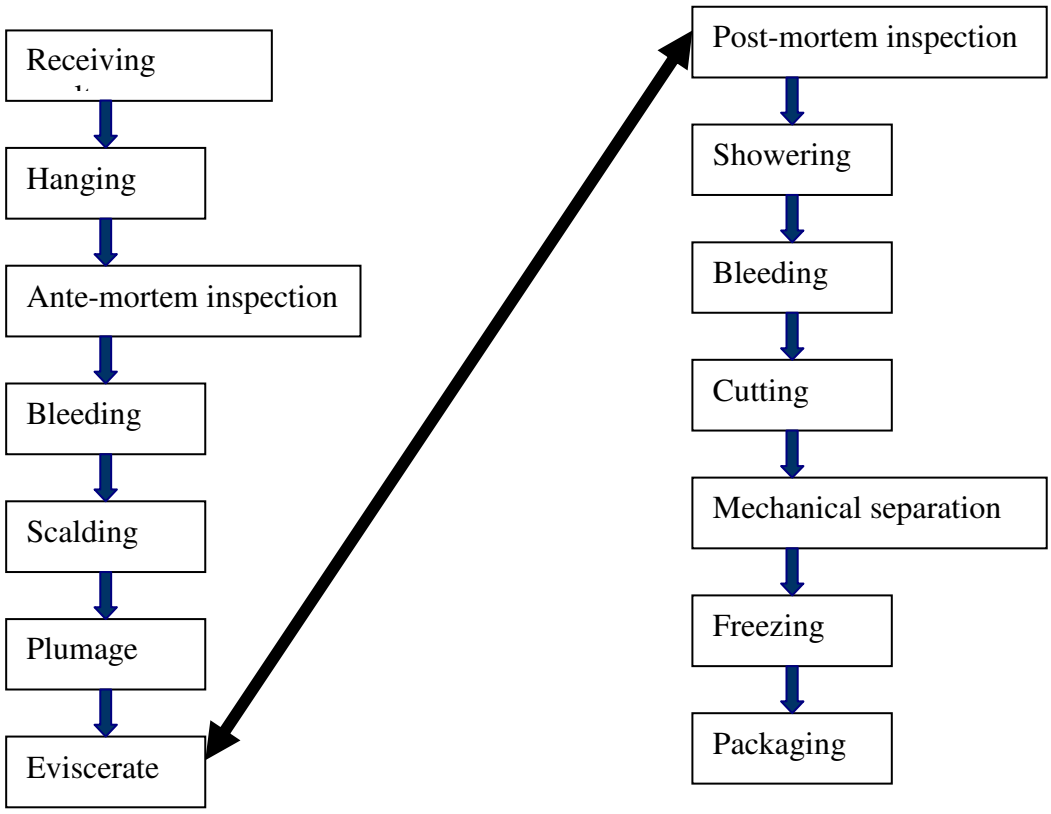


Figure 1: Poultry slaughter process

- waste studied
We worked on liquid discharges: water recovered after washing poultry carcasses, cleaning and disinfection of premises equipment.

- Origin and timing of collection
The first objective of sampling is to obtain representative samples of the element to be analyzed and the sampling value in measurements where samples are repeated periodically. Over a period of 30 days, we were able to do physico-chemical and microbiological analysis for samples taken from liquid discharges of poultry slaughter.

- Sample Preparation
From the homogenized sample, and using a sterile 10ml pipette, 10ml were taken and transferred to a vial containing 90 ml of physiological saline as a diluent.

Physico-chemical analyzes
- pH measurement
The pH was measured using a pH meter Orion-type Reseach Its calibration at pH 4 and 7 is performed before any measurement. The values are taken directly from the display cell.

-Determination of total nitrogen (Kjeldahl method)
After digestion with sulfuric acid in the presence of hot catalyst, the total nitrogen content is determined by Kjeldahl method: ammonium sulphate formed is displaced by a solution of sodium hydroxide. The ammonia released is driven to the water vapor condensed in contact with a condenser and collected in a known quantity and an excess of HCl (0.1N). The excess acid is titrated with a standard solution of NaOH (0.1N).

-Determination of total phosphorus
Total phosphorus is extracted with concentrated nitric acid and assayed by calcimetry brilliant.

-COD measurement

The Chemical Oxygen Demand (COD) is the oxygen consumption by strong chemical oxidants to oxidize organic and mineral water. It allows to assess the pollution load of wastewater.

Assessing the amount of oxygen (mg/l), used by the oxidation reactions, from the measurement of the residue of reactants after 2 h. Oxidation is performed hot, in an acid medium, in the presence of an excess of oxidant. In a tube COD reagents, 2 ml of distilled water, boiling at 150°C for 2 hours, and after cooling we read COD value at the colorimeter.

-Measurement of BOD5

BOD5 Biological Oxygen Demand over 5 days, is the amount of oxygen required by micro-organisms to oxidize (degrade) the total organic matter of a sample of water maintained at 20 ° C, the dark for 5 days. To measure the BOD5, it performs a first measurement of the oxygen concentration in a sample of water. Repeat this action five days later. BOD5 represents the difference between the two concentrations.

-Suspended solids (SS)

Refers to all of the solids in waste water and can be retained by filtration or centrifugation, it is measured in mg / l. The sample is filtered using a filtration device ordinary filter is then dried in an oven, and the mass of the residue in the filter is measured with a precision balance. The mass of suspended solids in mg/L = (mf - mi)*(1/Volume filtered L)

mf: the final mass of the dry filter after filtration to the output of the oven

mi: the initial mass of dry filter

-GermsWanted

Microbiological analysis of slaughterhouse waste is made before and after fermentation to maximize the effectiveness of biological process applied. To do this we counted all floras studied.

-The total aerobic mesophilic flora (FMAT): This plant is a good indicator of the overall contamination of fermented waste. It is enumerated on PCA agar incubated for 24hours at 30°C.

-Coliforms: on lactose agar désoxycolate (DCL) incubated for 24 h at 30°C for total coliforms and 44°C for fecalcoliforms.

-Staphylococci: are enumerated on Baird Parker agar supplemented with egg yolk and potassium tellurite and incubated at 37°C for 48h.

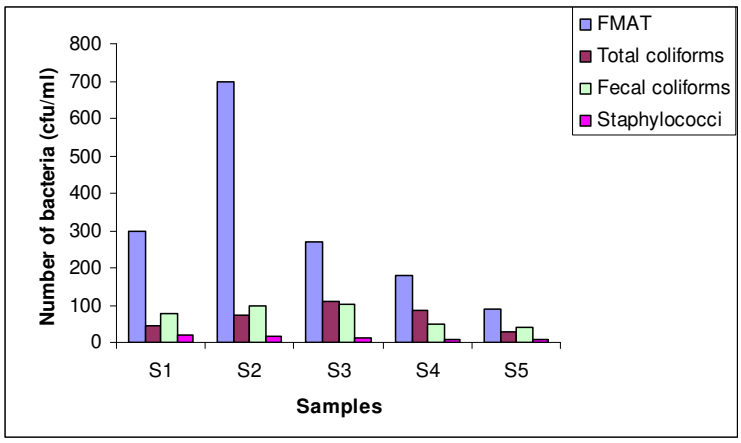
RESULTS

-Results of bacterial contamination

Over a period of 30 days, with a frequency of 5 samples per day, we were able to microbiological analyzes of samples taken, giving, after calculating the average, the results presented in Figure 2.

From data obtained in the figure, we can say that the number of germs in the second sample is very high because of their accumulation, knowing that the slaughter starts at 2 hours in the morning.

The results of the microbial load of the samples shows a charge very abundant pathogens including total and fecal coliforms. Levels recorded are respectively 9.10^4, 8.10^5 and 3.10^5 cfu /ml. Reducing the number of germs in the third sample is due to disinfectants used for washing which starts at 14h.



(S : Sample)

Figure 2: Evolution of the number of cells per sample for 30 days

-Results of physicochemical parameters

With regard to the physico-chemical analyzes, we were able to evaluate the parameters described in our goals, or pH, temperature, COD, BOD5, total phosphorus and total nitrogen.

-pH measurement results

We have also been able to determine the evolution of the pH during the day, with a frequency of three measurements per day, from the figure 2 we see that the pH increases from the first to the third sample that is due to the disinfectant used to washing steps and are often basic.

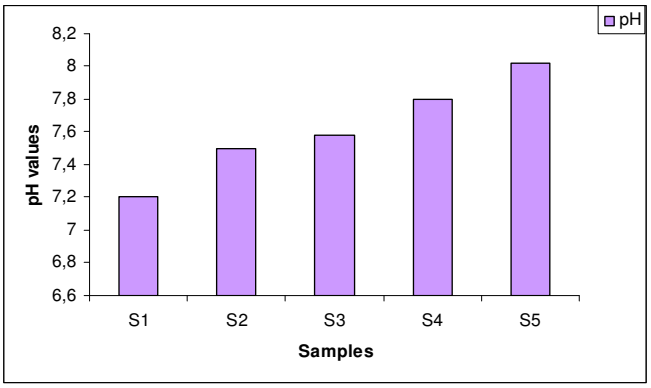


Figure 3: Evolution of pH during the day for the five samples taken

COD measurement results

For the analyzes of COD (Chemical Oxygen Demand), the results are presented in the figure 4 which explain the variation of test results COD during the day for the three samples taken. According to the graph we note that the value of the COD is reduced from the first to the third sample, which explains the reduction of the microbial load in the water.

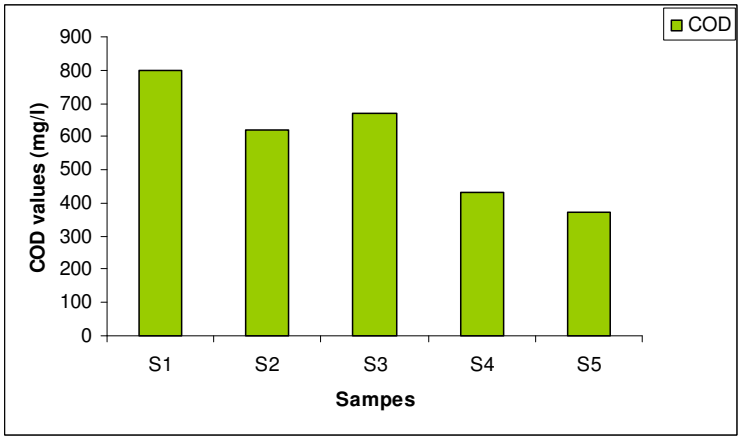


Figure 4: Evolution of COD during the day for the five samples taken

BOD5 measurement results

The values of biochemical oxygen demand decrease from the first to the third sampling, this decrease is due to the reduction of the microbial load in the effluent resulting from the use of cleaning products. Figure 5 shows the values of BOD5 measured.

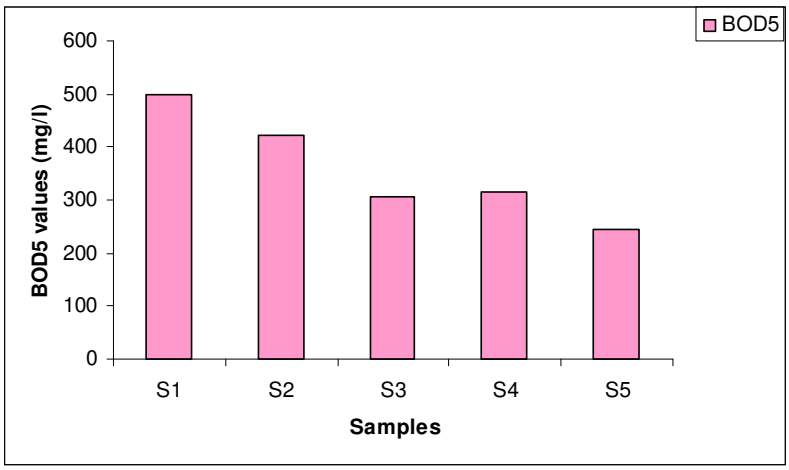


Figure 5: Evolution of BOD5 during the day for the five samples taken

SS Measurement results

Regarding the analysis of the (Suspended solids) we have obtained the values shown in Figure 5.

According to the figure5 we note that there is a drop in the values of suspended matter from the first to the third sampling which explains the reduction of the nutrients (phosphorus) and soil erosion through cleaning (according to standard Lydec <500 mg/l).

The abundance of suspended solids in the water helps to reduce brightness and lower organic production due, in particular, a drop in dissolved oxygen resulting in a reduction of the phenomena of photosynthesis. The mechanical effects of suspended solids are also important (clogging fish gills, reducing the settling and development of plants and invertebrates background, etc ...).

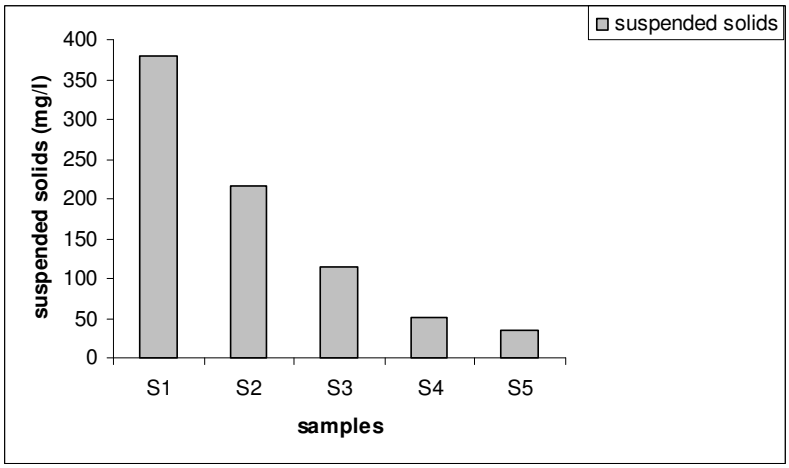


Figure 6: Evolution of Suspended solids during the day for the five samples taken

-

TKN Measurement results

The results shows that the value of total nitrogen also decreases but with a slight variation from the first to the third sampling. The rate of liquefaction is very limited throughout the period of analysis, this is probably due to the total nitrogen content in the raw material and the growth of pathogens was originally inhibition of the proliferation of micro-unwanted organisms.

- Results of total phosphorus

From the results we can say that the rate of total phosphorus in the first sample exceeds the standard. From the figure, we see that the most contaminated sample is first because most of the organic load is spilled during slaughter. The excess organic matter, including phosphate, resulting in increased development of aquatic plants, preventing light penetration and diminishing the concentration of oxygen available to living beings (eutrophication).

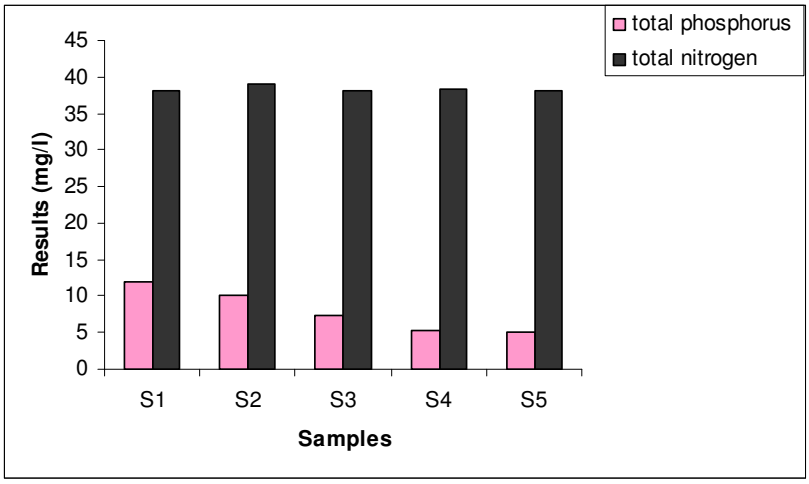


Figure 7: Evolution of total Nitrogen and total Phosphorus for five samples

Discussion

The liquid and solid wastes of poultry slaughterhouses are produced according to the number slaughtered. They are discharged directly into landfills. Therefore they are responsible for the environmental pollution and endanger the public health. The recovery of such wastes is justified for two reasons:

- Relieve storage areas, limit the sources of pollution are becoming increasingly apparent in recent times and protect the population adjacent landfills against the effect of this type of waste (Kherrati et al, 1998; Reuveni et al, 2002).

-Retrieve a rich source of organic matter and other items which might be used in feeding animals or in agriculture (Petersen et al, 2003; Rajeshwari et al, 2000 ; labioui et al, 2007).

According to the results, effluents slaughter does not exceed the standards posed by Lydec for the microbial load and organic matter richness.

We note that liquid waste of the slaughterhouse contain a significant organic load, they are discharged into sewers for pretreatment before being thrown into the sea, this charge is dependent on poultry feed and the environment of slaughter (Laaroussi et al, 2007).

The dry processing is preferable for the by-products of slaughtered poultry, if they are at large enough quantities, as well as gizzards and intestines after removing their content.

The poultry flour has approximately the same value as the big animal's flour. They are used with good results to provide the protein for pigs. These flours, are rich with vitamin choline group, are often incorporated into poultry feed at doses up to 5%. It is a mixture of all waste, composed of about 45% of poultry by-products, 40% of hydrolyzed feathers and 15% of chicken fat. This flour can be incorporated satisfactorily in poultry feed (Bourgois et al, 2007). Moreover, the valorization of these wastes requires a suitable ferment, a good knowledge of their physico-chemical and microbiological characteristics, and a carbon source to promote the biotransformation waste (Laforest et al, 1999; Caixeta, et al, 2002).

Conclusion

The installation of a purification plant is one of the processes necessary for the treatment of the liquid waste before they are discharged into the public network.

Blood collected from the slaughter of poultry, intended for incineration, is rich with protein and can be used for animal feed after its transformation into flour. Whereas solid waste are stored in the public discharge which threatening the environment of neighboring places.

The valuation of solid waste is a cost-effective process for the company and reducing the negative impact on the environment by transforming waste into fertilizer and animal feed.

Each contractor active in processing poultry meat should know the relative importance of its plant as a source of pollution, and what preventive measures can be implemented to minimize environmental impacts (Eljalil et al, 2000).

RÉFÉRENCES

1- Benzakour A, Saissi R, Benzakour M, et Didier G,. Situation actuelle et évolution de la gestion des dechets solides au Maroc. Sciences Enviro. 2004,11(2), 157- 170.

2-Bourgois J., Debray B., Laforest V. Les traitements chimiques et physicochimiques
des déchets", Les Techniques de l'Ingénieur, 2007. Volume G, 127-140.

3- Caixeta, CET; Cammarota, MC; Xavier,. Slaughterhouse wastewater treatment: evaluation of a new three-phase separation system in a UASB reactor 81(1), 2002, pp. 61 – 69.
4- Eljalil. M, Faid. M, Elyachioui. M. Procédé biotechnologique pour le traitement et le recyclage des fientes de volaille et essai de valorisation dans l'alimentation de la poule pondeuse. Thèse de Doctorat National, Université Ibn Tofaïl, Kénitra, Maroc,2000, 86-87.
5- Essandoubi. S, Faid. M , Elyachioui. M, . Caractérisation microbiologique des déchets d'éviscération de volailles. - Rev. Méd. Afr. 2002, 16.
6- Gérard MIQUEL, Serge POIGNANT. Les nouvelles techniques de recyclage et de valorisation des déchets ménagers et des déchets industriels banals. Rapport 415. Office parlementaire d'évaluation des choix scientifiques et technologiques.1999, pp. 21-23.7- Kherrati B, Faid M, Elyachioui M, and Wahmane A. process for recycling slaughterhouses wastes and by-product by fermentation. Bioresource Technology,1998, 63, 75-79.
8- Labioui .H, Elmoualdi .L, Benabbou .Y, Ouhssine .M, Elyachioui .M. . traitement et valorisation des déchets en provenance d'abattoirs au Maroc. Agrosolutions. 2007,18 (1), 35-40.
9- Laforest V., Debray B., Bourgois J. Méthode de réduction des rejets aqueux des ateliers de traitement de surface, Déchets Sciences et Techniques, 1999, n°1, pp 41-45
10- Laarousi Elmoualdi, Hicham Labioui, Mohammed El Yachioui et Mohammed Ouhssine,. Caractérisation, transformation et valorisation de déchets d'éviscération de volaille de Kénitra, 2006, n°2 (1), 102-115.
11- Petersen, S.O., Henriksen, K., Mortensen, G.K., Krogh, P.H., Brandt, K.K., Sørensen, J., Madsen, T., Petersen, J., et Grøn, C.. Recycling of sewage sludge and household compost to arable land: fate and effects of organic contaminants, and impact on soil fertility. Soil Till. Rers. 2003, 72, 139-152.
12- Rajeshwari, KV; Balakrishnan, M; Kansal, A; Lata, K; Kishore. State-of-the-art of anaerobic digestion technology for industrial wastewater treatment, 2000, 4(2), pp. 135 – 156
13- Reuveni, R., Raviv, M., Krasnovsky, A., Freiman, L., Medina, S., Bar, A., et Orion, D.. Compost induces protection against Fusarium oxysporum in sweet basil. Crop Protection, 2002, 21, 583-587.

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:
http://www.iiste.org

CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

Prospective authors of journals can find the submission instruction on the following page: http://www.iiste.org/journals/ All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

MORE RESOURCES

Book publication information: http://www.iiste.org/book/

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar