International Journal of Biotechnology and Microbiology
www.biotechnologyjournals.com
Online ISSN: 2664-7680, Print ISSN: 2664-7672
Received: 17-03-2022, Accepted: 03-04-2022, Published: 18-04-2022
Volume 4, Issue 1, 2022, Page No. 54-61

Evaluation of bacteriological and parasitological quality raw domestic waste water from the city of Conakry (Republic of Guinea)

Daloba Soumah[1], Demba Magassouba[1], Mamby Keita[2], Ansoumane Sakouvogui[3]
[1] Department of Biology, Faculty of Sciences, Gamal Abdel Nasser University of Conakry, Guinea
[2] Department of Physics, Faculty of Sciences, Gamal Abdel Nasser University of Conakry, Guinea
[3] Department of Energy, Higher Institute of Technology of Mamou, Guinea

Abstract
Like the majority of large African cities, Conakry is faced with the problems of wastewater management and the protection of the quality of water resources. This work on the evaluation of the bacteriological and parasitic loads of domestic raw wastewater from Conakry has highlighted the presence of bacteria, such as Salmonella (typhi and spp), faecal Coliforms/Escherichia coli, faecal Streptococci and Parasites in domestic wastewater in the city of Conakry. The bacteriological analysis showed that the loads of faecal coliforms/E.coli (CF) are higher than those of faecal streptococci (SF), with maximum for faecal/E.coli (7×10^5/100ml) in Dabondy in Matam and in Kakimbo in Ratoma and for faecal streptococci (6×10^5/100ml) in Dabondy in Matam, Yimbayah market in Matoto and in Kakimbo in Ratoma. The average bacteriological loads in (UFC/100mL) of the five communes of Conakry are respectively: Kaloum CF (4.80×10^5), S.F (3.60×10^5); Matam CF (5.80×10^5), S.F (4.80×10^5); Matoto CF (4.60×10^5), S.F (4.20×10^5); Ratoma CF (4.75.105), S.F (3.75.105) and Dixinn CF (5.75×10^5), S.F (4×10^5). The average total loads of the city are thus: CF (5×10^5), S.F (4.07×10^5). Qualitative parasitological analysis made it possible to identify eggs and cysts of four types of parasites (Entaboiba histolytica, Ascaris, Pinworms, Fasciola hepatica and Trichuris), with a predominance of eggs of Ascaris sp and Entaboiba histolytica, i.e. 100% each, followed respectively by Pinworm (84%), Trichuris (16%) and Fasciola hepatica (4%). The most contaminated municipalities remain those of Dixinn and Ratoma, followed respectively by Matoto, Matam and Dixinn. The quantitative parasite analysis made it possible to count (eggs/litre) each type of parasite, namely: Ascaris (25.5 eggs/l); Pinworm (4.23 eggs/l); Trichuris (2.4 eggs/l) and Fasciola hepatica (0.2 eggs/l). The microorganisms identified during this research can be the source of a health risk, in particular gastroenteritis, diarrhea, ascariasis, dysentery, hepatitis, typhoid. At the end of this work, we propose carried out a technique of treatment by filtration of the domestic waste water of Conakry, which will be the subject of another article.

Keywords: evaluation, bacteriological, parasitological, domestic wastewater, Conakry

Introduction
The proliferation of wastewater results from the demographic explosion of the population, the defect of the drainage networks and the lack of a treatment station for this wastewater [1]. Water is a precious commodity that is subject to various types of pollution and degradation: ecosystems and human health are directly impacted. The pollution present in the water is of various origins: industrial, domestic or agricultural [2]. Many diseases from which the population suffers are partly linked to the unhealthiness of its living environment, to the insufficient evacuation of domestic and industrial wastewater. The latter have become increasingly enormous in the face of industrial development, economic growth, demographic expansion and the high density of urban areas [3].
In the absence of treatment, this waste water constitutes a growing danger to human health and the natural environment because of their loads of toxic chemical materials and pathogenic micro-organisms (bacteria, viruses, parasites, etc.). They therefore constitute permanent threats to health as well as to human health [4, 5]. According to the World Health Organization (WHO), 80% of the diseases that affect the population of the planet are linked to water pollution. In fact, most of the microorganisms that are the cause of the great historical epidemics of waterborne origin have their normal habitat in the intestines of man and certain warm-blooded animals. This is why the control and monitoring of water quality, particularly waste water, seems increasingly essential [6].
WHO regularly publishes Water Quality Guidelines which many countries use to develop their own national standards. These guidelines represent a scientific assessment of the health risks associated with biological and chemical substances in drinking-water and the effectiveness of the measures deployed to address them [7]. Nowadays, wastewater is frequently reusable in irrigation (fodder crops or market gardening); in industry (cooling circuit, construction, paper mills, textile industries, etc.); in urban areas (firefighting, car and road washing, watering of parks, etc.); in the production of drinking water and for groundwater recharge [8, 9].

Water can therefore act as a vector for potentially dangerous microbiological agents such as salmonella, cholera vibrios and parasites. Contamination can occur through recreational waters (swimming pools, lakes and rivers used for swimming), drinking water from treated surface water, irrigated plants or foods contaminated during their preparation [10]. The Republic of Guinea, described as the "Water Tower" of West Africa, is experiencing serious problems of drinking water supply in households and communities. In 2012, the national drinking water coverage rate was 74% with (92%) in urban areas and (71%) in rural areas. Boreholes accounted for 47% of household drinking water supply. On the other hand, 22% get their water from taps and 16.1% from surface water.

The poor disposal of wastewater and excreta leads to pollution of the soil, air, groundwater and surface water as well as the stagnation of wastewater in certain places with the development of breeding sites [11]. Faced with this situation and within the framework of the health control of waterborne diseases, we proceeded to the evaluation of the bacteriological and parasitological loads of domestic wastewater in the city of Conakry.

Material and Methods

Study zone

This study was carried out in the five communes of Conakry from June 08 to 20, 2021. Twenty five (25) sampling sites were chosen, five (5) of which per commune. Conakry is a port city opened by a wide cornice on the Atlantic Ocean and which today has more than two million inhabitants. This makes it one of the most important African cities with an area of 450 km2. Its climate is June to September, with a minimum rainfall of 3000mm and a maximum of 4300mm. The humidity varies from 69 to 88% and an average annual temperature of 25°C. The city Conakry is located on the narrow peninsula of Kaloum, which stretches into the Atlantic Ocean. It is subdivided into five (5) municipalities which are: Kaloum, Dixinn, Matam, Ratoma and Matoto [12]. The different sampling points are illustrated on the map in Fig. 1.

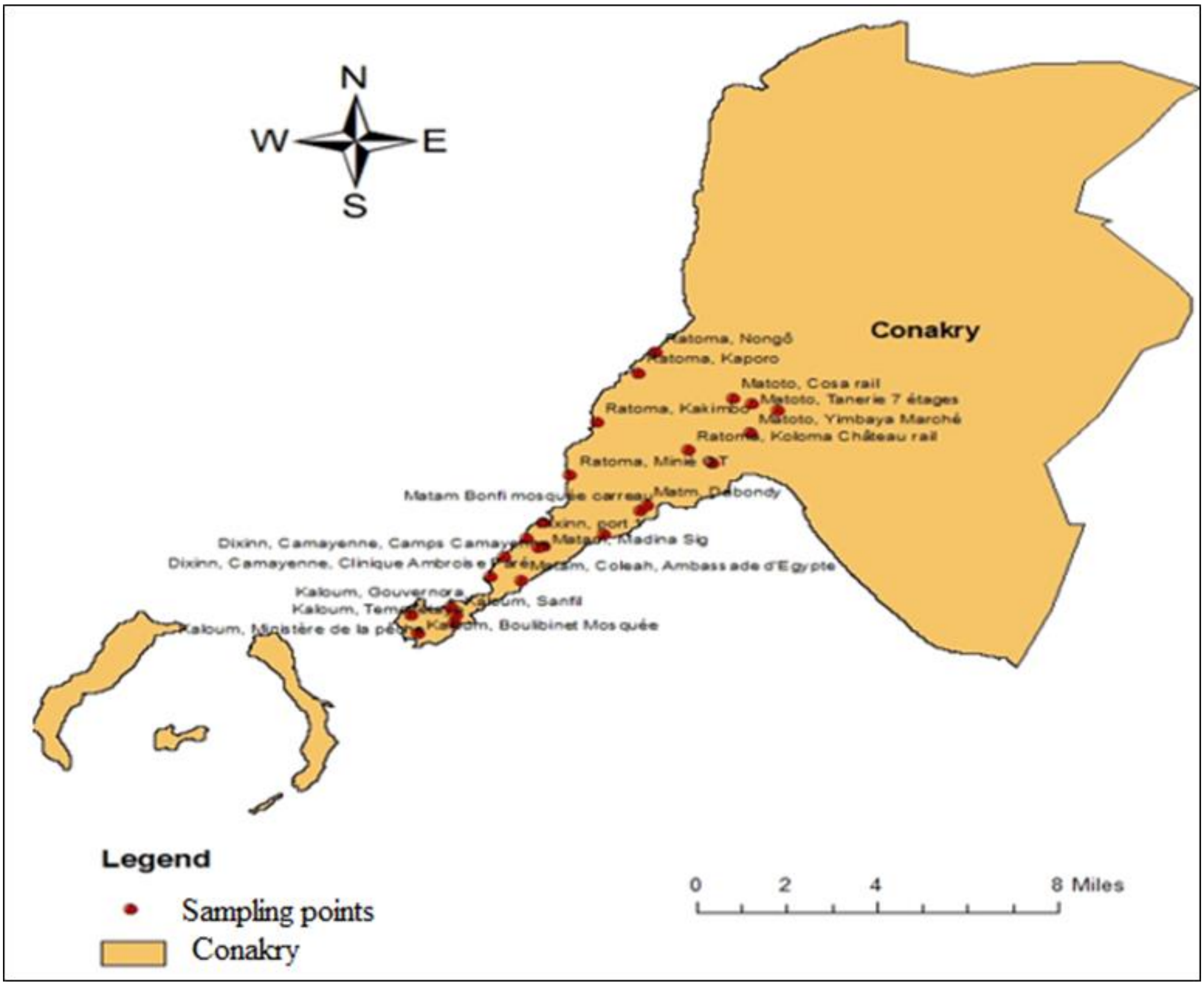

Fig 1: Sampling mapping

Methodology

Sampling

A total of 25 samples, including five (5) per municipality (Kaloum, Dixinn, Matam, Matoto and Ratoma) were taken over two days, June 9 and 10, 2021, from 8:30 a.m. to 5:30 p.m. each day. A volume of (500 ml) of wastewater was sampled at the surface and at depth (30 to 50 cm) depending on the site, in sterile bottles. These samples were taken under rigorous hygienic conditions and packaged in a cooler at +4°C, sent to the Central Veterinary Diagnostic Laboratory for Food Hygiene in Conakry for bacteriological and parasitological analysis.

Analysis of samples

Bacteriological analysis

The bacteriological analysis focused on the search for Salmonella, streptococci and faecal coliforms. The search for Salmonella was carried out according to the ISO 6579 standard, the broth used is SFB (Segmented filamentous bacteria) [13]. A pre-enrichment of a 1/10th dilution of the waste water with buffered peptone water was incubated at 37°C for 16h to 24h. The enrichment was carried out with 0.1ml of the pre-enriched medium in 10ml of the vassiliadis ratio broth, and incubated at 42°C for 18h to 24h. The isolation was carried out on selective medium. It consisted of inoculating the Hektoen agar from the enrichment broth, then incubating at 37°C for 24 hours. Lactose negative colonies with a black center were purified on Hektoen agar and incubated at 37°C for 24 h. The biochemical identification was made in the appi 20E gallery [14]. The method of research and enumeration of faecal Streptococci (FS) used is similar to that of colimetry in liquid media. The count results for faecal streptococci are expressed like those for Escherichia coli and coliform as the number of germs per 100 ml [15]. For the search for Faecal Coliforms (F.C.), the MacKenzie test is applied. In the most probable count (MPN) method (NF T 90-413, 1985), from each positive tube on lactose broth with BCPL at double or single concentration, a tube of Schubert medium fitted with a bell is inoculated. from Durham and incubate at 44°C for 48 hours [16].

Parasitological analysis

This parasitological analysis is done qualitatively and quantitatively. Macroscopic analysis was carried out systematically before any microscopic examination of wastewater. It consisted of evaluating the quality of the sample and looking for the presence of parasitic elements with the naked eye. All this of course only applies to parasitic elements having a sufficient size to be distinguished (of the order of a millimeter). Macroscopic parasitic elements were visible. Those that were not visible, we had to research after sieving on a sieve with a mesh of about one millimeter and centrifugation of the waste water, the pellet obtained was deposited between the slide and coverslip and observed under the microscope. This technique allowed us to highlight the larval forms of certain parasites: Ascaris, strongyles and pinworms. The parasitological analysis by the method of Mac Master of wastewater was carried out according to the Bailenger technique recommended by the WHO[17, 18]. The results of the parasitological analysis are expressed using the formula proposed by the WHO (1997): (N = AX/PV). With, A: number of eggs counted on the Mac Master slide or average of numbers found on 2 or 3 slides; X: volume of the final product (ml); P: capacity of the slide of Mac Master (0.3 ml); V: Volume of the initial wastewater sample to be analyzed[19]. The photos in Figure 2 show some of the steps in this experimental study.

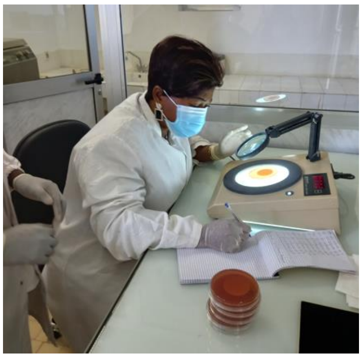

Photo 1: Contamination of streptococcus colonies

Photo 2: Casting of faecal coliform culture medium

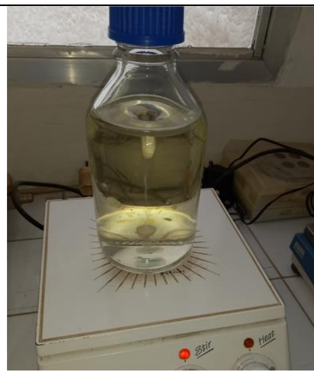

Photo 3: Preparation of culture medium

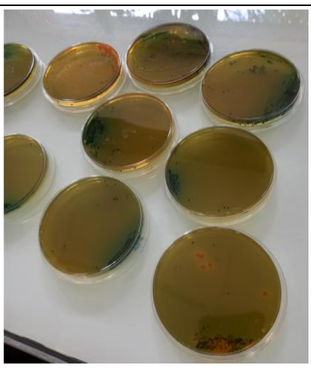

Photo 4: Faecal coliform colonies

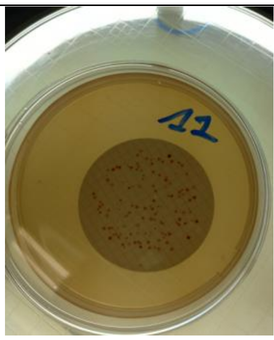

Photo 5: Colonies of faecal streptococci

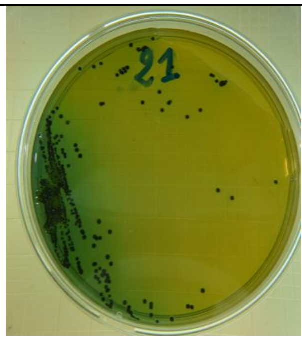

Photo 6: Colonies of salmonella a

Fig 2: Stages of the experimental study

Results and Discussion

Results

The results of the bacteriological and parasitological analyzes of the samples of domestic wastewater from the five municipalities of the city of Conakry are shown in Tables 2 and 3.

Table 2: Bacteriological analyzes

Locality	Sample	C.F/100ml	S.F/100ml	Salmonella/100ml
Kaloum	Boulbinet Mosquée	4.10^5	2.10^5	S. spp
	Temenètaye	3.10^5	2.10^5	S. typhi
	Sanfil	5.10^5	4.10^5	
	Gouvernorat	6.10^5	5.10^5	S. spp
	Ministère de la pêche	6.10^5	5.10^5	S. typhi
Matam	Coleah A/Egypte	6.10^5	5.10^5	
	Madina Sig	6.10^5	5.10^5	
	Matam Lido corniche	5.10^5	4.10^5	
	Bonfi Mosquée	5.10^5	4.10^5	S. spp
	Dabondy	7.10^5	6.10^5	S. typhi
Matota	Aéroport Camp carrefour	6.10^5	5.10^5	
	Yimbaya marché	4.10^5	6.10^5	
	Tannerie Bas-fond	4.10^5	3.10^5	S. spp
	Tannerie sept étage	4.10^5	3.10^5	S. typhi
	Cosa rail	5.10^5	4.10^5	
Ratoma	Coloma1 château rail	6.10^5	5.10^5	
	Nongo	2.10^6	1.10^6	
	Kaporo port	5.10^5	4.10^5	
	Kakimbo	7.10^5	6.10^5	
	Minière GT	5.10^5	4.10^5	
Dixinn	Dixinn port 3	5.10^5	4.10^5	
	Millenium	6.10^5	5.10^5	
	Camp Camayenne	4.10^5	3.10^5	
	Université Gamal	6.10^5	5.10^5	
	Clinique Ambroise	4.10^5	3.10^5	S. spp

Table 3: Parasitological analysis

Locality	Sample	Entaboiba histolytica	Ascaris	Oxyure	Fasciola hepatica	Trichuris
Kaloum	Boulbinet Mosquée	+	+	+	-	+
	Temenètaye	+	+	+	-	-
	Sanfil	+	+	+	-	-
	Gouvernorat	+	+	+	-	-
	Ministère de la pêche	+	+	-	-	-
Matam	Coleah A/Egypte	+	+	-	-	+
	Madina Sig	+	+	+	-	-
	Matam Lido corniche	+	+	+	-	-
	Bonfi Mosquée	+	+	+	-	-
	Dabondy	+	+	+	-	+
Matoto	Aeroport Camp carrefour	+	+	+	-	-
	Yimbayah marché	+	+	-	-	-
	Tanerie Bas-fond	+	+	+	-	-
	Tanerie septétage	+	+	+	-	-
	Cosa rail	+	+	+	-	-
Ratoma	Coloma1 château rail	+	+	+	-	-
	Nongo	+	+	+	-	-
	Kaporo port	+	+	+	-	-
	Kakimbo	+	+	+	+	-
	Minière GT	+	+	+	-	+
Dixinn	Dixinn port 3	+	+	+	-	-
	Millenium	+	+	-	-	-
	Camp Camayenne	+	+	+	-	-
	Université Gamal	+	+	+	-	-
	Clinique Ambroise	+	+	+	-	-

The diagrams in Figures 3 and 4 illustrate the bacteriological loads per domestic wastewater sampling site in the different municipalities of Conakry.

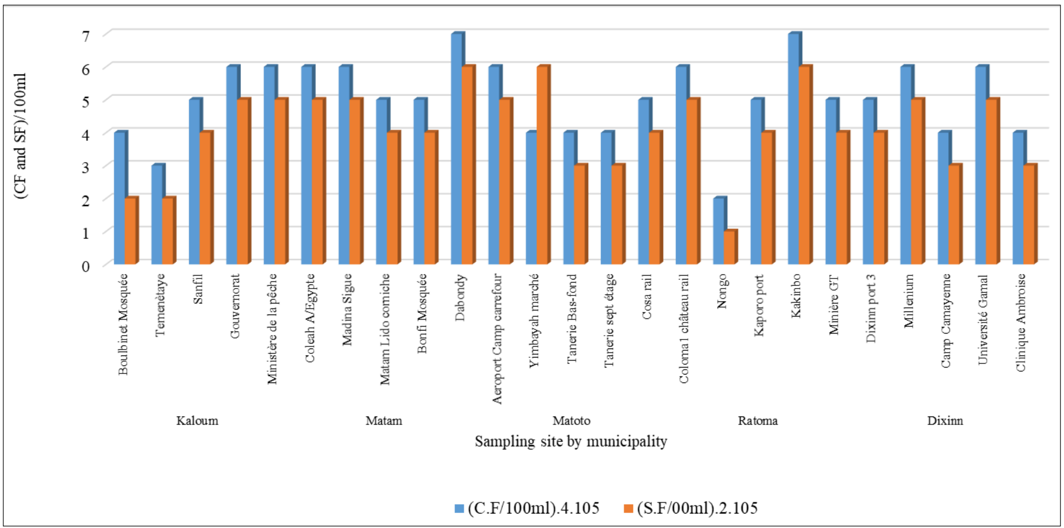

Fig 3: Bacteriological loads by sampling site

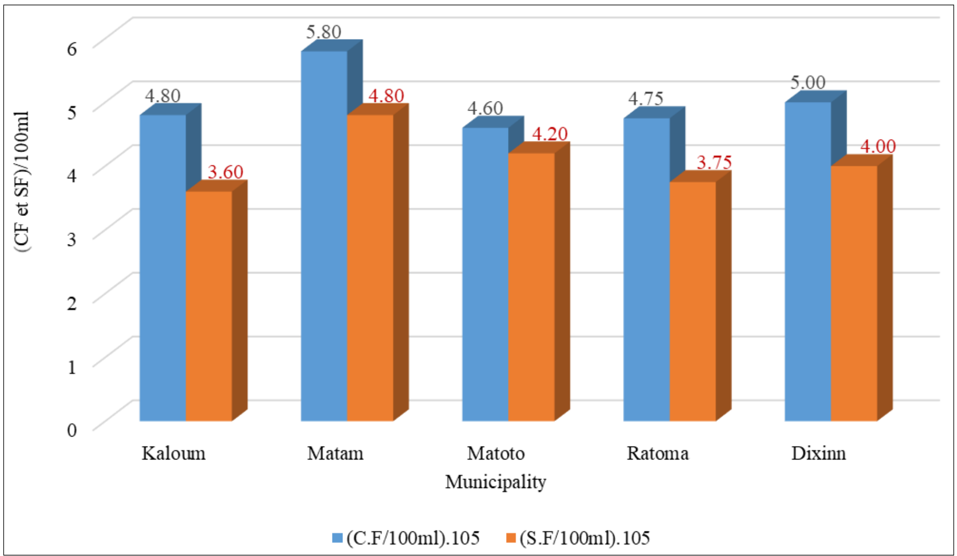

Fig 4: Average bacteriological loads per municipality

The diagrams in Figures 5, 6 and 7 illustrate the contamination rates by parasite type, by municipality and their count.

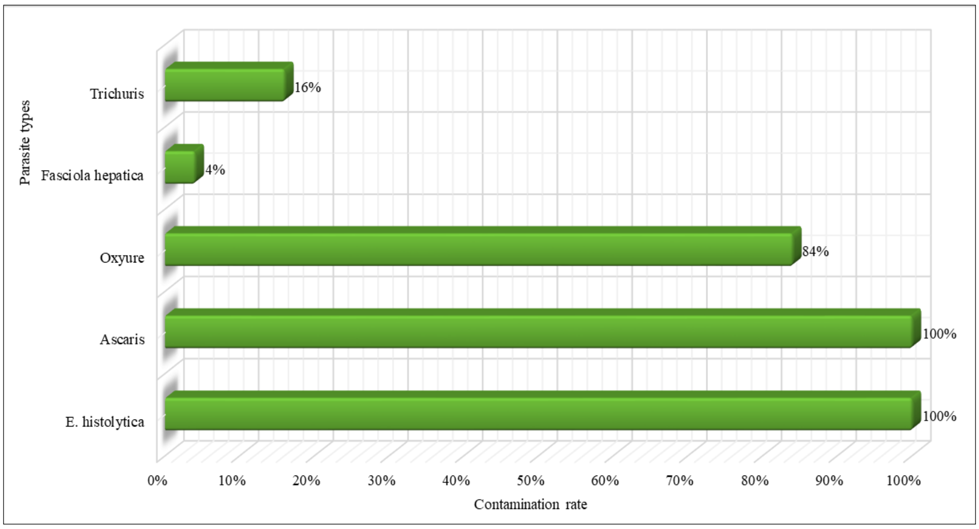

Fig 5: Contamination rate by parasite type

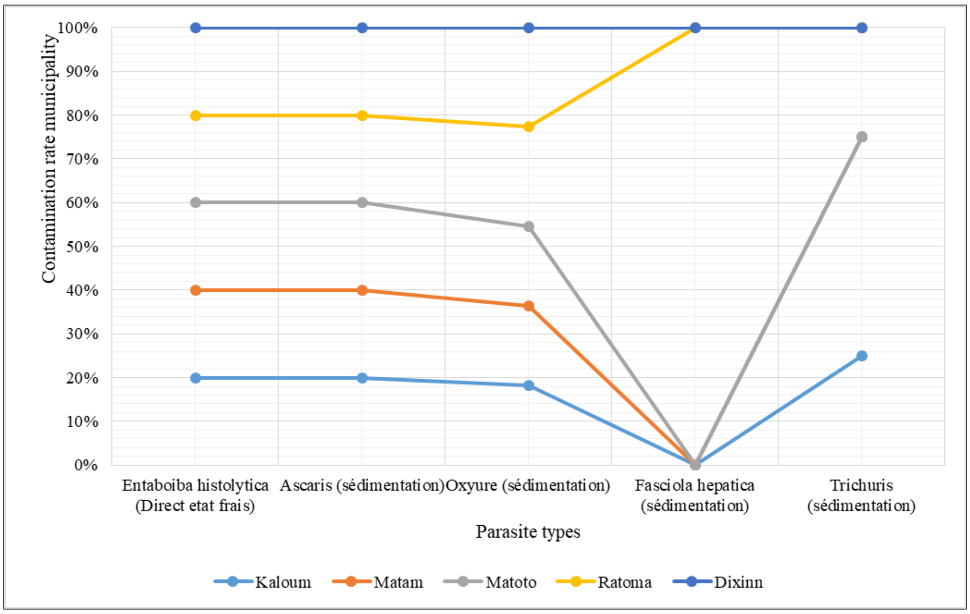

Fig 6: Parasite contamination rate by municipality

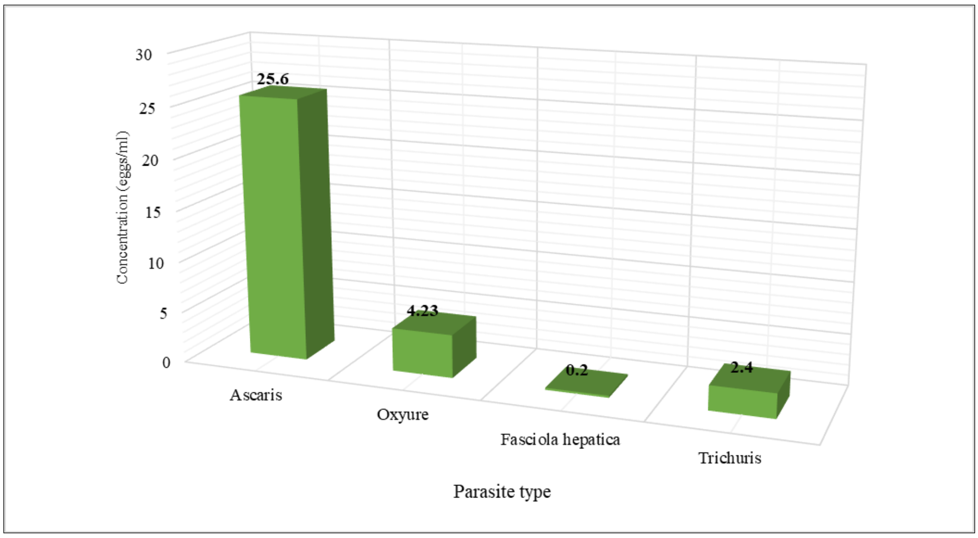

Fig 7: Parasite count

Discussions

The results of bacteriological analyzes of twenty-five (25) samples of domestic wastewater from the city show the presence of faecal coliforms/E.coli (CF), faecal streptococci (SF) and salmonella in all samples at different loads. The diagrams in Figures 3 and 4 respectively show the bacteriological loads by sampling site and by municipality.

The faecal coliform/E.coli (CF) loads are higher than those of faecal streptococci (SF), with maximum for faecal/E.coli (7×10^5/100ml) in Dabondy in Matam and Kakimbo in Ratoma and for faecal streptococci (6.105/100ml) at Dabondy in Matam, Yimbaya market in Matoto and at Kakimbo in Ratoma (figure 3).

The average bacteriological loads in (UFC/100mL) of the five municipalities of Conakry (figure 4) are respectively: Kaloum CF (4.80×10^5), S.F (3.60×10^5); Matam CF (5.80×10^5), S.F (4.80×10^5); Matoto CF (4.60×10^5), S.F (4.20×10^5); Ratoma CF (4.75×10^5), S.F (3.75×10^5) and Dixinn CF (5.75×10^5), S.F (4×10^5). The average total loads of the city are thus: CF (5.105), S.F (4.07×10^5). These results show that the domestic wastewater of the commune of Matam is the most polluted, cala this justifies by the presence of the large market of Guinea Madina in this commune. Similarly, all wastewater from the five municipalities of Conakry is of very poor quality with bacteria levels above 103 CFU/100 ml set by WHO guidelines (1989) for the discharge of wastewater without risk into the environment.

Also, according to some authors, the bacteriological loads of Conakry are lower than those of certain cities in African countries such as: Morocco, Tunisia, Benin, Ivory Coast). They presented loads varying between 10^6 germs/100mL and 2.6×10^8 germs/100ml [20, 21]. The rainy season during which this work was carried out could also be responsible for this low rate of contamination with a dilution effect on environmental microbial loads and could result in an underestimation of bacterial loads [13].

The high density of CF/E. coli, the most specific indicator bacterium of faecal pollution, in the water analyzed, clearly indicates their contamination by faecal germs and therefore the potential epidemiological risk represented by their discharge without treatment [13]. In addition, wastewater is considered the optimal medium for microbial proliferation [22]. The results of the parasitological analysis of wastewater from Conakry showed the presence in all the samples of parasites at very varied concentrations depending on the site.

Qualitative analysis identified four types of parasites (Entaboiba histolytica, Ascaris, Pinworm, Fasciola hepatica and Trichuris), with a predominance of Ascaris sp and Entaboiba histolytica eggs, i.e. 100% each, followed respectively by Pinworm (84%), Trichuris (16%), with the lowest in Fasciola hepatica, 4% (Fig. 5).

The most contaminated municipalities remain those of Dixinn and Ratoma, followed respectively by Matoto, Matam and Dixinn (Fig. 6). These contamination rates depend on the socio-economic living conditions of the population of the area. These data reveal faecal pollution conveyed by these raw effluents.

The quantitative analysis made it possible to count (eggs/litre) each of the type of parasite (Fig. 7), ie: Ascaris (25.5 eggs/l); Pinworm (4.23 eggs/l); Trichuris (2.4 eggs/l); and Fasciola hepatica (0.2 eggs/l). The sources of contamination of these effluents are generally of human and animal origin [23]. These contamination rates can vary from one season to another, depending on climatic conditions (temperature, humidity, oxygen and solar radiation) [24].

Conclusion

Water can therefore act as a vector for potentially dangerous microbiological agents such as salmonella, colibacillosis and streptococci. The reuse of wastewater without any prior treatment leads to potential health risks since it is rich in pathogenic microorganisms, the larvae and eggs of parasites. Monitoring the evolution of microbiological and parasitic pollution of domestic wastewater in the city of Conakry showed the presence of salmonella, faecal coliforms/E coli, faecal streptococci in terms of bacteria. The parasitological study proved the presence of parasites: Entamoeba Histolytica, Ascaris eggs in all samples. Pinworm and Trichuris were found in a few samples. As for Fasciola hepatica, we noted the absence in all the samples analyzed. The analyzed wastewater is not recommended for use in any activity without prior treatment.

References

1. Alhassane Diami Diallo, Mafory Bangoura, Cellou Kante, Mamadou Bailo Diallo. Ansoumane Sakouvogui Physicochemical and Microbiological Characterization of the Singuedala River at Mamou (Republic of Guinea), IJESC,2019:9(5):21855-21858.
2. Bassom Pierre Cindy, Procédé à boues activées pour le traitement d’effluents papetiers: de la conception d'un pilote a la validation de modèles, Thèse de doctorat de l’Institut National Polytechnique De Grenoble, 2007, 25-42.
3. Camara T. Etude de la qualité physico-chimique et bactériologique des sources d’approvisionnement en eau dans la ville de Conakry. Thèse de doctorat, Université Gamal Abdel Nasser de Conakry, 2017, 298.
4. Daloba S, Mangué S, Dr. Ansoumane S, Mamby K. Determination of the microbiological characteristics of the fecal sludge of the city of Conakry, World Journal of Advance Healthcare Research,2019:3(4):109-112.
5. El Ouali Lalami, Zanibou A, Bekhti K, Zerrouq F, Merzouki M. Contrôle de la qualité microbiologique des eaux usées domestiques et industrielles de la ville de Fès au Maroc (Microbiological Control wastewater domestic and industrial city of Fes Morocco), J. Mater. Environ. Sci,2014:5(S1):2325-2332.
6. Organisation Mondiale de la Santé (OMS). Guidelines for drinking-water quality. Vol.1. Recommandations, 3rd, Ed. World Health Organization. Geneva, 2004.
7. Taleb.S. Professeur« confrontation des normes algériennes des eaux potables aux directives de l’organisation mondiale de la santé (OMS) ». Laboratoire de chimie analytique appliquée-faculté des sciences-université d. liabes- sidi bel-abbès, Algérie.
8. Erwan Carré, Qualité biologique des eaux usées traitées en vue de la réutilisation, Thèse de doctorat de l’Université de Lyon, 2017, 359.
9. Afssa. Réutilisation des eaux usées traitées pour l’arrosage ou l’irrigation. Agence française de sécurité sanitaire des aliments, Saisine n°2001-SA-0075, 2008.
10. Bain R, Bartram J, Elliott M, Matthews R, McMahan L, Tung R *et al*. A summary catalogue of microbial drinking water tests for low andmedium resource settings. International Journal of Environmental Research and Public Health,2012:9(5):1609-25.
11. Rapport du Ministère de la Santé et de l’Hygiène Publique, Publique, Stratégie Nationale de l’Hygiène Publique 2014 - 2018, Direction Nationale de l’Hygiène de la République de Guinée, 2018, 40.
12. Daloba Soumah, Aboubacar Oumar Bangoura, Ansoumane Sakouvogui and Alhassane Diami Diallo, Comparative study of the physicochemical characteristics of the sludge from the city of Conakry, World Journal of Pharmaceutical and Life Science, 2020, 373- 377.
13. Rodier J, Legube B, Merlet N, Brunet R et coll, Analyse de l'eau. Eaux naturelles, eaux résiduaires, eaux de mer. Dunod, 9ème éd. Paris, 2009, 945-1020, 1113, 1411, 1579.
14. Garcia-Armisen, T. and Servais, P., Enumeration of viable *E. coli* in rivers and wastewaters by fluorescent in situ hybridization. Journal of Microbiological Methods,2004:58:269-279.
15. Rodier J, Legube B, Merlet N. L’analyse de l’eau - 10e édition. Malakoff.

16. Dunod. Labres. E et Mouffok F. Le cours national d'hygiène et de microbiologie des eaux de boisson. Manuel des travaux pratique des eaux. Institut Pasteur d'Algérie, 2016, 53.