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DETERMINATION OF THE MICROBIOLOGICAL CHARACTERISTICS OF THE FECAL SLUDGE OF THE CITY OF CONAKRY

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ABSTRACT

In Conakry, as in most major cities in sub-Saharan Africa, there is very little sewage system. Autonomous drainage works are the most commonly used. These structures produce sludge that must be properly drained and treated in order to preserve the health of the population and protect the environment. The risks associated with the use of fresh fecal sludge in agriculture, in addition to the potential hazards of their untreated discharges into the wild, are potential hazards to human health. The objective of this study is to determine the bacteriological characteristics of the fecal sludge in the city of Conakry in order to make a choice among alternative technologies of treatment. To achieve this objective, a sampling and characterization of fecal sludge from the different municipalities of Conakry were carried out. Thus, the main results obtained indicate that: The concentrations in Fecal Coliforms per 100 ml of BV are: Matoto (15×10^5/100ml), Ratoma (14.9×10^5/100ml), Dixinn (13.2×10^5/100ml), Kaloum (1, 12.10^5/100ml) and Matam (0.44×10^5/100 ml). The parasitological qualities show the presence of eggs of certain parasites, which are: Toxoplasmagondii, Taenia saginata, Taenia solium, Ascaris lumbricoides, Duodenal hookworm, Trichocephalic trichiura, Larvae and Mansoni.

KEYWORDS: Determination, characteristics, Sludge, bacteriological, parasites.

INTRODUCTION

According to the World Health Organization (WHO), there are 2.6 billion people in the world who do not have access to adequate sanitation systems and nearly 1.1 billion people continue to defecate in the open air.[1] For developing countries in particular, a United Nations report on the Millennium Development Goals (MDGs) estimated in 2008 that almost a quarter of the population in developing countries did not have a system of education. while 15% used unsuitable sanitary facilities. In addition, the open defecation practiced by the majority of the population endangers the entire community, given the increased risk of contracting diarrheal diseases, cholera, worm infestations, hepatitis and other related diseases.[2]

In West Africa, there are initiatives in some countries, such as Burkina Faso, Ghana, Senegal, Côte d'Ivoire, Mali and Guinea, dealing with the fecal sludge treatment system. These systems consist of extensive or low-cost technologies that are either used separately or in combination with others. These are: sedimentation / thickening ponds, co-composting with solid waste, drying beds, anaerobic digestion with biogas production, decanter-digester etc.[3,4]

In Conakry, in the context of sanitation only, since then, thanks to the support of the World Bank and Canada, there have been two (2) manure disposal sites for manure in Sonfonia and Yimbaya. But these sites are almost not used because of the transport costs too high for the population. As a result, the small amount of sludge collected does not allow the elimination of bacteria and viruses by the heat of composting and thus compost production for agriculture.[5]

However, a large quantity of fecal sludge from individual sanitation works is produced in Conakry. These fecal sludges contain pathogenic microorganisms, which are fecal coliforms and total coliforms, helminth eggs and protozoan cysts.

The general objective of this study is to determine the bacteriological characteristics of the fecal sludge of the city of Conakry. The specific objectives are as follows: to make the parasitological analyzes of the samples of the fecal sludge of the city of Conakry, to make a comparison between the parasitological parameters of the different municipalities of the city of Conakry, to define the causes of the variation of these parameters according to of the different communes of Conakry.

MATERIALS AND METHODS OF WORK

Presentation of the site

Conakry is a port city opened by a broad ledge on the Atlantic Ocean and which today has more than 2 million inhabitants. This makes it one of the most important African cities with an area of 308 km2, a length of 34 km and a width of 1 to 6 km. Located in West Africa, Guinea is open on the Atlantic Ocean, bordered on the south by Liberia and Sierra Leone, on the north by Senegal and Guinea-Bissau, on the east by Mali and Côte d'Ivoire.[6]

Its climate is of sub-Guinean tropical type, characterized by the alternation of two (2) seasons, dry from October to May and humid or rainy from June to September. The local microclimate due to the influence of the ocean that brings the monsoon and sea breezes is responsible for a plentiful rainfall: with a minimum of 3000 mm and a maximum of 4300mm. The humidity of the air varies from 69 to 88%. The average annual minimum temperature is 23°C with a very low thermal amplitude, the maximum is around 32°C.[6]

The city Conakry is located on the narrow peninsula of Kaloum, which stretches in the Atlantic Ocean. Off the coast, the islands of Loos are known for their beaches, dense palm forests and water sports that can be practiced there. It is subdivided into five (5) communes which are: Kaloum, Dixinn, Matam, Ratoma and Matoto. Each commune is divided into neighborhoods and neighborhoods into sectors. All the communes are characterized by insalubrity materialized by piles of garbage, the frequent stagnation of wastewater.[6] Figure 1 shows the sampling points in the city of Conakry.

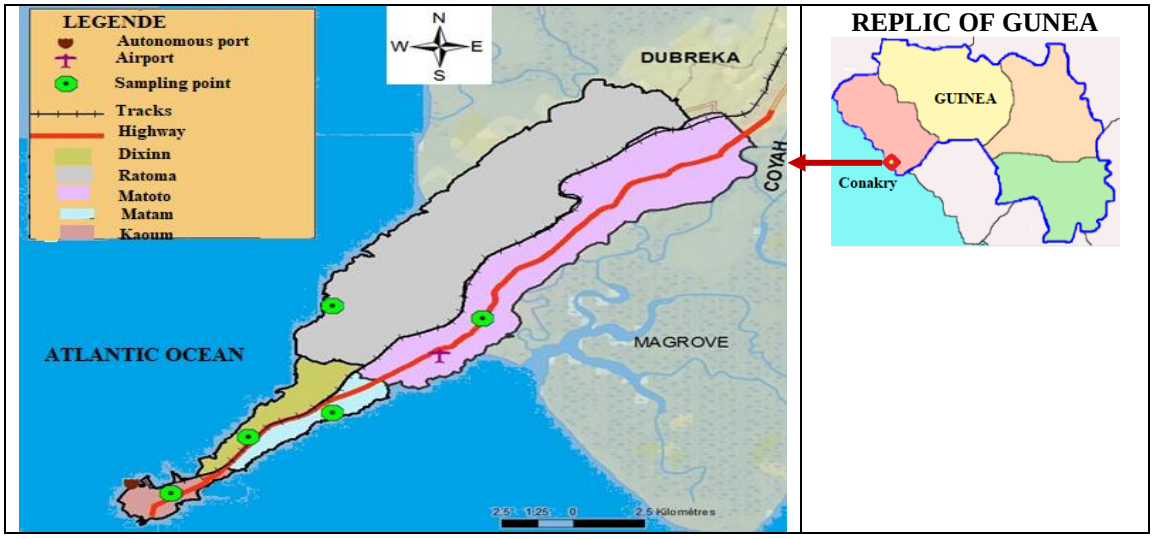

Figure 1: Map of the city of Conakry.

Equipment

As part of this study, two (2) types of equipment (reagents and equipment) were used. We can mention among others.

Reagents: zinc sulphate solution, ether or ethyl acetate, acetoacetic buffer, detergent solution and filter membranes.

Equipment: plastic containers for sample collection, an adjustable centrifuge, centrifuge tubes with a lid, pipettes, McMaster blades, vibratory shaker, hand pump or siphon, test tube or pipette graduated, a thermometer, an oven, sterile collectors, filter membrane clamp, petri dishes, incubator, autoclave or pressure cooker and scale.

METHODS

Sampling

Fecal sludge samples were taken from the five (5) communes of the city of Conakry, namely: Kaloum, in the Coronthy district at the civil prison (central house); Matam, in the district of Madina Market; Ratoma at Kipe Slaughterhouse; Dixinn, in the Bloc Block of Teachers; Matoto, in the Yimbaya district behind the market (Figure 1).

Samples were taken in sterile collectors and placed in coolers on 19/07/2017 and then transported to the laboratories for analysis.

Sample analysis techniques

Parasitological analyzes of the samples were carried out in the Parasitology Laboratory of Ignace DEEN Hospital

in Conakry. The microbiological analyzes of the samples were carried out at the Central Veterinary Laboratory for Diagnosis of Food Hygiene in Conakry.

For Fecal Coliforms (CF), the method is based on the search and enumeration of bacterial colonies by the membrane filtration technique and inoculation into appropriate culture media (Chromocult Agar Specific Agar for CF) followed by incubation at the appropriate temperature for 18 to 24 h.[7] This method complies with the French standard NF EN ISO 9308-1, September 2000.

Parasitological analyzes are performed using the Beilenger technique and the Direct Examination method.[8] This analysis involved 5g of fresh dung sample, the parasite egg concentration is based on the principle of the flotation method in the presence of zinc sulphate (ZnSO4: 56.81%) after dispersion of the particles by ammonium bicarbonate (11.9%).[9,10] Identification of parasite eggs was done at 400 magnification using a 0.3-ml Mac Master slide.

RESULTS AND DISCUSSIONS

The results obtained during this study are illustrated respectively in tables 1, 2 and in the diagram of figure 1.

Table 1: Fecal Coliforms (CF).

Communes	Matam	Matoto	Dixinn	Kaloum	Ratoma
CF/100**ml**	$>150\times10^4$	44×10^3	132×10^4	112×10^3	45×10^3

The diagram in figure 1 shows the concentration of fecal sludge in the different municipalities of the city of Conakry in fecal coliforms (CF).

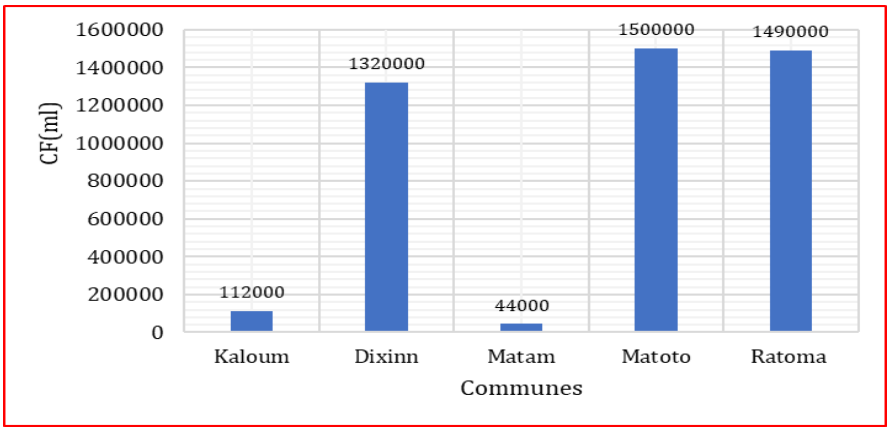

Figure 2: Fecal Coliform Fecal Concentrations

Table 2: Parasitological parameters of the five (5) communes of the city of Conakry.

Class of parasites	Parasites	Matam	Matoto	Dixinn	Kaloum	Ratoma
Protozoa	Toxoplasma gondii	+	+	+	+	++
Cestodes	Taenia saginata	+	+			
	Taenia solium	+	+	+	+	+
Helminth	Ascaris lumbricoides	+	+	+	+	+
	Ancylostomiases duodenale	+			+	+
	Trichocephalic trichiura	+	+	+	+	+
	Angelfish larvae	+				
Trematodes	Mansoni					+

DISCUSSION OF RESULTS

Microbiological parameters

The microbiological qualities (fecal coliforms or bacteria) of the fecal sludge of the municipalities of the city of Conakry, analyzed reveals bacterium concentrations in the order of (15.10^5/100ml) for Matoto, (14.9×10^5/100ml) for Ratoma and (13.2×10^5/100ml) for Dixinn, these results are much superior to those of Kaloum ($1,12,10^5$/100ml) and Matam (0.44×10^5/100ml). The results of Matoto, Ratoma, Dixinn and Kaloum are higher than that reported by Diallo B.D., 2015.[5] (0.75834×10^5/100ml). On the other hand, all our results are lower than those reported by Tadjouwa K., 2016.[11] being (3.6×10^8/100ml) in Dakar and (from 2.2×10^9 to 1×10^{13}/100ml) in Amman. They are also superior to the results of (Martine K., et al., 2016) or 3.2×10^5/100ml in Ouagadougou.[5] These results represent an indicator of fecal sludge pollution in these different communes of

Conakry in fecal coliforms (bacteria from faeces produced by humans and warm-blooded animals).

Parasitologiques parameters

The parasitological qualities of the fecal sludge of the communes of the city of Conakry, analyzed, reveal the presence of the following parasite eggs: Toxoplasmagondii, Taenia saginata, Taenia solium, Ascaris, Ankylostoma, whipworm, Angelfish larvae and Mansoni.

Toxoplasmagondii is present in the fecal sludge of the five (5) communes. For Ratoma it is 2 to 4 eggs per field (++) and the four (4) other communes Matam, Dixinn, Kaloum and Matoto it is 1 to 2 eggs per field (+). Taenia saginata is present in the fecal samples of two (2) communes (Matam and Matoto) with 1 to 2 eggs per field (+). Ascaris lumbricoides is present in the mud samples of the five (5) communes of Conakry with 1 to 2 eggs per field (+). The duodenal ancylostomiases' is present in the mud samples of three (3) communes (Matam, Kaloum and Ratoma) of Conakry with 1 to 2 eggs per field (+). The whipworm is present in the mud samples of the five (5) communes of Conakry with 1 to 2 eggs per field (+). Angelfish larvae are present in the mud samples of a single commune (Matam) of Conakry with 1 to 2 eggs per field (+). Mansoni is present in fecal slime samples from a single commune (Ratoma) in Conakry with 1 to 2 eggs per field (+).

Although parasitic infections are common in most developing countries, the presence of parasites associated with them in sludge depends on the intensity of infections in the population. The number of samples is insufficient to be representative of the city. However, the average concentration obtained remains lower than the concentrations often found in tropical countries. This confirms the need to treat these sludges adequately, in order to reduce health and environmental risks.[12]

CONCLUSION

The city of Conakry is experiencing an exponential growth of its population with an increase in needs including those in sanitation. The autonomous sanitation works are the most promoted for their accessibility. By-product management of this type of sanitation is a necessity to reduce the impact of their impacts on health and the environment. The physicochemical and bacteriological analyzes show that the fecal sludge of the five (5) communes of the city of Conakry are rich in organic matter, in nutrients but also in pathogenic bacteria. These results show that sludge remains favorable to biological and chemical processes. It is therefore important to meet certain standards to reduce the risk of disease transmission, avoiding spilling into the wild and using it in agriculture without prior treatment. At the end of this work, considering the consistency and the physicochemical and microbiological characteristics of the sludge, it can be considered the possibility of treating them advantageously with other hardy technologies such as planted beds which favor the leachate infiltration and faster dehydration.

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