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A Glance at the World

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This column comprises notes and info not subjected to peer-review focusing on waste management issues in different corners of the world. Its aim is to open a window onto the solid waste management situation in any given country, major city or significant geographic area that may be of interest to the scientific and technical community.

A study that investigates the effect of indiscriminate municipal solid waste disposal on the surface water quality in Juba, Republic of South Sudan

Juba is the capital city of the newest world's country, the Republic of South Sudan in North East Africa. The city is located within the southern part of South Sudan in Central Equatoria State along the western bank of the river Nile. Juba is a county made up of three districts (*payams*) which include Juba, Kator and Munuki and is directly administered by the city mayor. It is one of the most undeveloped places in the world: although slow to moderate developmental progress is being made in many physical, social, political and economic sectors. It was reported that Juba is perhaps currently among the fastest developing places in the world.

More specifically, growth in its population is noticeable. In 2011, the population of Juba was estimated at approximately more than 500,000 people. It is situated in the midst of vast expanses of open space, including swamplands and agrarian landscapes. Juba is estimated to occupy a 12 km area in diameter from the center of the city (approximately 11,300 hectares). The city is characterized by rapid development, urban sprawl and inadequate services provision. Due to the rapid growth in the population and with majority of the people settling in urban centers: all forms of waste and associated residual materials have tremendously increased in the City. Unfortunately, there is no proper waste management infrastructure.

The absence of a proper municipal solid waste management system is manifested in the sight of trash deposits everywhere – dumped beside streets, clogging streams, bobbing down into the river Nile, littered around buildings, even strewn across the graves in the municipal cemetery and with plastic trash predominating all over the city. Some locals describe the mounting waste in the city as raindrops from the clouds. In line with the situation on the ground, this study aimed at determining the degree of the surface water pollution in Juba city due to the indiscriminate municipal solid waste disposal. The study was focused only on testing feacal colliform and some physical parameters of the water of the river Nile and the streams within the city. This is because the uncollected waste and unscientifically dumped municipal solid waste in the developing countries (for example, the Republic of South Sudan) is often mixed with human and animal excreta, so contributing to flooding, breeding of insect and rodent vectors and the spread of diseases (Cointreau, 1982).

Sampling design

This research was carried out during the rainy season (April–August 2012) in two different phases and these include sampling the river Nile and sampling of five streams within the city. The main objective was to check for the presence of fecal coliform; however, some physical parameters were also tested. Eight sampling sites were chosen along the Nile with the upstream to downstream pattern. Each one of them was represented by a numbered **S** symbol (S1–S8). S1 was at Rajaf upstream, S2 at Lologo, S3 at Juba Bridge, S4 at Juba Port, S5 at Urban Water Corporation (Intake point), S6 at Jebel Nyoka, S7 at Roton and S8 at Morlobor Village downstream. S1 is 7 km South of Juba and S8 is 13 km away to the North; these two sites were considered to be the control points. While the rest of the sites were within Juba city with a distant interval of about 1.5 km. For the five streams, a randomized sampling design was applied.

Samples' collection and analysis procedure

The water samples were collected mostly during the morning hours under controlled temperature conditions using 1000 ml properly labeled screw-capped sterile plastic bottles. Immediately after taking a sample, it was put in a portable cooler box containing ice boxes so as to maintain the 4 °C temperature before reaching the laboratory as recommended by USEPA (1985). The samples were then transported to the Central Laboratory for Water Quality (Juba, South Sudan) for analysis at least within a maximum of 6 h. They were then properly analyzed following quality control procedure for water quality analysis using the "Membrane Filtration Method".

For this study, the medium used was enriched medium (Lauryl Sulphate Broth). The requirement is that 35 g to be dissolved in 1 l of distilled water (1000 ml).

The five month's (April–August 2012) sampling period was with sampling frequency of 4 times per month for each site. This was done in order to obtain a representative value. A total of 160 samples from the river Nile and 100 from the five streams were analyzed. All samples were incubated at the temperature of 44 °C for 24 h as the target was only fecal colliform. Then the number of colonies formed were counted. There was one exceptional case that is Gumba-losok stream whereby both Total and Fecal Colliform were tested; here the incubation temperature for the Total Coliform was 37 °C. This was done because there was a very small village of less

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than 50 people that uses the stream water for direct drinking without any kind of treatment. The physical parameters were analyzed on site using a pH, electrical conductivity (EC) and total dissolved solids (TDS) meter (Model HI 98129, Manufactured by HANNA). They include Temperature, pH, EC and TDS.

The River Nile

The overall results showed that the average fecal CFU/100 ml concentration for all the eight sampled sites of the river Nile ranges between 15.25 and 102.6 mpn/100 ml at sites S8 and S6 respectively. This fecal coliform count range is far above the 0 mpn/100 ml for drinking water as the recommended standard by the World Health Organization (WHO) (2001). Unfortunately and regretably, most of the poor population of Juba city still directly depends on the river Nile water for drinking and all other domestic needs. The presence of high fecal coliform concentration in the river water is not only a clear indication of the serious municipal solid waste pollution in Juba; but also it signifies the high percentage of both human and animal excreta in the waste stream. This is in accordance with the findings of Cointreau (1982) that "in the developing countries, municipal solid waste is often mixed with human and animal excreta". Another major source of this contamination is the illegal direct discharge of untreated sewage into the river Nile from the hotels along it. The river water is therefore contaminated with pathogens which can cause various water borne diseases. This is in part explained by the high incidence of diseases such as typhoid, diarrhea, hepatitis A, gastro-intestinal infections and Cholera at certain time of the year (that is: the rainy season) in the city. Thus, the river water is not fit to be used for domestic purposes, except otherwise if treated: but it can be used in recreational purpose for example, swimming and boating because the concentration is below the 200 mpn/100 ml as recommended by USEPA (1985). The sites S1 and S8 to some extent performed their role as control points by showing the low readings. The values of pH at all the sampling sites ranged from 6.8 to 8.3 and were normal according to the WHO (2001) recommended values. The temperature for all the sites was also within the normal range with regards to the tropical zone. The TDS for all the sites ranges between 47 and 123 mg/100 ml. This range is far beyond the 500 mg/l WHO recommended value. This clearly shows that the banks of the river Nile are exposed and lack natural vegetation cover. The EC ranges between 59 μs and 201 μs/cm: six of the sites (S1–S6) results were all above the WHO (2001) 160 μs/cm recommended value and this is due to the fact that there are a lot of human activities. For example, car washing, swimming, cloths washing, bathing and many others; all these activities could be a good source of chemicals' input into to the river. S7 and S8 were below due to the fact that they are having very low human activities and also far from the city especially for the case of S8.

The streams

For the streams, the fecal CFU/100 ml concentrations were abnormally so high except for Gumba-losok stream; the range was between 1.25 and 11,540.5 mpn/100 ml. Khor Romula has very high concentration despite the fact that it is at the out skirt of the city. The reason for the high fecal contamination is that, at its upstream, there are a good number of cattle herders who supply Juba with fresh beef. During rainy season, all these cattle dung is washed into the stream. For Khor Williang, Lobuliet and Khor Bou, they are just passing through the heart of the city. These streams are being used for open air defecation by the kids during the day time and at night by the grown up. This is because in Juba, almost 40% of the population does not have toilets/pit-latrines in their houses (a very serious and unacceptable sanitary problem). This estimation is in line with the South Sudan's National Bureau of Statistics (NBS) Baseline Household Survey report of 2009. The report clearly stated that 80% of the population in South Sudan does not have access to any toilet facility, 86% of the rural population and 46% of the urban population. In addition, there are also some domestic animals (goats, sheep and cattle) in some individuals' houses in the city: a kind of maintaining some African cultures and traditions. All these are the contributing factors to the extremely high fecal concentrations. As for Gumba-losok stream, the low colonies count is attributed to the fact that it is far (13 km) from the city and also the village near it is of less than 50 persons. The pH and the temperature of all the streams were within the normal range. For the TDS and EC of the three streams mentioned above, concentrations were extremely high: the high human activities in the city are the cause. While Khor Romula and Gumba-losok fall within the WHO (2001) recommended value due to the very small vicinity population. A special consideration was given to Gumba-losok stream: its total coliform was tested and the result was so alarming. The reading was 980,000 mpn/100 ml. It is so sad and painful to see that the small village around the stream was using this highly contaminated water for direct drinking and this is a real serious problem facing this village.

Conclusions

The analysis results obtained from this study revealed that, the river Nile is highly contaminated with fecal coliform to the extent that it is unfit to be used as drinking water except for other purposes. The study also showed that the entire streams in Juba have abnormally so high fecal coliform concentration thus; their water is not fit for any human use. Therefore, the results of this study can be so useful to the general public and the government of the Republic of South Sudan. It will also alert those people who are currently using the contaminated water about the high risk of being affected by water-borne diseases and the related ones if they continue using it especially for drinking. Water-borne diseases such typhoid, diarrhea, dysentery, hepatitis A and occasionally cholera are currently a serious public health problem in Juba. Hence, this study will act as guide for the government of the Republic of South Sudan to take the necessary measures to tackle the municipal solid waste pollution in the city. Finally, more extensive surveys are needed to monitor the quality of the river water in order to reduce the level of water-borne diseases' incidence. Thus, the responsible authorities in Juba must heavily invest in municipal solid waste management in order to avoid the high risk to both human health and the environment.

References

Cointreau, S.J., (1982). Environmental Management of Urban Solid Wastes in Developing Countries. A Project Guide. Technical Paper Number 5.World Bank Urban Development. The World Bank, Washington, USA.

USEPA, 1985. Test methods for Escherichia coli and enterococci in water by the membrane filter procedure (Method #1103.1). EPA 600/4-85-076. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, OH.

WHO, 2001. Guidelines for Drinking Water Quality, Recommendations, Geneva.

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