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IN AN UNCERTAIN ENVIRONMENT**

**Surface water pollution in Nigerian urban areas:  
a close look at Jos city and its surroundings**

*R. E. Daffi & P. R. Kassam, Nigeria*

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*Surface water has been employed for different purposes without consideration of its quality and suitability. Solid waste disposal practices in most urban centres have negatively impacted on surface water quality. It is common practice for inhabitants to dispose their wastes in rivers and streams within populated areas of cities. Jos City, in North Central Nigeria, as a fast growing urban centre, has experienced environmental pollution as a result of these practices. This paper is aimed at assessing the impact of solid waste disposal practices on surface water. A general survey of the area was carried out to assess methods of solid waste disposal. Some properties of surface water at three locations of solid waste disposal were assessed. The results showed that the water tested are contaminated. Recommendations include enlightenment of residents on the dangers of dumping solid waste into streams and provision of solid waste collectors at such places.*

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## **Introduction**

Generally, surface water is expected to be prone to pollution from environmental contaminants because rainwater falling over a catchment moves on the surface of the earth collecting suspended, dissolved and colloidal matters (Steel and McGhee, 1979; Henry and Heinke, 1995; Rao, 2004). In Nigeria, where most of the major urban centres experience problems of municipal solid waste management as a result of rapid population growth (Imam et al, 2007), the extent of surface water pollution can become worrisome. Over population has also resulted in acute water shortage, especially during dry periods of the year, resulting to the use of polluted surface water for agricultural and other purposes. This can pose serious threats to human health and life. Even with the establishment of Federal Environmental Protection Agency (FEPA) through decree Number 58 of 1988 and the subsequent establishment of the state agencies, heaps of solid wastes are common sights on roadsides, markets areas, along river valleys and other open spaces within major cities in the country. Though the major policy thrust of the National Environmental Sanitation Policy, developed by Federal Ministry of Environment in January 2005, is to ensure sound Environmental Sanitation practices that will promote sustainable development, public health and good quality of life, environmental sanitation remains very poor in our neighbourhoods leading to impairment of surface water quality. Jos City, in North Central Nigeria, is a fast growing urban centre, being the capital of Plateau State, and it has its own share of surface water pollution as a result of ineffective solid waste disposal. The state Ministry of Environment has made efforts to put in place solid waste collectors but their efforts seem to be ineffective, the major reason being the attitude of people to solid waste disposal. The main aim of this investigation is to assess the impact of solid waste disposal practices as a result of rapid population growth on surface water and its uses. The criteria that define surface quality are dissolved oxygen, solids, coliform bacteria, toxins, pH, temperature and other parameters that may be necessary depending on the intended use (Hammer and Hammer, 1996).

## **Methodology**

The methods employed for this assessment were first a general survey of the area to assess methods of solid waste disposal. Problems associated with existing solid waste management systems and facilities were assessed. The effects of the methods of solid waste disposal practice on surface water were also

assessed. Information was also collected from relevant bodies especially the Plateau State Ministry of Environment. Samples of water were collected downstream from points of solid waste disposal in June 2008 at three locations within Jos metropolis namely: Gada Biu, Jankwano and Tudun Wada. These were tested for coliform, hardness, Biochemical Oxygen Demand (BOD), pH, Total Solids, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Chloride and also the following metals: Cadmium, Chromium and Magnesium, using methods outlined in Rump and Krist (1992). The results were compared to advanced standards for surface water and their uses.

### Study area

The study area is located in the central part of Nigeria on the Jos plateau at an altitude ranging from 1200m to 1829m above sea level. It enjoys a temperate climate and is characterized by captivating rock formations. Geologically, the area lies within the Jos Younger Granite Ring Complex and the Nigerian Basement Complex. The rainy season is usually from April to October with a mean annual rainfall depth of 1400mm. The Jos Plateau is the source of many rivers in northern Nigeria notably Rivers Kaduna, Gongola, Hadejia and Yobe. Based on the 2006 population census, the city is estimated to have a population of about 900,000 residents.

### Municipal solid waste disposal practices in Jos

The Plateau State Ministry of Environment has provided solid waste disposal points within various locations in Jos Bukuru metropolis where residents are expected to drop their wastes for collection by officials of the ministry who will in turn take them to the final disposal point. Some problems that have been observed are:

- People dump the wastes anywhere but inside these containers most of the time because children are usually sent to dispose the wastes and they cannot lift them into the containers.
- Sometimes when these collectors are filled up they are not emptied immediately during public holidays and also as a result of one problem or the other from the body responsible for the evacuation. People are left with no option but to dump their wastes on the ground around the collectors.
- The trucks that are used for the evacuation of these wastes are most often open and flying dirt litter the environment all the way to the final disposal point.
- The final solid wastes disposal point is another eyesore (Plate I). It is a big open dump located as close as about 10m from the highway, about 100m from a settlement called Rafin Gwaza on the south and Mista Ali on the North respectively, and in a valley. This makes it a major source of environmental pollution that is of particular threat to surface water bodies.

On the other hand, even with this effort by the state government, people's attitude has remained unchanged. Around the business areas (markets), traders dump their wastes in the middle of the streets. Most of the drainages within these business streets, like Ahmadu Bello Way, have been blocked because they are the closest place and easiest way for shop owners to dump solid wastes generated from their businesses. Water normally floods the streets with every kind of dirt when rain falls during rainy season.

In residential areas, people find it easier to dump their wastes in uncompleted buildings and undeveloped pieces of land within the locality. The commonest and worst practice is where there is a stream close to these residences, people openly stand on or by bridges and dump their wastes into these water bodies (Plate II). Almost every stream within residential areas have been turned into solid waste disposal sites.



**Photograph 1. Solid waste final disposal site**

Source: Author



**Photograph 1. Solid waste dumped in a stream**

Source: Author

### Uses of surface water within the study area

Even with the seemingly high level of pollution of surface water within Jos metropolis, the water has been employed for various uses which include agricultural uses i.e. irrigation of farms in the dry season where mainly vegetables such as cabbage, carrots, sweet pepper, cucumber, green beans, peas and so on, are produced. The vegetables harvested from the farms are washed with water from the streams. The water is also employed for domestic uses where people wash their clothes and also bath themselves in the streams. Also the water is sometimes collected in containers, taken home and utilised for household chores like washing plates and other kitchenware.

### Surface water quality at some locations

The results of the water samples tested are shown in the Table 1.

| <b>Table 1: Parameters tested compared to water quality standards</b> |                 |                 |                   |   |                                  |
|---|-----------------|-----------------|-------------------|---|----------------------------------|
| <b>Parameters Tested (mg/l)</b>                                       | <b>Gada Biu</b> | <b>Jankwano</b> | <b>Tudun Wada</b> | <b>Acceptable Values for Raw Water Quality*</b> | <b>Conformity with standards</b> |
| Total Coliform  | 2.0             | 1.7             | 1.5               | 1**   | No for all                       |
| Total Hardness  | 157.59          | 123.96          | 115.90            | 100*  | No for all                       |
| Total Dissolved Solids  | 1000            | 1000            | 520               | 1500 for fresh water*                           | Yes for one                      |
| Chlorides   | 300             | 200             | 250               | 200*  | No for all                       |
| Cadmium   | 0.12            | 0.11            | 0.05              | 0.01**  | No for all                       |
| Chromium  | 60.24           | 60.00           | 59.00             | 0.1**   | No for all                       |
| Magnesium   | 20.20           | 19.50           | 17.20             | 150   | Yes for all                      |
| Iron  | 2.00            | 1.99            | 1.50              | 1.0*  | No for all                       |
| BOD   | 320             | 300             | 150               | 6.0*  | No for all                       |
| pH  | 6.00            | 6.65            | 7.50              | 5.5 - 8.5*                                      | Yes for all                      |

\*World Health Organisation International Standards for Drinking Water 1963

\*\*Nigerian water quality criteria for irrigational waters and livestock watering (FEPA, 1991)

The water samples all showed there was faecal contamination with total coliform showing values higher than set standards.

Most aquatic ecosystems can tolerate TDS of up to 1000mg/l while poultry can tolerate approximately up to 2900mg/l and livestock watering has a limit of 3000mg/l while dairy cattle have a safe upper limit of 7200mg/l. This implies that two of the water samples are toxic for fish while all are ok for poultry and cattle. This can also interfere with agricultural, domestic and other uses of the water.

High chloride content for two of the samples gave an indication of high degree of pollution of the water as a result of the solid wastes dumped in it. Cadmium (toxic to the kidney) and Chromium (cause cancer) concentrations were also seen to be high while Magnesium concentration was ok.

High iron content in the water could be due to the presence of iron in the oil which is predominantly hard lateritic top soil. It could also be as result of organic contamination that causes deoxygenation of the water (Gray, 2006). It however does not present any health risks.

Biochemical Oxygen Demand (BOD) for the water was high for all samples with Gada Biu and Jankwano showing much higher values. This is an indication of the level of organic pollution and concentration in the stream.

pH was slightly acidic for samples taken from Gada Biu and Jankwano indicating a higher level of pollution compared to the water from Tudun Wada.

### **Conclusion and recommendation**

From the results obtained, surface water within the study area are contaminated as a result of direct dumping of solid wastes into the streams. This habit is so ingrained in people such that it has become a normal way of life because they have been left unchecked over time. It is necessary to change the mindset of people with respect to this bad habit because it renders surface waters unfit for agricultural and domestic uses. The following recommendations are generally made for Nigerian urban areas that are experiencing similar problems:

1. An inventory of affected streams should be taken for possible clean up.
2. Protection should be provided for streams within inhabited areas of urban centres.
3. Awareness and enlightenment should be carried out among residents on the effects of dumping solid waste into streams on the water quality.
4. More solid waste collectors should be provided especially around areas close to streams to discourage domestic waste being dumped into the streams.
5. There should be a legislation against dumping of waste into surface water bodies and possible prosecution against defaulters.
6. The National Environmental Sanitation Policy should be enforced in all states and local governments.
7. Polluted surface water should not be used for agriculture or domestic purposes.
8. Alternative sources of water should be explored to provide potable water in adequate quantity to these areas.

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### **Keywords**

Surface water, solid waste, pollution, waste management

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### **Contact details**

R. E. Daffi  
Department of Civil Engineering,  
Plateau State Polytechnic, Barkin Ladi  
Tel: +2348034516774  
Email: rmedaffi@yahoo.com

P. R. Kassam  
Plateau Rural Water Supply and Sanitation Agency,  
Jos  
Tel: +2348035863998  
Email: nenrot@gmail.com

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