



A water quality study of Ulası river at selected locations

C. C. Mbajıorgu, Nigeria

WATER QUALITY MONITORING of a river can be used to define existing conditions, detect trends and/or establish causes or sources of pollution. The water quality of the *Ulası* river was studied by sampling the river water at three locations along its course within Ihiala LGA, Anambra State, Nigeria. The samples were analyzed using standard laboratory methods as appropriate to each water quality parameter, and the results compared with WHO water quality standards. Spatial variation of the water quality along the river course was also investigated.

Compared to the WHO standards, the river water contains an excessively high number of coliform organisms, it has too high a concentration of iron, while its fluoride content is less than the minimum level of 0.5 mg/l recommended to prevent dental caries in children. Also, the river water is found to be very soft. On quality variation along the river course it is found that color, suspended solids, hardness, phosphate, BOD and coliforms count had the highest concentrations at the middle location, Osuakwa. The pronounced occurrence of these pollutants at this location is attributed to a variety of anthropogenic factors, including a busy rural market located on the riverbank, cassava fermentation in the river, sand quarrying from the river bed, and transportation of local people and foodstuff across the river. But sulphate and nitrate contents had higher values at the first location, Okija, due to the use of artificial fertilizers for local agricultural production. Also, there is an increasing iron content downstream along the river course, probably due to the passage of the river through rock and soil formations containing mineral iron.

It is concluded that *Ulası* river water is not suitable for direct human consumption at all the three locations sampled in this study. Due to softness, the river water will be corrosive to supply mains if pipe-borne. In addition to appropriate water treatment, sanitary facilities are required in the area to control the river pollution.

Introduction

The Ulası River is a widely spread river found in southeastern Nigeria (Fig. 1). Sourced in Dikenafai (latitude 05° 45'N, longitude 07° 10'E), in Imo State, it flows through several towns in both Imo and Anambra States (Urualla, Akokwa, Okija, Ihiala, Uli, Mgdidi) gathering tributaries in its course. It forms a confluence with the Oguta Lake at Oguta, and proceeds towards and then into the Niger delta. The river overflows its banks every August and gradually recedes by subsequent months, depositing alluvial soils on

its banks and floodplains, which are very fertile. Farmers cultivate the banks during this period. The flood plains are wet and very productive during the rainy season, enabling food to be produced early in the year. The river is also a means of transportation for the villagers who travel from one town to another by canoe, for commercial purposes or to convey farm produce on market days. The river also supports several fishermen and provides a means of livelihood for their families.

This study assessed the water quality of the Ulası river, by examining the physical, chemical and biological nature of water samples drawn from sections of the river (in Ihiala LGA of Anambra State, Nigeria) in relation to WHO quality standards for drinking water. The study enables definition of existing conditions, and provides a basis for trends detection as well as information for determining cause-and-effect relations with respect to, for example, point and non-point sources of pollutants, anthropogenic activities and waste disposal along the river.

Catchment description

The Upper Ulası River (UUR) catchment starts from Dikenafai and ends at the river's crossing of the Onitsha-Owerri Road at Okija in Ihiala LGA of Anambra State. Figure 2 shows the topography of the UUR catchment (about 131.25 km²).

The river took its rise 183 m (600 ft) above mean sea level at Dikenafai and continued on an undulating slope to Okija which is at 91.5 m (300 ft) above mean sea level. The UUR catchment is mainly of the ferrallitic soil type, which according to Obihara (1961) comprises of deep porous sandy loams/loamy sands with the clay content increasing gradually with depth. Ferrallitic soils are rich in free iron, but have a low mineral reserve and therefore low fertility.

The natural vegetation type in the UUR catchment is the tropical or lowland rain forest. Large parts of the rainforest zone may be termed an 'oil palm bush.' The forest is characterized by an abundance of plant species sometimes exceeding 150 different species per hectare.

Methodology

Samples of raw water from the Ulası river were taken from the three locations along the course of the river, namely, (i) Okija, (ii) Osuakwa, Ihiala, and (iii) Ihite, Ihiala, all in Ihiala LGA of Anambra State. The samples were in small enough quantities to be conveniently transported to and handled in the laboratory. A 4-litre sample was taken daily

Table 1. Water quality data for three locations* along Ulasi river

Parameters	Unit	Location I	Location II	Location III
Colour	Colour Units	15; 15; 10	20; 10; 18	10; 15; 20
Suspended Solids	mg/l	4.7; 5.3; 3.5	8.0; 6.0; 10.0	6.6; 5.4; 7.5
Hardness	CaCO ₃ mg/l	6.0; 7.5; 4.5	10.0; 8.0; 12.0	6.0; 10.0; 8.0
Phosphate	mg/l	3.5; 4.5; 4.0	4.8; 6.7; 5.0	3.7; 5.8; 4.0
Sulphate	mg/l	8.2; 10.0; 11.8	7.4; 8.0; 5.6	4.4; 6.6; 5.5
Nitrate	mg/l	0.7; 0.9; 1.4	1.0; 0.8; 0.6	0.6; 0.4; 0.5
Fluoride	mg/l	0.08; 0.06; 0.10	0.05; 0.04; 0.06	0.06; 0.02; 0.04
Iron	mg/l	1.2; 1.0; 1.4	1.1; 1.3; 1.8	2.0; 1.8; 2.2
BOD	mg/l	0.4; 1.2; 0.8	2.0; 1.8; 2.2	1.8; 1.1; 1.6
Coliform	Per 100 ml	210; 460; 120	>2400; 150; 240	460; 240; 1100

*I, II and III represent, respectively, Okija, Osuakwa-Ihila, and Ihite-Ihiala sampling locations along Ulasi River.

Table 2. Comparison of water quality data with WHO guidelines

Parameters	Unit	I	II	III	WHO
Color	Color Units	13.3	16.0	15	15
Suspended Solids	mg/l	4.5	8.0	6.5	-
Hardness	CaCO ₃ mg/l	6	10	8	500
Phosphate	mg/l	4.0	5.5	4.5	5.0
Sulphate	mg/l	10.0	7.0	5.5	400
Nitrate	mg/l	1.0	0.8	0.5	50
Fluoride	mg/l	0.08	0.05	0.04	1.5
Iron	mg/l	1.2	1.4	2.0	0.3
BOD	mg/l	0.8	2.0	1.5	-
Coliform	Per 100 ml	263	930	600	0 to 10

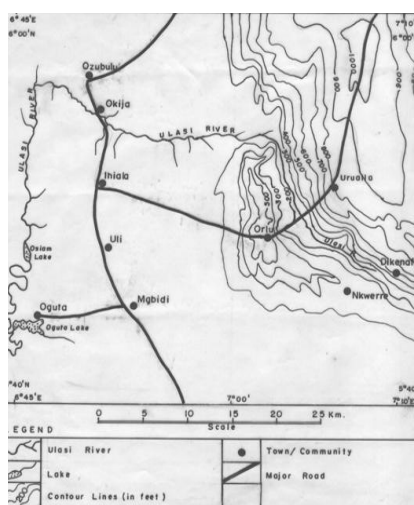


Figure 1. Topography of the upper Ulasi river

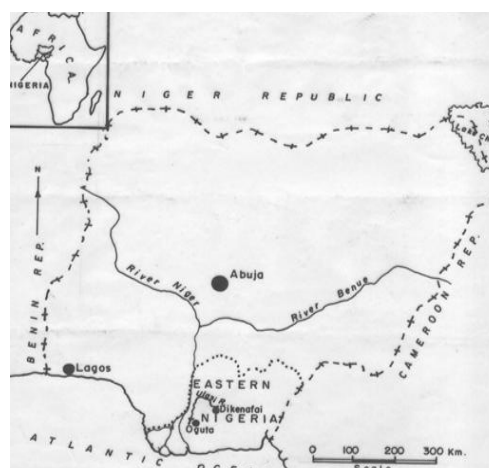


Figure 2. Map of Nigeria showing the Eastern region and the upper Ulasi river from source at Dikenafai to Oguta Lake

at each location, for nine days, and was brought to the laboratory at University of Nigeria, Nsukka on the same day of collection, for analysis. Record was made of each sample, and sampling bottles had appropriate labels on them. The samples were refrigerated upon receipt in the laboratory to avoid external contamination or deterioration until the time of analysis. Physical, chemical and bacteriological examinations were carried out on the samples about 4 hours after collection. All the analyses were based on standard methods, as described by American Public Health Association (1989). Each sample was analyzed for the following parameters: color, odor, suspended solids, hardness, nitrate, fluoride, iron, phosphate, sulphate, BOD and total coliforms.

Results and discussion

The results of the laboratory analyses of samples collected from the three locations, Okija, Osuakwa-Ihiala, and Ihite-Ihiala, along the course of the Ulasi river are shown below in Table 1. For each location, three replications of sample results are shown.

Similarly, Table 2 shows a comparison of average values of measured water quality parameters with WHO drinking water standards (WHO, 1971).

For the aesthetics parameter, color, the results varying from 13.3 to 16 CU show that the river water is just aesthetically acceptable (WHO limit for domestic purposes is 15 CU). The suspended solids concentration varied from 4.5 to 8.0 mg/l for the locations sampled (WHO requirement, nil). On chemical quality parameters, hardness varied from 6 to 10 mg/l (WHO limit, 500 mg/l), while phosphorus varied from 4.0 to 5.5 mg/l (WHO limit, 5.0 mg/l); these are, respectively, too low and too close to the acceptable

C. C. MBAJIORGU, Eco-Hydrological Systems Research Unit, Department of Agricultural Engineering
University of Nigeria, Nsukka, Enugu State 410001.
E-mail: const.c.mbajiorgu@talk21.com
