# Management of septic sludge in southwest Nigeria

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INADEQUATE AND INEFFICIENT management of septic sludge is one of the most pressing environmental problems faced by cities of the developing world. In Nigeria however, attention seemed to be focussed on solid wastes and hazardous industrial wastes without many realizing that septic sludge is just as detrimental to human health. The custodian of world health – World Health Organization (WHO) in 1996 sited indiscriminate disposal of septic sludge as a major causative agent of communicable and water-borne diseases, particularly in developing countries (Cairncross and Feachem, 1997) Unlike some developing nations which have taken heed to the WHO clarion call, Nigeria is yet to evolve policies and strategies to address the menace. It has been reported that people use sullage mixed with human faeces and urine for agriculture in major urban centres in the nation (Sridhar, 1995; Sridhar, 2000). This paper describes our experience on septic sludge management in a (South Western) Nigerian City, Ibadan, with a sprawling population of about 2.9 million. The main objectives of the study included assessment of the current management practices as far as septic sludge is concerned as well as design of a feasible management system.

## Current practices on septic sludge management

An overview of existing management practices for septic sludge in Ibadan shows that the three main methods being commonly adopted are:

(a) Disposal into water bodies and open drains
(b) Disposal on land
(c) Burial in shallow trenches

Septic sludge is indiscriminately dumped into rivers or canals without prior treatment. The Ogunpa and Kudeti rivers - two major rivers in the city have been receptacles for septic sludge to the extent of overflowing their banks in 1980 and 1988 causing untold destruction to lives and properties. Wastes disposal (including septic sludge) has been identified as one of the principal factors responsible for the flooding (Sangodoyin and Essien, 1996).

Another common practice is to dump septic sludge on abandoned plots, open land or into bushes. This exposes people to the risk of infection by pathogens e.g. various bacteria, viruses and worms. This has been noticed amongst those living close to septic sludge dumping sites along Orogun – Shasha road in Ibadan City.

Thirdly, for many households in Ibadan, burial of septic sludge constitutes an handy means of sludge disposal. It involves the digging of a trench close to the septic tank, shoveling the slurry into the trench and covering it with soil. However fly breeding and pathogen transmission often show up as the health risks resulting when the sludge is not buried deep enough with any specifications.

## Evaluation of annual septic sludge generation rate

From field surveys conducted at the five local governments in inner Ibadan metropolis, data were collected to be able to arrive at a realistic estimate of the annual septic sludge generation rate in the five sampled local government areas. The average disludging interval of the septic tanks in most households investigated in the study area was found to be four years while the average volume of the septic tanks was 2.84m$^3$. Hammer (1977) specified 2.8m$^3$ as the minimum capacity of septic tank for a two – bedroom house in the United States of America. Table 1 presents the inspection data for the housing units from which the sludge generation rate of the study area was calculated as follows:

*Total Average Monthly Inspections*
  *=3516 + 3403 + 4664 + 933 + 1842 = 14, 358 houses*

*Using the Frequency Assumption Method (EPA, 1984),*
*Annual volume =*

$$\text{Annual volume} = \frac{\text{Number of Septic tanks x Average Volume (m}^3)}{\text{Dislodging interval (years)}}$$

*Annual Volume =*

$$\frac{14358 \times 2.84}{4}$$

*= 10194.2m³/year*

Alternatively, the volume of the septic tank can be calculated using the formula:
Volume = 3 days x population x 0.85 x water consumption.
Where population = 11 persons and water consumption = 100pcd
i.e. = Volume = 3 x 11 x 0.85 x $\frac{100}{1000}$m$^3$ = 2.81m$^3$

Which is reasonably close to the value of 2.84m$^3$ used.

## Experimental results and discussions

Replicate samples of septic sludge were analyzed in the laboratory for their moisture content, ash content, and initial *Ascaris* ova count as well as percentages composition of carbon, nitrogen, phosphorous and potassium. Table 2 presents the results showing that addition of calcium oxide (lime) and wood ash were effective in bringing down the ascaris count to nil value although the former yielded better results in that about half of the latter's quantity was required to achieve $Og^{-1}$ value of the final ascaris count. Lime addition creates an alkaline environment that is not conducive for microorganism survival and it also reduces odours. EPA (1984) in a report stated that lime stabilization is an accepted process to significantly reduce pathogens.

## Appropriate management option for septic sludge in Ibadan

From the results presented in Table 2, it is apparent that lime would readily lend itself to use as stabilizer of the sludge in the landfill design considered as the appropriate management option (AMO), for the Ibadan case study. The landfill is of the trench type which involves the excavation of deep trenches. The basic parameter for the trench landfill is volume which has been estimated to be 10194.2m³per year. The bottom of the landfill was lined with 90cm tight clay, fine – grained solid mixed with bentonite although the releatively expensive geo membrane may also be used. This was done to prevent the infiltration of leachate into ground water. Under drains were also placed on the liner to channel water away from the landfill area to disposal outlet and subjected to appropriate treatment which could either be by read bed or activated sludge.

The overall landfill cover is a trade off between a moisture barrier and a protective layer. The cover consists of various layers, each meant for a specific purpose. The surface layer provides a suitable medium for plant growth while the biotic layer is meant to prevent penetration of the moisture barrier by burrowing animals or plant roots. Infiltration into the top layer of the cover is removed by the drainage layer while the hydraulic barrier is instrumental to prevent the filtration from reaching the stabilized sludge. The foundation layer is placed to prevent the puncture of the hydraulic barrier by sharp objects.

## Conclusions and recommendations

From the study the following conclusions and drain are drawn:

- Public health is currently being threatened due to the exposure of residents and unprotected waste handlers to untreated sludge in Ibadan metropolis arising from septic tanks and pit toilets.
- The awareness among communities of the overall hazardous effects of septic sludge is to a great extent, lacking in the city
- Little attention is currently paid to septic sludge management by the stakeholders (e.g. communities, various

### Table 1. Inspection data for housing units

| | Ibadan North East local govt. | Ibadan Southwest local govt. | Ibadan Southeast local govt. | Ibadan Northwest local govt. | Ibadan North local govt. |
|---|---|---|---|---|---|
| Period | January 2003 | January 2002 | June – October 2001 | January – December 2001 | January – December 2001 |
| Duration of Inspection | 1 month | 1 month | 5 months | 12 months | 12 months |
| Houses with water closet toilet | 1424 | 2029 | 9339 | 6419 | 10552 |
| Houses with pit latrine toilets | 2092 | 1374 | 13937 | 4781 | 11550 |
| Total | 3516 | 3403 | 23336 | 11200 | 22102 |
| Average monthly inspections | 3516 | 3403 | 4664 | 933 | 1842 |

**Table 2. Results of laboratory analysis of septic sludge samples**

| *Parameters* | **Values** |
|---|---|
| Mean Ash content | 15.3 |
| Mean Moisture content | 84.9 |
| Initial Ascaris ova count | 1133 |
| Total Carbon | 20 |
| Total Nitrogen | 6 |
| Total Phosphorous | 3 |
| Total Potassium | 9 |
| Lime added | 415 |
| Ascaris ova count after the addition of lime | 0 |
| Ash added | 840 |
| Ascaris ova count after the addition of ash | 0 |

All values expressed as % except Ascaris ova count per $g^{-1}$ and added lime and ash treated as g/l

tiers of Government and service providers). This is reflected in the haphazard management as well as the general laxity of the regulating agencies saddled with the responsibilities of enforcing the largely inadequate legislation on septic sludge management in Ibadan city.

Thus, the researchers recommend that:

- A proper disposal landfill site be zoned out in each local government for proper disposal of septic sludge
- An effective monitoring mechanism must be put in place to ensure conformity to the laid down local and international standards for treatment and disposal of septic sludge
- Private sector participation in the management process is encouraged with adequate training. NGOs could be helpful in educating the people on sanitary management of septic sludge.
- An effective data base on the subject matter need be generated. This will substantially aid proffering of solutions to the problems of haphazard management of septic sludge in Ibadan.
- Finally, there is the need for a national policy in Nigeria covering all aspects of septic sludge management particularly hygienic disposal and resource utilization due to higher levels of nutrients present. However all hands must be on deck to ensure that such policy is adhered to.

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