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Case Study on Impacts and Appropriate Septic Sludge Management Techniques in Nigeria

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ABSTRACT

The paper discusses persistent challenges regarding sludge management in Nigeria. It suggests notional knowledge management techniques for opposing metropolitan sludge management, especially in Nigeria. The lack of sludge treatment infrastructure and the risk of cholera, combined with the existing demand for fertilizers, fuel, and availability of market waste and agricultural waste offer the opportunity for the creation urine-powered generator, compost toilet, fertilizer, plasma gasification reactor and grow mushrooms or watercress facilities for effective waste management.

Keywords: Septic, Sludge management, Environment, Developing nation, Illness.

INTRODUCTION

Humans excreta are distant apart with double faces whether the adverse side of a constant source of disease plus contamination which grips people back in life besides positive side that aids agriculture or used as fuel and energy source as well allowing people to blossom [1-2]. The negative side is more pronounced because it generates some of the major environmental and health difficulties faced by people living in poor societies, comprising of water pollution and the transmission of diseases and infections which affects around 2.5 billion people in unindustrialized countries with 300 million people from Africa [3-4]. Fitting and operating sewage plus wastewater treatment plants is costly and conventional wastewater management is not an ecologically friendly process since so much energy is utilized and has disposal complications issues [5]. Consequently, due to cost, many areas in the developing nations have opted out [4]. Despite the progress made under the MDO (Millennium Development Goals), there are millions of people currently without suitable sanitation. It is obvious that built-up coverage is greater than rural, although the population of people living in rural regions is higher than that established in metropolises [6]. According to the UN (United Nations), approximately forty-eight percent (48%) of the world's population stays in urban settlements, certain districts like Europe, Latin America, and the Caribbean this number reaches 96% and 88% respectively [7-8], represented in Figure 1. Unhygienic conditions are responsible for almost two point five (2.5) million deaths annually from diarrhea, six hundred thousand (600,000) from typhoid fever and about fifty percent (50%) of the urban population and a greater percentage of rural dwellers, has a high morbidity danger due to these conditions [6,9]. Most deceased are children below five and the deaths rate is equivalent to one child dying every fifteen seconds, also one third (1/3) of the population in developing nations is infested by intestinal worms such as Ascaris and Trichuris [10]. The main objectives of the study included an appraisal of the new management practices as concerns septic sludge besides design of a realistic management system because making sure that all humans are safeguarded from bad sanitation will not be easy, but it's vital to termination of extreme poverty.

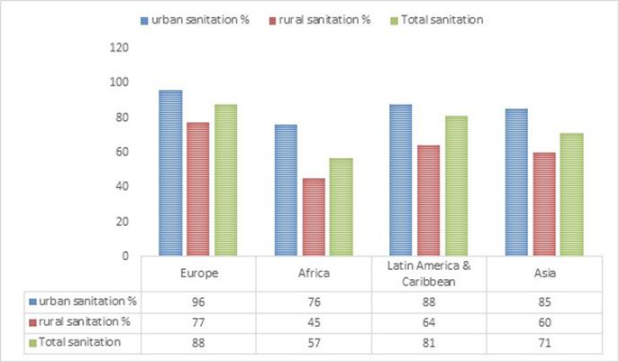

Figure 1: Average sanitation coverage in developing countries by region.

LITERATURE REVIEW

Prevailing sludge management progressions and practices in Nigeria

An overview of prevailing management practices for septic sludge in Nigeria shows that the three main techniques being commonly approved are: Discarding into water bodies and exposed drains; Land disposal and Burial in shallow channels. Septic sludge is comprehensively discarded into rivers or canals without prior treatment, like some major rivers in Nigeria overflowing their banks caused untold devastation to lives and properties with principal factors responsible has been identified as the wrong disposal of septic sludge into the water bodies [10]. Alternative general practice is to dump septic sludge on unrestrained plots, open land or into bushes, but this exposes populaces to the risk of infection through pathogens like different bacteria, viruses, and worms which have been perceived amongst those living close to septic sludge discarding sites. Thirdly, for countless households in Nigeria, septic sludge burial institutes handy sludge disposal methods, this involves the trench digging near septic tank, scooping the slurry into the trench as well as covering it with soil. Nevertheless, fly breeding and pathogen dispersion often show up as the health threats resulting when the sludge is not concealed deep enough with any specifications. Figure 2 shows the first activated sludge process laboratory and modern activated sludge process.

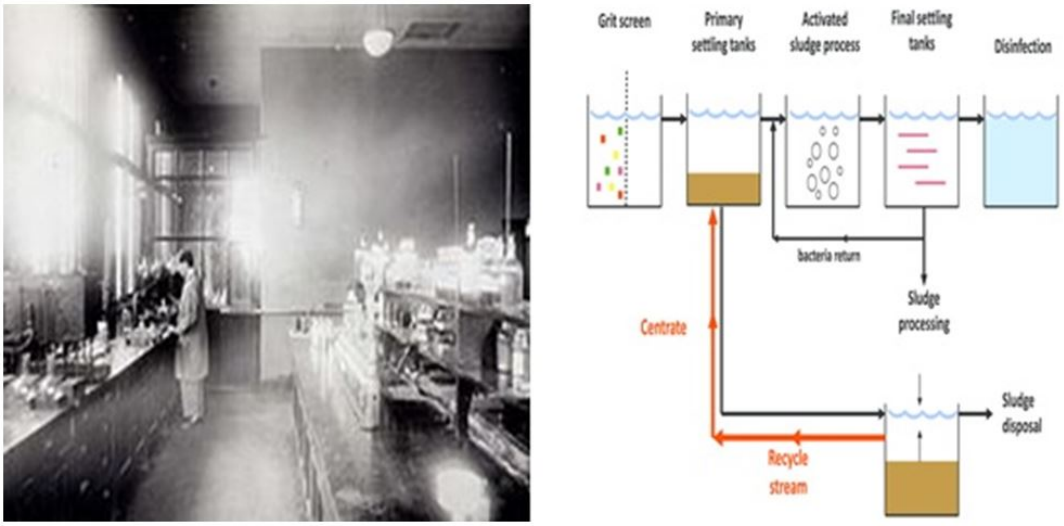

Figure 2: Activated sludge process at Davyhulme sewage lab in the 20th century (left) and Conventional activated sludge process.

Low-cost options commonly utilized in some developing communities

Dry or low-water sanitation: For the past few eras dry or truncated sanitation have been gaining attention with the arrival of viable and low-cost hygiene. The waste can be managed directly on-site, or gathered and transported to the treatment plant. Different products can be acquired after processing for instance fertilizers, compost, water, biofuel,

soil conditioners, and biogas. The low-cost options frequently used are: Pit latrines where the human excreta is gathered in a pit situated directly beneath the toilet; Urine diversion dehydrated toilets in which the waste is divided into dual diverse compartments and discharge flush toilets which uses a little water quantities from half litres to two litres to flush away the excreta and for anal cleaning (Figure 3).

Figure 3: Pit toilet and water closet with washing hand basin in mess.

Desiccation asteurisation: This permits faecal sludge from aerated upgraded pit latrines to be handled. The machine is capable to dry and purify the sludge by means of infrared radiation and the end result can then be safely utilized in agriculture.

Dark soldier flies' larvae for faecal material: Once dilapidation, the larvae, which are rich in fatty acids and proteins, might be utilized for poultry food or for biodiesel manufacturing.

GOVERNMENT DISPOSITION ON SLUDGE MANAGEMENT IN DEVELOPING NATIONS

Developing nations have not reviewed their Community health and urban development policies, for instance, illegal land subdivisions, undocumented land transferals, a violation on public land, unlawful settlements; unapproved housing constructions; etcetera that will help the sanitation sector. Most towns, for example, have bye-laws that need land ownership to prove before a property can be linked to sewer networks, these policies omit the majority of the people that access on-site properties. Besides a lot of in-formalities generated by the laws and policies, authorities do not tackle the sanitation needs of the majority of the populaces. Mostly failure of governments to regulate land usage and provision of sludge treatment facilities causes manual emptying, illegal deposits and open defecation in most developing nations.

Way forward on households sludge management in Nigeria

Humans have developed ingenious methods to handle their waste throughout time, there is modern sewage system by connecting toilets a vast network of pipes, impressive in the manner that it eradicates the immediate health hazards of feces, but not all waste that originates in a toilet is processed in a viable manner. Oftentimes, feces and other human waste is eventually ejected into oceans, huge pits, and other faraway spaces. Sewage treatment plants are intricate systems that comprise physical, chemical as well biological methods to create ecologically dewatered sludge and safe wastewater. The treated byproducts can be used for agricultural purposes, incinerated or disposed in a landfill.

APPROPRIATE MANAGEMENT OPTION FOR SEPTIC SLUDGE IN NIGERIA

Urine-powered generator

This is the technique of separating hydrogen from water inside urine by using the device utilizing electrolysis and then fuels a generator with the gas. Urine is placed into an electrolytic cell which divides hydrogen that goes into a

water filter for sanitization out and then discharges into a gas cylinder, which resembles type used for out-of-doors barbeque grills; the gas cylinder impetuses the clean hydrogen into an extra cylinder that has liquefied borax, in order to eradicate moisture from the gas. Borax is a natural mineral, normally used in washing soap and the hydrogen is pressed into a power generator in the last step of the method [11]. This was carried out by a professor Gerardine Botte from Chemical And Biomolecular Engineering at Ohio University and four girls between 14-15 years in Nigeria (Figure 4).

Figure 4: Generator that uses urine as fuel.

Plasma Gasification Reactor

This turns dried feces into hydrogen gas by first drying out the poop then makes it go through a plasma gasification process. Gasification is related to plain old burning; however, it occurs at a much advanced temperature (2,500°C) with a diverse goal in mind. When an electric current passes inside a gas it creates a plasma which in turn is visible to the pre-dried feces (Figure 5). Hydrogen at the other side is stored in a fuel cell as well as kill all pathogens in the feces because of its super-high temperature, a giant public health bonus by the Delft University of Technology.

Figure 5: The plasma gasification reactor.

Fertilizer

In some parts of Africa, a model that powers itself is being rolled out, essentially for separating toilet and waste incinerates which in turn generate sufficient power to operate and charging household appliances including mobile phones. Table 1 shows some countries that turn human waste into wealth.

Table 1: Countries where human waste has been exploit for wealth creation.

S.no	Nations	Purpose
1	York's sewage system generated fertilizer shipped across the US to Colorado	For agricultural boom
2	Some part of the world uses feces directly	For irrigating fields
3	Manchester fecal sludge processing plant that uses "thermal hydrolysis" technology	Generate sufficient clean energy to power then used as a clean fertilizer.
4	Britain	To powered public bus
5	Grand Junction Colorado	To power, a fleet of 40 service vehicles, comprising of transit buses, garbage trucks, and street sweepers.

Also from nations like India, Sridevi did some calculation when she concluded her doctoral thesis in ecological sanitation at the University of Agricultural Sciences in Bangalore that if 40% of the populaces in India stowed their urine for their crops usage, the nation's farmers can save $26.7 million (1.2 billion rupees) in fertilizer expenditures. Our bodies make roughly 4-8 cups or 1-2 litres of urine each day, which is rich in phosphorus, nitrogen as well potassium and they are elements that crops love and cheaper fertilizer. This was tested on banana plantation shown below (Figure 6).

Figure 6: Banana plantation tried with urine from human as a fertilizer.

Composting latrines

The simple biological composting latrine design is dual pits, one concealed with a semi-movable structure which is the main toilet and walls. Then human waste is mixed with materials like agricultural waste, ash or yard clippings. When the pit gets filled, it was transferred to another pit, the first pit was covered and the natural microorganisms and animal agents of putrefaction were allowed act on them. After the waste is naturally treated, excavate the compost and spread it as a nontoxic fertilizer on crop fields. This method is being promoted in Haiti by toilets for people and soil.

Grow mushrooms or watercress

Less than half of countryside Bolivians have consistent access to a toilet, according to the WHO (World Health Organization), because of such paucity aid organizations have donates composting latrines to people in the area, but

studies revealed that only one-fifth (1/5) to half (1/2) of composting latrines are utilized appropriately. Instead, people excreted on the exposed ground. Therefore for better free toilet usage, an experiment was conducted on compost from appropriately used latrines in which water was spread on afforested land planted with monterrey pine sprouts (Figure 7). The pine trees offer a habitation for expensive bolete mushrooms that might generate moderately high pays for the public. Also the specimen of the fertilization urine powers is an odd trial in nurturing watercress. A study on drinkpeed offers how to grow comestible watercress in a bowl full of urine.

Figure 7: Mushrooms picture.

CONCLUSION

New sewage sanitation systems can offer safe and satisfying toilet alternatives in developing nations where money, electricity or water are deficient in supply but monitoring setting and innovative method should take into account local economic, institutional and practical conditions. An overview of management options like urine-powered generator, composting latrines, fertilizer, plasma gasification reactor and growing mushrooms or watercress which may prove sustainable in less industrialized countries is provided, as sludge treatment infrastructure shortage causes cholera and other deadly illness.

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