

STATUS OF ABATTOIR WASTES RESEARCH IN NIGERIA

S.L. Ezeoha^a, B.O. Ugwuishiwu

DEPARTMENT OF AGRICULTURAL AND BIORESOURCES ENGINEERING, UNIVERSITY OF NIGERIA, NSUKKA, NIGERIA

^a(Email: louiezeoha@yahoo.com)

Abstract

Literature review was done to investigate the potential of abattoir wastes to befoul the environment, or cause hazards to human health, and harm to living resources and ecological systems. Abattoir wastes include animal blood, horns, bones, animal faeces, paunch manure, and abattoir effluent. The review result shows that abattoir wastes have the potential to pollute surface waters, underground waters, abattoir/market environment, and consumables around the abattoir, especially when abattoir wastes are not properly treated and disposed off. Abattoir wastes should be managed to achieve allowable effluent standards, odour control, or to exploit the benefits locking in the wastes before safely and economically disposing the ultimate wastes. In order to develop optimized abattoir wastes management strategies that would ensure reduction in environmental pollution in Nigeria, this paper proposes some research considerations on the pollution potential of abattoir wastes in Nigeria. The paper aims at stimulating increased research in the area of abattoir wastes management in Nigeria in order to avoid the dangerous consequences of poorly managed abattoir wastes.

Keywords: pollution, abattoir, abattoir wastes, paunch manure, animal manure

1. Introduction

One type of wastes that is of great concern in both urban and rural areas in Nigeria is abattoir or slaughter-house wastes. Almost everyday in all the urban and rural markets in Nigeria, animals are slaughtered and the meat sold to the public for consumption. Meat wastes originate from killing; hide removal or dehairing, paunch handling, rendering, trimming, processing and clean-up operations. Therefore, abattoir wastes often contain blood, fat, organic and inorganic solids, and salts and chemicals added during processing operations [1, 2].

In ruminants, the first stomach or paunch

contains undigested materials called paunch manure, which can contain long hairs, whole grains and large plant fragments. The faeces of livestock (animal manure) consist of undigested food, mostly cellulose-fibre, undigested protein, excess Nitrogen from digested protein, residue from digested fluids, waste mineral matter, worn-out cells from intestinal linings, mucus, bacteria, and foreign matter such as dirt consumed, Calcium, Magnesium, Iron, Phosphorous, Sodium, etc. [3, 4]. Abattoir effluent (waste water) has a complex composition and can be very harmful to the environment [5]. Therefore the importance of knowing the pollution potentials of abattoir wastes

cannot be over-emphasized.

1.1. Pollution

Pollution is a general term and is defined in many ways. In the broadest sense as conceived by the layman, it is the befouling of the environment by man's activities, particularly by the disposal of solid, gaseous, and liquid waste products [6, 7]. Pollution may be defined as the introduction by man into the environment of substances or energy liable to cause hazards to human health, harm to living resources and ecological systems, damage to structure or amenity, or interference with legitimate uses of the environment [8]. The Hawley's condensed chemical dictionary defines pollution as the introduction into any environment of substances that are not normally present therein and that are potentially toxic or otherwise objectionable [9].

1.2. Water pollution

Water pollution is the contamination of fresh or salt water with materials that are toxic, noxious, or otherwise harmful to fish and other animals and to man, including thermal pollution [9]. Water pollution is produced primarily by the activities of man, specifically his mismanagement of water resources [10]. A satisfactory operational definition might be that water pollution is any thing whether physical or chemical that affects the natural condition or the intended use of water [11].

Water pollutants include organic wastes e.g. volatile suspended solids (VSS), living agents (e.g. bacteria, viruses), plant nutrients (especially Nitrogen and Phosphorous), synthetic organic chemicals (e.g. DDT, dieldrin, etc.), inorganic chemicals and mineral matter (e.g. metals, metal salts, acids, particulate matter, etc.), sediments, radioactive materials, hot water, cold water, oil [10, 11].

1.3. Air pollution

Air pollution is the contamination of air by unwanted gases, smoke particles, and other

substances [12]. Comprehensively, air pollution means the presence in the outdoor atmosphere of one or more air contaminants (pollutants) in quantities, of characteristics and of duration which are injurious to human, plant, or animal life or to property, or which unreasonably interfere with the comfortable enjoyment of life and property [1]. Air pollutants include: carbon monoxide (CO), sulfur oxides (SO_x), nitrogen oxides (NO_x), ozone (O₃), carbon dioxide (CO₂), ammonia and ammonium compounds (NH₃ and NH_{4x}), cyanides (HCN), fluorides (F), chlorine and hydrogen chloride (Cl and HCL), suspended particulate matter (SPM), hydro carbons (HC), asbestos fibre emissions, heavy metal particles and radioactive substances, etc. [12, 13].

1.4. Food pollution

Food pollution may be defined as the fouling, soiling or contamination of food by bacterial pathogens, harmful biological organisms and deleterious inorganic and organic chemicals [14]. Fungi and bacteria often colonize crops stored as food. Other substances like metals, nitrates, oxalates, nitrosamines, various organic acids, sorbic acids, and sulfur dioxide can also contaminate food accidentally, or as a result of deliberate human action [8].

2. Abattoir Based Pollutants

2.1. Animal blood

Animal blood is known to possess high oxygen demand. Blood from beef cattle has a biochemical oxygen demand (BOD₅) of 156,500mg/l and a chemical oxygen demand (COD) of 218,300mg/l [15]. The implication of this fact is that discharge of animal blood into streams would deplete the dissolved oxygen (DO) of the aquatic environment.

2.2. Paunch manure

In ruminants, the first stomach or paunch contains undigested materials or paunch manure. The paunch manure could have a moisture content of about 88% with an average

COD of 177,300mg/l, and average BOD₅ of 50,200mg/l. The solid portion of the paunch manure contains the greatest pollution load, about 73% of the COD and 40% of the BOD [15]. Improper disposal of paunch manure can therefore exert oxygen demand on the receiving environment or breed large population of decomposers (micro-organism) some of which may be pathogenic.

2.3. Animal faeces or manure

The faeces of livestock has been observed to consist of undigested food, mostly cellulose-fibre, undigested protein, excess nitrogen from digested protein, residue from digested fluids, waste mineral matter, worn-out cells from intestinal linings, mucus, bacteria, and foreign matter such as dirt consumed, calcium, magnesium, iron, phosphorus, sodium, etc. Improper disposal of animal faeces can therefore cause oxygen-depletion in the receiving environment. It can also cause nutrient-over enrichment of the receiving system. And the possibility of disease causation is also present.

2.4. Abattoir effluent

Fresh Abattoir effluent is mainly composed of diluted blood, fat and suspended solids. It may also contain some coarse solids e.g. manure, pieces of meat etc. Generally, fresh abattoir effluent has been shown to contain solids, minerals, metals, and micro-organisms; and to exert oxygen demand. On the other hand, aged and decomposing abattoir effluent is often malodorous [16, 17].

2.5. Animal horns and bones

Animal horns and bones when not disposed off properly are unsightly; they occupy useful space; are odorous and attract flies, and can cause nuisance.

2.6. Decomposing manure pile

In most abattoirs in Nigeria, both the paunch manure and the animal faeces are allowed to pile up and decompose without necessary attention. Such manure piles are permanent sources of pollution within the market

environment, as they are often foul-smelling, attract both flies and scavengers, and breed mosquitoes.

3. Pollution Potential of Abattoir Wastes

3.1. Pollution of surface waters

Abattoir wastes contain materials that have oxygen demand (BOD or COD). Therefore, runoff from abattoir wastes piles can affect the quality of nearby streams. Low level of dissolved oxygen (DO) and ammonia toxicity in such streams could result in death of fish. Also, eutrophication (excessive vegetative growth) in stream channels, which occurs because of the nutrients (nitrogen and phosphorus) in abattoir effluent, could reduce the size of receiving stream channels, which could cause over-flooding and its consequent damages. In addition to reducing streams physical and chemical quality, pathogens from abattoir effluent could be transmitted to humans via water based recreations.

3.2. Pollution of underground water

Abattoir wastes often contain pollutants that can enter the ground water and alter its quality [18]. The presence of ground water pollutants of organic nature is made known through taste, odour, foaming or damage to crops which have been irrigated with this water. A study of nitrate nitrogen in soils under feed-lots noted accumulations from almost zero to 3783kg per acre in a 4m soil profile [19]. Samples of ground water under feed-lots in the south Platte River Valley, an area containing most of the cattle in Colorado, U.S.A, has been observed to contain ammonium nitrogen up to 38mg/L, organic carbon up to 300mg/L, and to have had an offensive odour. Also viral diseases have been caused by ground water pollution [11].

3.3. Pollution of the abattoir environment

Abattoir wastes can produce odours which interfere with the enjoyment of life and prop-

erty and thus can be a source of localized air pollution. Some of the odorous compounds like Sulphides, Mercaptans, Amines, Organic acids, etc. are tenacious, clinging to clothing and other articles, persist for long periods, and carry great distances [1, 20].

3.4. Pollution or contamination of consumables

The surroundings of most abattoirs in Nigeria give offensive odours and breed mosquitoes due to the pile-up of solid wastes, faeces, carcass, horns, scraps of tissue, etc. After rain-storm, the pile effluent flows and spreads to some other parts of the market. It is common to see pigs swim in the effluent and roam the market with their bodies covered with the putrefying wastes materials. In this process, consumables in the market could be polluted or contaminated. Also, where abattoir effluent-polluted waters are used to grow salad crops and vegetables, transmission of infections is bound to occur because animal wastes are known to contain pathogenic organisms, causing salmonellosis, leptospirosis, tularemia, foot and mouth disease, hog cholera, etc. [16, 21, 22].

4. Proposed Research Considerations

It is incontrovertible that abattoir wastes possess pollution potential. They are capable of polluting surface waters, underground waters, abattoirs and the general market environments, and consumables. The characteristics of abattoir wastes and effluent vary from day do day, and season to season, depending on the number and types of livestock being processed, the manner in which the yards are cleaned, and on the available seasonal feeds of the animals etc.

Based on the above understanding, the research needs of the problems of abattoir wastes will include the following:

1. Characterization of abattoir wastes and effluents which includes the physicochemical and microbiological characterization.

2. Environmental impact assessment of abattoir wastes on surrounding surface waters, surrounding wells and boreholes, the butchers health, and on crops grown with effluent contaminated pond waters, rivulets and streams.

3. The effects of abattoir size, abattoir facilities, types of livestock processed, overall market size, etc. on the pollution potential of abattoir wastes.

4. Appraisal of existing abattoir waste treatment and disposal practices in Nigeria and the recommendation of remedial measures.

5. The impact of the knowledge of the pollution potential of abattoir wastes on environmental legislations, abattoir designs, and abattoir waste management strategy.

6. The development of the utilization potential of abattoir wastes and the consequent effects on the marketability of the wastes.

7. The economic analysis of abattoir wastes disposal practices vis--vis the environmental quality levels that the public is willing to pay for.

5. Summary and Recommendations

The meat processing industry is considered to be an ever-growing industry in Nigeria; and more and bigger abattoirs will yet be constructed. Abattoir waste management issues will therefore be raised from time to time. We do know that abattoir wastes have pollution potential. We also know that abattoir-based pollutants include animal blood, paunch manure, animal faeces, the wastewater, and the horns and bones.

The implication of this knowledge is that abattoir wastes should be managed to achieve stipulated effluent standards, odour control, or to exploit the benefits locking in the wastes before safely and economically disposing the ultimate wastes.

But in order to optimize abattoir waste management strategies that will ensure reduction of environmental pollution, there is the

need for intensive research in all aspects of the problem. We need information on how best to utilize the horns, the bones, etc. to enhance their quick removal from abattoirs after their generation. We need information on the appropriate methods for disposing the ultimate wastes after selling the utilizable ones. We also need information on the economic implications and sustainability of existing abattoir wastes management strategies.

In Nigeria, the intensive research being recommended here needs to be zoned ecologically, edaphically, and socio-culturally in order to detect significant differences, if any or otherwise.

The problems of abattoir wastes in both rural and urban environments in Nigeria will soon begin to attract the attention of our national, states, and local legislative bodies. It is certain no meaningful and effective legislation can be formulated without expert recommendations based on research facts and figures. This is why the importance of increased research in abattoir wastes management in Nigeria cannot be over emphasized.

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