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P.B.U. ACHI*

MANAGEMENT OF INDUSTRIAL WASTES IN NIGERIA

A total of 200 production and service industries in Nigeria are randomly selected and handling of their industrial wastes is investigated. The common trend is that over 80% of industrial plants seriously pollute the environment and less than 18% of all plants are engaged in any form of reprocessing of their industrial wastes. The chemical/petrochemical and brewing/food industries dominate the industrial economy and therefore constitute the worst offenders in poorly planned waste management. The above indicate that Nigerian environment is in very bad and adverse state.

1. INTRODUCTION

It was a great shock to Nigeria and the other countries of West Africa to find out, in July 1988, that hundreds of tons of toxic industrial wastes, including several tons of polychlorinated biphenyl (PCB), were dumped by an Italian Company at Koko, a small town in the Bendel State of Nigeria. Even while the international diplomatic ripples caused by the discovery have not settled, many Nigerian industries operating internally continue their habitual and irresponsible management of their industrial wastes.

As Nigeria has been industrialized by leaps and bounds, a number of controversial industrial projects are overlooked. These planning mistakes could be regretful in the future, but Nigerians are recently becoming aware of the serious environmental hazards posed by the mismanagement of industrial wastes. In Ifo, another small town in the Ogun State of Nigeria, in September 1986, hundreds of palm trees (Nigeria's major cash tree crop) were felled because of noxious effect of acid dust from a nearby cement factory. In Kaduna the picture is the same. In this second largest city of Nigeria, a superphosphate fertilizer plant releases toxic fumes of sulphur dioxide into the air causing acidic rains. The acidic rains continue to deplete the vegetation in the area, thus increasing the aridity of this part of the country.

* Industrial & Production Engineering, Federal University of Technology, P.M.B. 1526, Owerri, Nigeria.

Nigerian cities and the countryside face a serious problem of safe disposal of other industrial wastes. In the study of the management of industrial wastes, the industry in Nigeria can be categorized into eleven groups, namely: petrochemical, general civil/marine engineering, general non-metals, metals, textile/rubber, food/breweries, electrical goods, agricultural production, general service/maintenance, cement/asbestos and vegetable oil industries. A total of 200 industries sampled randomly from different parts of Nigeria were investigated.

2. THE NIGERIAN INDUSTRIAL BACKGROUND IN WASTE DISPOSAL

In the first period of industrialization (up to 1970), Nigerian industries were really few and in the time of their establishment land was plentiful. In fact, both in the past and present the donation of land is being used by different communities in Nigeria as an incentive to encourage the establishment of industries in their area. The land owners were given inadequate (if any) financial compensation, and there were hardly any complaints. Because there was so much excess land around the plants, the disposal of wastes was carried out by dumping or through drains in the vicinity of the plants. The disposal of these wastes was never of significant importance to the industry and nobody complained, because in most cases the industry was established at the site before the present population around it! The trends in urbanization in Nigeria followed the general pattern of economic centres (like markets, industries and ports) as in many other developing countries. In the case of Nigerian industry, the disposal of liquid waste has been always considered as being of initial importance, a river bank was the obvious choice. Today in Nigeria there is hard to find any main river which does not have discharge channels of industrial effluents on the banks along its course. The Otamiri and Aba rivers in Owerri and Aba towns of the Imo State of Nigeria are the best examples.

In many cases, the basic reason justifying the establishment of the industries was solely the existence of a large market for the products. Even the existence of local raw materials was not of major importance, because foreign raw materials could be imported using the preceeds of the export of Nigerian primary products like palm oil, kernel, groundnuts, cocoa, petroleum, etc. Lacking the experience in running equivalent industries and being unfamiliar with the raw materials (to be imported) and their by-products, the indigenous potential manufacturer ignored adequate provisions for waste disposal. Therefore after the plants have been operating, he is suddenly faced with the dilemma of disposing the waste and resorts to indiscriminate dumping, draining and releasing toxic gases into the environment. The local population was unconscious of the threats and did not complain.

Following the 1970–1974 economic plan in Nigeria, the import of certain consumer goods was restricted which resulted in import-substitution industries to emerge rapidly. Again, the main attention was focussed on the expansion of the exist-

ing large market, but local sources of raw materials and plans for waste disposal received little attention. At this time, Nigeria was "enjoying" an oil boom and foreign exchange, and import of industrial raw materials (whose by-products were unfamiliar) was noteworthy. Many private and corporate manufacturers accelerated the establishment of various branches of industry in that second period of industrialization (from 1970 to present), Today the management of industrial wastes does not conform to the provisions of the Nigerian "Public Health Rules (Sanitation Provisions)", Section 44–50, of 1958. These public health rules define regulations governing the use of: landfills, burrow pits, composting, incinerating, recycling and other modern methods for conventional ultimate waste disposal. How far people responsible for environment protection respect public health in the disposal of wastes can be seen in the manner of management of their industrial waste which is presented below.

3. REPROCESSING OF WASTES IN NIGERIAN INDUSTRIES

In general, reprocessing of industrial wastes is undertaken for the following major reasons [1]:

(i) to reduce toxic wastes to non-toxic materials,
(ii) to recover useful industrial raw materials from the wastes,
(iii) to convert the waste to manageable shapes; sizes and states before disposal,
(iv) to remove offensive odour or even colour before disposal.

Except for the period of the 1967–1970 civil war, Nigerian industries did not experience much problems with importing industrial raw materials until the mid-seventies. Before this time, it was considered uneconomic in Nigeria to reprocess wastes for the purposes of material recovery when taking into account the costs of a direct import of such materials. Therefore reprocessing of wastes was not common. Also as was stated earlier, abundance of apparently "no man's land" and general disregard for public health requirements negated the remaining compelling reasons for waste reprocessing.

Since the late seventies, however, the Nigerian industrial economy has become dangerously unstable as a result of the scarcity of raw materials following the paucity of foreign exchange which resulted from the drop in the revenue from crude oil. By the eighties, some Nigerian industries had started to consider seriously waste reprocessing solely for the purposes of raw meterials recovery. Lack of the necessary technology, expertise and funds have so far restricted the number of industries engaged in waste reprocessing to only very few as shown in table 1.

Preliminary reprocessing in Nigerian industry involves separation of solid components from a mixture, removal of solid sediments from liquids by filtration or converting the waste into handleable shapes, sizes and states. In complete reprocessing, the waste is treated physically, thermally or chemically to convert it into industrially useful materials and totally inert and non-polluting components.

Table 1

Waste reprocessing in Nigerian industries

Type of industry	Preliminary reprocessing %	Complete reprocessing %
Petrochemical	9	9
Civil/marine enginnering	8	8
Non-metals (glass, plastics, paper, etc)	50	0
Metals	38	19
Textiles, rubber, leather, foam	33	0
Cement/asbestos	0	0
Foods/breweries*	14	0
Electrical goods	0	0
Agricultural production	0	0
Service/maintenance	0	0
Vegetable oil mills	75	75

* Another 14% sell wastes to other companies.

In petrochemical industries the re-injection of waste water and gas into deep wells (occassionally done by only two oil companies in Nigeria) is considered a complete reprocessing when compared with gas flaring and oil field flooding common in Nigerian oil industry. As far as chemical waste disposal is concerned very few Nigerian industries attempt to recover certain reagents from chemical waste solutions. In the fish processing, the reprocessing of fish waste into animal feeds and agricultural manure is considered a complete reprocessing. In the vegetable oil industries, the palm, groundnut and cotton seed oil processing mills are used. The groundnut oil mills allow almost complete converting of final wastes into animal feed, while the initial wastes (scales and shells) are used as fuel for the boilers. Similarly, in the palm oil mills, the post-oil fibres and palm-kernel shells are used for heating boilers, while post-oil kernel cake is processed to obtain animal feed. However, the sludges from palm-oil processing are usually drained into gutters, thus polluting the soil surface and near-by rivers.

4. ENVIRONMENTAL POLLUTION BY NIGERIAN INDUSTRIES

Environmental pollution by Nigerian industries include [2]:

(i) dumping indecomposable solid and liquid wastes on soil surface (DS),

(ii) channelling inert liquid waste into open gutters to open collection points (CO),

(iii) channelling inert and decomposable liquid waste into rivers or streams (CR),

(iv) open air burning (uncontrolled) of solid and gaseous waste (OB),

(v) dumping of decomposable solid/liquid waste on soil surface (PDS),

(vi) emission of inert fumes (coloured smoke) into open air (IGA),

(vii) emission of hazardous (toxic) gas into open air (TGA),

(viii) channelling hazardous liquid waste into open gutters (TCO),

(ix) channelling hazardous liquid waste into rivers/streams (TCR),

(x) pollution of coastlines and farmlands due to oil spillage (OC).

Table 2 illustrates pollution of the Nigerian environment by eleven categories of Nigerian industries.

Table 2

Pollution by Nigerian Industries

Type of industry	% of plants polluting environment	Pollution type	Recorded direct physical injuries/ damages (D)
Petrochemical	86	All (i–x)	D
Civil/marine	92	DS, PDS, CO, CR	–
Non-metals	50	OB, IGA, CO	–
Metals	50	DS	–
Textile/rubber	70	OB, CO, CR, IGA	–
Cement/asbestos	100	DS, TGA, TCR	D
Foods/breweries	90	PDS, CO, CR, IGA	D
Electrical goods	30	DS, OB	–
Agricultural production	100	CO, CR, PDS	–
Service	100	CO, DS, CR	D
Vegetable oil	60	CO, CR	–

Among the most widespread environmental pollution is the indiscriminate channelling of liquid (and semi-liquid) wastes into rivers and streams. As a result, several rivers and streams, which were sources of water to local communities before industrialization, are drying up quickly. Many streams have stopped flowing and the aquatic life has become virtually extinct. An example is the curiously famous Nworie river in Owerri which has stopped flowing due to industrial pollution caused by plants (and even a government-owned mortuary) sited directly on its banks.

In Nigeria, the drainage systems in cities are frequently inadequate to handle the heavy flooding that accompany the torrential rains from March to October. During and after each heavy rainfull, industrial wastes with darkish spent coal-tar and engine oil (from service workshops) are common sights in Nigerian city gutters. Most of these

industrial wastes reach streams, rivers and stagnant ponds where they constitute serious health hazards.

In the petroleum industry the flaring of natural gas that continuously lights the Nigerian skyline is a wastage of resources and a cause of pollution of the Nigerian atmosphere during 24-hours. Frequent oil spillage is caused by inadequate safety measures in the petroleum industry and it often extensively damages aquatic life, displaces whole villages and destroyes crops and farmlands.

The frequent poisoning by chemicals, which leads to epidemic among many Nigerian communities, can be traced to the discharge of untreated chemical wastes and pesticides (from chemical industries) into gutters and drainage systems which are usually channelled to rivers and streams. Since most Nigerian communities either totally lack pipe-borne water or possess water pipes which are dry most of the time, they rely either totally or temporarely on the streams and rivers and thus being regularly poisoned by the river-borne chemicals. The author's colleagues investigated the Aba and Otamiri rivers in Imo State of Nigeria [3] and revealed the presence of chemical pollutants like Cd, NO_3, Mn, Pb in water in dangerously high concentrations all the year round. The values of pH ranging from 4.3 to 8 were measured along the course of the river.

5. CONCLUSIONS

The data presented prove that if marked attention was paid to reprocessing of industrial wastes, the degree of pollution in Nigeria would be minimized. Some of the reprocessing activities comprise such a purification of waste-water that it can be converted into portable supplies to the communities as well as processing of hydrocarbons into materials for life stock feeds. The wastes from textile plants could be sold either to the manufacturers of bush lamps and kerosene stoves for wicks or to toy makers for stuffing their toys.

A principal measure to handle industrial pollution is to educate people on how the management of industrial wastes affects their health. In Nigeria this education would take considerable efforts to bring about the desired awareness in both rural and urban areas. The government and people constitute the best "watch-dogs" over the pollution of the environment resulting from improper management of industrial wastes prevalent in Nigeria. Faced with rising economic problems (especially unemployment), the goverment is too busy to enforce existing public health laws. Some of the industrialists also ignore environmental legislation, and some of those who are familiar with the existing rules often collude with public health inspectors to flout the regulations. All these problems militate against the efforts of the government to establish industrial waste management techniques that eliminate industrial pollution.

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GOSPODAROWANIE ODPADAMI PRZEMYSŁOWYMI W NIGERII

W losowo wybranych dwustu zakładach przemysłowych w Nigerii zbadano stan gospodarowania odpadami przemysłowymi. Stwierdzono, że ponad 80% zakładów poważnie zanieczyszcza środowisko naturalne, zaś tylko niecałe 18% stosuje regenerację ścieków. W gospodarce nigeryjskiej dominuje przemysł chemiczny, petrochemiczny i spożywczy i te właśnie gałęzie przemysłu mają największy udział w źle planowanej gospodarce odpadami. Opisana sytuacja świadczy, że środowisko naturalne w Nigerii jest w bardzo niekorzystnym stanie.

ХОЗЯЙСТВОВАНИЕ ПРОМЫШЛЕННЫМИ ОТБРОСАМИ В НИГЕРИИ

В случайно избранных 200 промышленных предприятиях в Нигерии исследовано состояние хозяйствования промышленными отбросами. Было установлено, что свыше 80% предприятий серьезно загрязняет среду, а лишь неполных 18% применяет регенерацию сточных вод. В нигерийской экономике преобладают химическая, нефтехимическая и пищевая промышленности, которые имеют самую большую долю в плохо планированном хозяйствовании отбросами. Описанная ситуация свидетельствует о том, что естественная среда в Нигерии оказалась в опасном положении.