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# Prospect of Using Solid Wastes from Food Processing Industries in Livestock Feed Formulation

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**Abstract:** This study was carried out to determine the prospect of incorporating solid wastes from food processing industries into livestock feeds. Solid wastes from 2 industries were analyzed into their components to determine the possibility of their use as livestock feeds. The results of the analysis showed that the solid wastes could be a good source of livestock feed. It was recommended that the practice of dumping solid wastes on industrial premises, into near-by streams and water bodies, or buried into landfills should be stopped as such practices could lead to environmental degradation, economic losses and poses public health hazards to human, aquatic and land animals.

**Key words:** Food processing, livestock feeds, prospect, solid wastes, formulation

## INTRODUCTION

The generation of wastes can be said to be an inevitable product of living. The continued advancement in science and technology is contributing significantly to the increased volume and toxicity of waste generated and also to its treatment, recycling, reuse and reduced toxicity. About 100 world leaders and another 65,000 delegates recently gathered in Johannesburg, South Africa in the Rio + 10 Conference organized by the United Nations to tackle the world level of poverty, misery and environmental degradation resulting from unsustained development (Newswatch Magazine, 2002; Chukwu, 2005). Developing nations (including Nigeria) are also affected by this earth's threatening problem. The 1995 U.K. Environment Act defines waste as any substance or object, which the holder discards or intends to discard. The Act identifies different classes/types of wastes to include household wastes, industrial wastes, commercial wastes, clinical/hospital wastes, municipal solid wastes and wastewater, inert wastes, special wastes, radioactive and other hazardous wastes (Momoh, 2002). These wastes find their ways into the waste stream. This no doubt, constitutes a threat to the nation's environment.

It is an understatement to say that indiscriminate dumping of solid wastes is a daily nuisance in many urban centres in Nigeria. As far back as the early 1980's, Oluwande (1984) reported that less than 25% of the solid wastes generated in many developing countries (Nigeria as special case study) are actually collected. The remaining 75% is allowed to cause nuisance and pollution of the environment. Worse still, the ever-increasing volume of waste generated has become a sign of affluence and is often wrongly branded as a normal phenomenon of developmental activities. Maclaren International Limited (1971) and Oluwande (1974) reported solid waste generation rates of 0.37 and 0.41 kg/h/d (kilogram per head per day) respectively for Ibadan whereas in a later study for Lagos metropolis, Sangodoyin and Osaighovo (1992) reported a value as much as 1.66 kg h $d^{-1}$ depending on the area's population density and income level of the residents. In developing environments, industries especially the small-scale industries are springing up more rapidly than other sectors of the economy. Their spent water and solid waste have to be disposed off effectively in order to minimize potential contact between people and the wastes.

Consequently, the need to evaluate the solid wastes from food processing industries to determine their alternative use (s) is imperative.

The main objectives of this study are to quantify the solid wastes generated by the selected food processing industries and analyze the wastes to ascertain their direct use as and/or incorporation into animal feeds. This was done using Nasco Foods Nigeria Limited, Jos and Cadbury Nigeria Plc, Ikeja, as case studies.

## MATERIALS AND METHODS

The food processing industries assessed in this study are Nasco Foods Nigeria Limited and Cadbury Nigeria Plc. They are located at No.44 Yakubu Gowon

Way, Jos, PlateauState and Lateef Jakande Road, Agidingbi, Ikeja, Lagos State, respectively. Jos is a city in the middle belt of Nigeria and capital of Plateau State. Jos is on Lat. 9° 52' N and Long. 8° 54' E. It is located near the centre of the Jos Plateau. Jos is about 1250 m above sea level on the Delimi River. The average monthly temperatures range between 21 and 25°C. The monthly rainfall ranges from 200-325 mm between May and September and 2.5-85 mm for the months of January through April and October through December (Roder, 2004). Ikeja is a town in the South-West of Nigeria and capital of Lagos State. Ikeja is on Lat. 6° 30' S and Long. 3° 30' W. It is located in Lagos Mainland. Ikeja is about 305 m above sea level. The average monthly temperatures range between 22.3 and 32.2°C. The annual average rainfall is 1507 mm.

This study was based on Investigative Survey Research Approach (ISRA) (Anazodo, 1975; Anazodo *et al*., 1986; Chukwu, 1994). The ISRA for obtaining data entails the schedule of a series of visits to the food processing industries of interest. The tasks accomplished during such visits include inspection and witnessing of processing operations, taking relevant measurements and collection of solid wastes for laboratory analysis. The sampling technique involved the removal of a small portion of the solid wastes that is representative of the entire waste.

For quantitative measurements, the quantity of wastes generated was estimated through the measurements of discharge ports and the rates and duration of discharge. From the overhead discharge port, a 20 kg (by weight) metallic steel container was used to collect the solid waste as it dropped from the discharge port for 6.0 sec. Three replicate samples were taken for each batch operation every 2 h and the average calculated. This is because the processing machines were shut down after running for 2 h and re-started after 30 min. The average of each batch operation was used for calculation. This approach was adopted for the 2 industries. The average production days in a year for the 2 selected industries are 200 days. The average production hours per day are 5 h. Based on the above, it was possible to quantify the solid wastes for the 2 industries. For the determination of the components of the solid wastes the AOAC nutritional guidelines (1980) were followed. The components of the solid wastes determined are moisture content, dry matter, lipid content, crude protein, carbohydrate, ash content and crude fibre.

## RESULTS AND DISCUSSION

The quantity of solid wastes generated by the 2 industries is presented in Table 1. Experimental analysis was carried out on the solid waste samples and the average ( $\bar{Y}$ ) of each component is presented in Table 2.

Table 1: Quantity of solid waste generated by nasco and cadbury

| Location/site | Average discharge (kg $s^{-1}$) | Average discharge (tonnes $h^{-1}$) | Total discharge (tonnes $year^{-1}$) |
|---|---|---|---|
| Nasco foods Nig. Ltd | 1.950 | 7.020 | 7020 |
| Cadbury Nigeria Plc | 1.347 | 4.849 | 4849 |

Table 2: Solid Waste analysis for nasco foods Nigeria Ltd and Cadbury Nigeria Plc

| Parameter (%) | $\bar{Y}_n$ | $\bar{Y}_c$ |
|---|---|---|
| Moisture content (MC) | 14.00 | 27.60 |
| Dry matter content (DM) | 30.00 | 20.00 |
| Lipid content (LC) | 1.69 | 1.60 |
| Crude protein (CP) | 26.00 | 23.40 |
| Carbohydrate (CHO) | 24.00 | 21.60 |
| Ash content (AC) | 2.80 | 3.20 |
| Crude fibre (CF) | 2.50 | 2.60 |

$\bar{Y}_n$ = Average for Nasco Foods Nigeria Limited; $\bar{Y}_c$ = Average for Cadbury Nigeria Plc

One of the specific objectives of this study was the analysis of the solid wastes from Nasco and Cadbury to determine the potentials of their use in animal feeds. The components of the solid wastes presented in Table 2 are discussed.

**Moisture Content (MC):** The solid waste contained between 14.00 (for Nasco) and 27.60% (for Cadbury) of moisture when discharged. The high moisture content for Cadbury waste makes it susceptible to rapid biodegradation by micro-organisms since it is an organic material. But it makes possible the immediate use of the waste for raw livestock feed. In this state it could be used as organic fertilizer or for biogas production. However, handling under this condition is very cumbersome due to wetness and bulkiness. Efficient incorporation into animal feed and for ease of transportation as organic fertilizer requires a reduction in the level of moisture content by dehydration. Actually Grand Cereals, Jos, recycles solid wastes from Nasco Foods for Vital Feeds Company.

**Dry matter content:** The dry matter content level (30 for Nasco and 20% for Cadbury) is quite adequate for the waste to be used as animal feed. According to Koloman (1990), a food processing waste that contained 16% dry matter fed to lactating cows during hot weather significantly increased milk yield, milk fat content and the total solid content of the milk. This is of significant importance to dairy industries in Nigeria which is a hot tropical zone.

**Lipid content:** The lipid content ranges between 1.69 for Nasco and 1.60% for Cadbury. It is a measure of the fat

content of the waste and according to Eusebio (1984), pigs require high protein and/or high fat content feed up to 3% because these nutrients are easily digested. This means that solid wastes from both Nasco and Cadbury are to have fat or lipid supplements if they are to be used to feed pigs. The feed is also adequate to be used as feed for layers, fish and fattening bulls. An animal can derive twice much energy from a molecule of fat than from a molecule of carbohydrate (Chukwu, 2005).

**Crude protein:** The crude protein content of more than 22% (26.00 for Nasco and 23.40% for Cadbury) is high enough for the waste to be used as poultry feed since only 22% crude protein content is needed for this purpose. When fortified with oil and premixes, the solid waste could even be used as feed for broilers. It can also be used to feed young animals, animals in the late stages of pregnancy, milking herds and high-producing egg layers.

**Carbohydrate:** The carbohydrate level in the wastes was between 24.00 for Nasco and 21.60% for Cadbury. This indicates that it could be a good source of energy for livestock feeds. It has been shown that it could replace as much as 33% of the grain requirements in livestock feed (Ojo, 1998). Ruminants, e.g. cattle, sheep and goats have been fed with the solid waste as a ready source of energy.

**Ash content:** The ash content value ranges between 3.20 and 2.80%. It is an indication of the mineral or organic material present in the solid waste. In general, the mineral constituents are essential for the formation of teeth, bones and blood and other body fluids when fed young farm animals (Chukwu, 2005).

**Crude fibre:** The crude fibre ranges between 2.50 and 2.60%. With the crude fibre level below 3%, the wastes could be used as concentrate feed. The crude fibre of a feed is an important factor of the diet and according to Ojo (1998) the crude fibre should be 3.16% for livestock feed. Dairy cattle, lactating and growing animals can be fed with it.

## CONCLUSION AND RECOMMENDATIONS

From the results of this study it was concluded that the solid wastes from food processing industries have great potentials for use as animal feeds. It was recommended that the practice whereby solid wastes are dumped on industrial premises, into near-by streams and waterbodies, or buried into landfills without proper treatment could lead to environmental degradation, economic losses and poses public health hazards to human, aquatic and land animals and therefore should be discouraged. This is because many parts of the biosphere operate as complex, interdependent interactive systems. As a result, any interplay of activities that could trigger off a negative impact on the environment should be stopped.

## REFERENCES

Anazodo, U.G.N., 1975. Systems approach to farm mechanization in Nigeria. NIJOTECH. Nig. J. Technol., 1 (1): 7 - 10.

Anazodo, U.G.N., T.O. Abimbola, and J.A. Dairo, 1986. Agricultural machinery inventory, type and condition in Nigeria: A National Investigative Survey Report, pp: 71.

AOAC, 1980. Official Methods of Analysis. Horwitz, W., (Ed.). Association of Official Analytical Chemists, Washington, DC.

Chukwu, O., 1994. Technical evaluation of rice threshers in use in Niger State, Nigeria, Unpublished M. Eng. Project, DAE, U.N.N., Enugu State, Nigeria.

Chukwu, O., 2005. Development of predictive models for evaluating environmental impact of the food processing industry: Case studies of Nasco foods Nigeria limited and Cadbury Nigeria Plc Unpublished Ph.D Thesis, DAE, F.U.T., Minna, Niger State, Nigeria.

Eusebio, J.A., 1984. Pig production in the Tropics. Science Books. 2nd Edn., pp: 20-50.

Koloman, B., 1990. Non-conventional feedstuffs in the nutrition of farm animals: Development in animal and veterinary sciences, 23. Elsevier Science Publ. Ltd., London

Maclaren International Limited, 1971. Master plan for waste disposal and drainage in Ibadan, Volume 1-6, Ministry of Works, Ibadan, Nigeria.

Momoh, O.A., 2002. Waste reduction: A sustainable approach to environmental-friendly manufacturing processes. In: Proc. 15th Ann. Conf. Nig. Assoc. Teachers Technol. Minna Nigeria, pp: 425-32.

Newswatch Magazine, 2002. World leaders move to save the planet from self-destruction, Lagos, pp: 42-43.

Ojo, O.O., 1998. Quantitative and qualitative analysis of Wastes from Nigeria's Brewery Industry, Unpublished M. Eng Project, FUT, Minna, Nigeria.

Oluwande, P.A., 1974. Investigations into certain Characteristics of Refuse from Western States of Nigeria. J. Solid Waste Manage., 3 (2): 22-32.

Oluwande, P.A., 1984. Assessment of solid waste management problems in China and on managing solid wastes in developing countries. Bangkok, Thailand, pp: 19.

Roder, W., 2004. Jos City. Microsoft encarta reference library. Microsoft Corporation.

Sangodoyin, A.Y. and J. Osaigbovo, 1992. Case study evaluation of domestic waste components, services and pollution aspects. J. Engin. Int. Dev., 1 (3): 23-29.