THE EFFECT OF CASSAVA WASTE ON THE ENVIRONMENT AND ITS IMPLICATIONS ON THE NATIONAL ECONOMY

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Abstract

Cassava has been identified as an important root crop especially to the people living within the West African sub-region. This is due to the numerous end-products to which cassava can be processed. However, processing cassava into these end-products is usually fraught with a lot of waste such as the peels, waste tubers, waste water and so on. These have some negative effects on the environment and the economy. This paper examines various aspects of cassava, including its chemical composition, methods frequently used for its waste disposal, the effects which the various types of waste have on the environment and national economy and then profers some solutions. The paper also makes some recommendations on how the waste can be effectively managed so as to make our environment safer to live in and the economy healthier.

Introduction

Cassava, a root tuber, has served, and will continue to serve as a major source of food to majority of the people living within the West African sub-region. The different types of food obtainable from cassava range from garri, fufu, tapioca to starch. Cassava according to Coursey and Boot (1977) also finds considerable use as a source of industrial starch, which is used mainly in the Textile and Adhesive industries.

Although a major source of food, especially carbohydrate, processing cassava into food items usually generates a lot of waste, which may be hazardous to the environment. The waste could be classified into three categories, namely, solid waste which include cassava peels, the leaves and pieces of waste tubers, the liquid waste (waste water) and gaseous waste arising from the decomposition of the other waste materials.

In most cases, cassava waste (peels, waste water and other solid constituents) is not properly disposed of; and this usually constitute a nuisance to the environment. Persons who reside close to the site where the waste is indiscriminately dumped suffer from problems of unbearable odour, presence of poisonous gases and a general unhealthy environment. The result is discomfort, anxiety, mosquitoes infestation and frequent illness. Therefore, the paper tries to discuss the effect of cassava waste on the environment and make suggestions on how to manage the waste product for disposal.

Chemical Composition Of Cassava And Cassava Waste

The work of Onwemen (1998), reveals that the peels of cassava comprise 10-20% of the tuber and 0.5-2.0% cork layer of the total tuber weight, while the edible fleshy portion makes up 80-90% of the tuber.

The tuber flesh is composed of about 62% water, 35% carbohydrate, 1-2% protein, 0.3% fat. 1-2% fibre and 1% mineral matters.

Most of the carbohydrate fraction is starch flesh. Phosphorous and iron are the predominant mineral matter with minimal amount of calcium. The tuber is relatively rich in vitamin C (35mg/100g fresh weight), and contains traces of niacin and vitamin A, B, and B_2 but the amount of thiamine and riboflavin is negligible (Onwueme, 1978).

According to Onwueme, the cassava tuber contains protein which is rich in arginine but low in methionine, lysine, tryptophan, phenyl alanine and tryosine. This shows that the protein in cassava is not only very low in quantity but it is also low in quality. In addition, there is a relatively large amount of non-protein nitrogen in the tuber. This implies that the protein content estimated from analysis tend to be higher than those estimated from amino acid (Onwueme, 1978)

The toxicity of cassava is caused by the presence of the cyanogenic glucoside; hnamann together with much smaller amount of the closely related lotaustralin. These are the two major cyanogenic glucosides. They are small but of significant amount in the cassava tuber. Linamann is

synthesized from the amino acid, valine while lotaustralin is synthesized from the amino acid isoleucine. Both glucosies are highly soluble in water and tend to decompose when heated to a temperature above 150°C(Hahn, 1997)

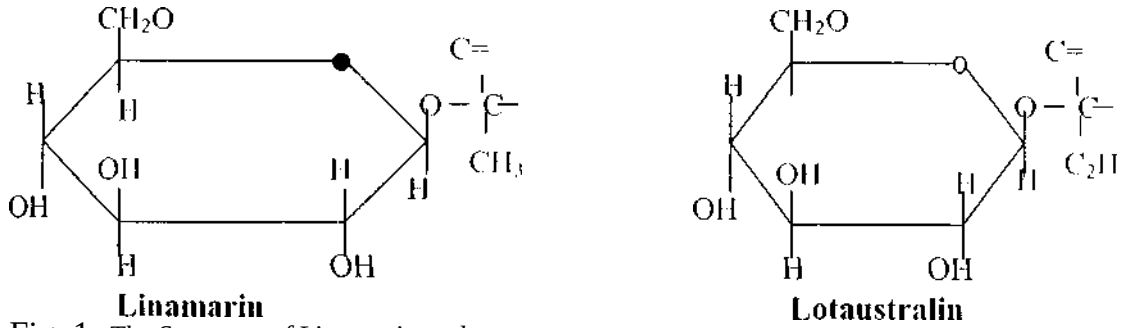

Fig. 1: *The Structure of Linamarin and Lotaustralin (Hahn, 1997)*

The enzyme linamarase (linase) is also present in cassava plant. This iniluenccs the hydrolysis of glucoside to hydrocyanic acid (prussic acid), which is highly poisonous to human and animals (David and Adam, 1985). The concentration of hydrocyanic acid in cassava tuber ranges from 10-490mg/kg tuber.

The leaves of cassava also contain cyanogenic glucosides at a concentration of about 200mg/kg of fresh leaves. However, the leaf contains a much higher concentration of linamarase than does the tuber of cassava also contains tannic acid ranging from 0.05 to 0.20mg/kg in the peel and 0.04 - 0.05mg/100g in the tuber itself (Onwueme, 1978).

The above analysis shows that cassava waste and waste water resulting from cassava processing consist of non-protein nitrogenous compounds, protein, glucosides of linamarin and lotaustralin, enzymes such as linamarase (linase), hydrochloric acid (from enzyme hydrolysis of linamarin and lotaustralin), mineral matters such as calcium, iron, phosphates, vitamin C. niacin, vitamins A, B, and B_2. These components play different significant roles in the environment in terms of their effects.

Methods Frequently Used For Cassava Waste Disposal

Waste is the non-beneficial materials that results from our use of certain things in the environment that must be discarded (PTTP, 2000). Cassava waste is made up of the peels and the waste water obtained from the processing of cassava into end products.

The methods of disposal of cassava waste are dependent upon the place where the processing takes place. If the peeling of the cassava was done in the farm, the peels would be dumped on the farmland. In a situation whereby the peeling is done closed to a cassava processing mill, or at home, the peels are thrown into a nearby refuse bin.

The waste water obtained from the mills where the peeled cassava is grated into paste is run through pipe into dug holes and in some cases, it is left to How on the earth's surface. In areas where the mill is close to a river or water body, the waste water is directed into the river or water body.

Effects Of Cassava Waste On The Environment And National Economy

Eutrophication: This is the natural ageing process in which the lakes and reservoir water become originally enriched leading to increasing domination by aquatic weeds, transformation to marshland and eventually to dry land. Eutrophication can be accelerated by human impact on nutrient such as the cassava waste water which is very rich in nutrient. Die-off and setting of plants growth result in Biochemical Oxygen Demand, BOD (Ero and Ohenhen, 2001). This tends to decrease dissolved oxygen level. The effect of eutrophication, which may be detrimental to aquatic life is compounded by large day-night excursion in dissolved oxygen due to photosynthesis and respiration.

In water bodies such as lakes, reservoir or rivers, phosphorus is typically the limiting nutrient, although the presence of nitrogen is also important (Metcalf and Eddy, 1991).

The growth of water weeds on the water ways has some negative effects on our national economy. Government spends a lot of money yearly getting rid of these weeds from the water ways. Where this is not done, marine traffic becomes problematic and persons who live in the riverine areas find it difficult to convey their wares to the urban areas.

Another negative effect is the reduction in the quantity of dissolved oxygen in our water bodies resulting in the loss of fish and a consequent reduction in our foreign exchange earnings.

Effect Of Nitrogenous Compounds

Nitrogen occurs in water as amine-nitrogen, nitrite -nitrogen, nitrate-nitrogen and other nitrogenous compounds and these may be derived from cassava waste. These different nitrogenous compounds arise as a result of decomposition of proteinous and non-proteinous nitrogen containing compounds. Studies carried out on water pollution indicate that nitrite -nitrogen is extremely toxic to most fishes and aquatic species at low concentration and high concentration of nitrate-nitrogen causes serious and occasionally fatal effect in children (Melcaf and Eddy, 1991).

The toxicity of the nitrogenous compounds in their nitrite-nitrogen, nitrate-nitrogen forms tend to affect the fishes in the water bodies and this again leads to a reduction in the number of fishes and a simultaneous reduction in the country's foreign exchange earnings.

Effect Of Odour

Odours are generally considered unhealthy annoyance to be removed from the air. Odours may affect the well being of people by eliciting unpleasant sensations, by triggering possibly harmful reflexes and other physiological reactions and by modifying olfactory functions. Unfavourable responses include breathing and coughing, upsetting of sleep, stomach and appetite, irritation of the eyes, nose and throat, reduction in the enjoyment of home and external environment, disturbances; annoyance, depression and sometimes a decrease in beat rate and constriction of blood vessels of the skin and muscle (Derek, 1992).

Odour emanating from cassava waste water results from the decomposition of the constituting nutrients and this can be extremely offensive. The offensive odour can lead to the deterioration of personal and community pride. Odour from cassava also interferes with human relation, discourage capital investment, lower socio-economic status and thus deter the growth of the economy.

Effect Of Cyanide

Hydrogen cyanide contains some toxic substances which cause partial blindness in human being and when exposed to the environment results in soil decomposition. Cyanide exposure may result in free cyanide intermediate breakdown product of linamarin.

In many African villages where large scale garri production is carried out, cyanide can be smelled in the air as well as from many products such as cassava. Exposure to 100-200 ppm IICN in air for 30-60 minutes can cause death. It has been estimated (Onwueme, 1978), that the lethal does of HCN for human being is 0.5-3.5mg/kg body weight.

Soil decomposition due to the action of hydrogen cyanide may lead to poor crops yield. Livestock is also not spared. Fresh cassava waste water, when taken by livestock, often lead to death. These situation have some negative effects on the farmer as well as the national economy.

Management Of Cassava Waste Prior To Disposal

Hydrogen cyanide (or hydrocyanic acid, HCN), a toxic compound, is an hydrolysis product of linamarin and lotanstration by enzymes. According to Onwueme (1978), the enzyme which brings about the hydrolysis can be destroyed at a temperature above 75^{ll}C. After the processing of cassava, the cassava waste water should be heated at least, to 100°C and above so as to destroy the enzyme which would have brought about the evolution of hydrogen cyanide (HCN) gas from the waste water due to hydrolysis.

Also before the leaves and peels are discarded or disposed off, they should be boiled for a few minutes above 10()°C so as to detoxify the leaves and peels in order to reduce to the barest minimum the toxic hydrocyanic acid effect that would have occurred from enzyme hydrolysis of glucoside present in the leaves and peels of cassava.

The hydrocyanic (or hydrogen cyanide, IICN) is lethal if more than 0.lg of it is contained in the cassava waste eaten by animals at any one time.

In addition, the glucoside in the cassava waste can be decomposed directly by healing to 150°C. In order to reduce hydrocyanic acid or hydrogen cyanide therefore, the waste can be heated to about

150°C to effect the decomposition of the glucoside and the enzymes.

Recommendations And Suggestions

Cassava is no doubt a very essential root crop. However, the waste arising from processing it into a useful end product should be properly controlled in order to reduce its effect on the environment and the economy.

To this end, government should enact laws to prevent the menace constituted by the waste. The government should, in addition, engage the mass media in informing the populace on the dangers of cassava waste to our environment and economy. The mass media on their part, should spell out clearly how cassava waste can be treated prior to disposal. This will help to educate the populace on how to maintain our environment and keep a healthy economy.

Cassava processing and its waste management should be incorporated into the environmental education unit in school at all levels, since cassava is a crop utilised by all and sundry. This, to a large extent, will reduce the problems associated with the improper processing and disposal of cassava waste.

Conclusion

Cassava has been identified as an important root crop, especially to the people living within the West African sub-region. This is due to the numerous end-products that are obtainable from the crop. However, it has been found that processing cassava into the various end-products is usually associated with some waste which could be harmful both, to the environment and the economy. To minimise this negative effect, proper treatment of cassava waste prior to disposal has been advocated.

Government on its part, should be actively involved by legislating on the proper and appropriate method of cassava waste disposal. It should also mount an enlightenment campaign, through the mass media, as a way of educating the populace on the negative effects posed by the improper disposal of cassava waste.

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