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ASSESSMENT OF HEAVY METAL RESIDUES IN CASSAVA FLOUR (LAFUN) DRIED BY ROAD-SIDE AND MARKETED IN DIFFERENT MARKETS IN IBADAN METROPOLIS

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ABSTRACT

Cassava flour, generally consumed in Africa as food, is a major source of carbohydrate. Its common drying technique in Nigeria is sun drying for cost optimization whereby the flour (in powder form) is spread by the roadside for moisture content reduction process. This research was carried out at 10 major traffic highways in Ibadan to study the level of trace element pollution introduced through this drying method, identifying the sources of the pollutants mainly as automobile exhaust emission (major) and street dust (minor).The samples were collected three times at a week interval.

Thirty samples were collected altogether, it was mixed, digested and analyzed using Atomic Absorption Spectroscopy (AAS) technique to determine the concentration of four elements (Pb, Cd, Cu, and Zn). The results show that even though, cassava flour is a rich source of the essential and beneficial minerals required for healthy living, it's drying technique exposes it to the excessive intake of some of these heavy metals which could be hazardous to human health, such as cancer. Alternative drying techniques are recommended.

Keywords: Cassava, Pollutant, Digestion, Harzadous.

1.INTRODUCTION

Cassava (manihot esculenta crantz) is a root crop and since the 19th century has become established as a stable crop, cultivate and consumed in many developing regions of the world. cassava cultivation and production is important and its increasing rapidly because it grows easily, has large yield and relative resistance to disease and pest. In 2004,the world output of cassava was 2002 million metric tones and in the same year Nigeria produced 38,179,000 metric tones of cassava, making the country (i.e Nigeria) the highest producer of cassava in the world(FAOSTAT, 2006).

The plant is grown for its edible tubers which serves as a staple food in many tropical countries and is also a source of an important starch. Its value as a famine relief crop, food, cash crop, livestock's feed and industrial raw materials has long being recognized (Adetunji And Nwako, 2002).

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Cassava is a tropical root crop, requiring at least eight months of warm weather to produce a crop. it is traditionally grown in a savanna climate, but can also be grown in extremes of rainfall. In most areas it does not tolerate flooding, however, in drought areas cassava losses its leaves to conserve moisture, producing new leaves when rains resume. It takes eighteen or more months to produce a crop under adverse conditions of cold or dry weather.

A major problem to utilization of cassava tuber is its high perishes ability and bulkiness, and this has increased the post harvest losses of cassava to over 8.4%.

After harvesting, cassava roots are highly perishable and when stored, rapid physiological and microbiological deterioration occur. Cassava tuber however consist of 60-70% of water and to reduce post-harvest losses, the tuber must be processed into a dry form, which reduces its moisture content and convert the tuber into a more durable and stable product with less volume and makes it more easy for the product to be transplanted.

Processing o f the cassava tuber is also necessary to eliminate or reduce the level of cyanide (hydro cyanide acid) in cassava tuber and to improve the palatability and portability of the food product (Lanscaster et al., 1982).

Cyanide is a poisonous substance found in both plants and animals, though in varying quantities. In the plant kingdom, it is commonly found in cassava, rubber, lina beans and sorghum (Sanni, 1968).

Cassava flour (lafun) is processed locally and allowed to dry in the open space in the sun which are majorly by the roadside and on major highways, thus exposed to heavy metal contamination such as lead, cadmium, copper, zinc, etc. these contamination are residues of combustion from motor bikes, cars, buses, lorries and trailers which ply these highways and this may make the cassava flour (Lafun) consumption hazardous to human and animal health. Heavy metals are hazardous because they bioaccumulate (Jarup 2003) and poison living cells.

Cassava tuber can be processed into products which include chips, broken roots, pellets, meals, residual pulp and cassava flour(Lafun) for human consumption and animal feed, which has made it a source of income and flexible labour requirement for women.

Alcoholic beverages can be made from the roofs. Young tenders leaves can be used as a potherb, containing high levels of protein (8-10% f.w) prepared in a similar manner as spinach, care should be taken to eliminate toxic compounds during the cooking process.

In south western Nigeria, cassava flour (Lafun) consumption is continually increasing and its used for a variety of purpose ranging from boiled cassava flour (Amala Lafun), adhesive and animal feed. So this research seeks to investigate the occurrence of heavy metal contamination in cassava flour (Lafun) dried by roadside, processed locally and marketed in Ibadan.

2.METHODOLOGY

Thirty samples of lafun (Cassava flour) were collected from ten different major highways in Ibadan which includes Ibadan Ago-Iwoye Road, Abeokuta Ibadan Road, Ife Ibadan Road, Ikire

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Ibadan Road, Oyo Ibadan Road, Ibarapa Road, Lagos Ibadan Road,Oyo Isehin Road, Oyo Shaki Road,

The control sample were processed traditionally by putting the peeled or unpeeled cassava tubers in a stream or in a stationary water and leave it to ferment until the root becomes soft. The peel and central fiber of the fermented root are manually removed and the recovered pulp is hand washed or pounded.

The micro-organisms involved in "lafun" production includes four yeasts: Pichia Onychis, Candida tropicalis, Geotichum candida, Rhodoturula species. The mold include: Aspergillus niger and Penicillum spp,the bacterial includes: Leuconostoc spp and Corynebacterium spp (Nwachukwu and Edwards.,1987). Moisture, PH and temperature conditions are critical for the growth of these micro-organisms in root and thus for fermentation. The cassava pulp is taken out and heaped up on the racks in the sun for further fermentation and draining of the excess moisture. In this way, much of the cyanide is effectively lost with the liquid.

Control sample was traditionally processed and sun dried on a pavement far away from road side.

Fresh Cassava Tuber

Peeling

Washing with H_20

Soaking (for 1-3 days)

Dehydration

Sun drying

Milling

Packaging

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FIGURE 1. Traditional Method of Processing Cassava Flour (Lafun) (Flow Chart).

3.DIGESTION

0.5g of each dried lafun was weighed carefully into the Kjeldahl digestion tubes to ensure that all lafun sample materials got to the bottom of the tubes. To this were added 1 Kjeldahl catalyst tablet and 100ml of Conc. H2SO4.These are set in appropriate hole of the digestion block heater in a fume cupboard. The digestion was left on for four hours, after which a clear colorless solution was left in the tube. The digest was cooled and carefully transferred into 100ml volumetric flask, it was thoroughly rinsed with distilled water and the flask was made up to mark.

4.DETERMINATION OF HEAVY METALS

Lead (Pd), Cadmium (Cd), Copper (Cu), and Zinc (Zn) in the Cassava Flour (Lafun) samples were determined using the Atomic Absorption Spectrophotometer (AAS)

Determination: The ash of each samples obtained was digested by adding 5ml of 2M HCL to the ash in the crucible and heat to dryness on a heating mantle. 5ml of 2M HCL was added again, heat to boil and filtered through a whatman No. 1 filter paper into a 100ml volumetric flask. The filtrate was made up to mark with distilled water stopper and made ready for reading of concentration of lead (Pd), cadmium (Cd), copper (Cu) and zinc (Zn) on the atomic absorption spectrophotometer The reading obtained was converted to percentage (%) at their respective wave length using their individual hallow cathode lamp.

5.STATISTICAL ANALYSIS

Data obtained were to analysis of variance and their means were compared at 5% level of probability using the least significant difference.

RESULT.

From the result of the experiment as shown in Table1 on the concentration of heavy metal contamination present in cassava flour (lafun) samples, lead (pb) was not detected in the control and samples from Ago- Iwoye Road, Oyo Iseyin Road, Oyo Shaki Road, Abeokuta Ibadan Road, Ife Ibadan Road, Ibarapa Road. While sample from Ikire Ibadan Road had the highest lead contamination of 0.094%, which were not significantly different from the sample collected from Oyo Ibadan Road. sample from Oyo Iseyin Road had the lowest lead contamination of 0.022%.

Cadmium contamination was not detected in the sample from control but the level of cadmium contamination detected in all other samples was the same and it was <0.002 for all the samples collected for this experiment.

Copper contamination of cassava flour (lafun) samples collected and analyzed for this experiment as shown in table 1 ranges from 0.018%-0.877%, Oyo Ibadan Road had the highest copper (cu) contamination which were not significantly different from Abeokuta Ibadan Road,

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Ibarapa Road, and Oyo Iseyin Road.while sample from Ife Ibadan Road, Ibadan Ago- Iwoye Road, Ikire Ibadan Road,Oyo Shaki Road and Lagos Ibadan Road had copper contamination of 0.018%,0.118%,0.032%,0.352%,0.084%.

From table 1, Zinc contamination in the cassava flour (lafun) samples ranges from 0.183%-0.183%,sample from Oyo Ibadan road had the highest Zinc contamination which was not significantly different with the samples from Ibarapa Road,Oyo Shaki Road and control sample. sample from Ibadan Ago -Iwoye Road, Abeokuta Ibadan Road, Ife Ibadan Road, Ikire Ibadan Road,Oyo Iseyin Road and Lagos Ibadan Road had Zinc contamination of 0.840%,0.655%,0.499%,0.952%,0.765%,0.989%.

Table 1: Heavy Metal Composition Of Cassava Flour (Lafun)

S/N	NAME OF SAMPLES	%Pb	%Cd	%Cu	%Zn
1	Control	Nd	Nd	0.217	0.183
2	Ibadan Ago - Iwoye Road	Nd	<0.002	0.118	0.840
3	Abeokuta Ibadan Road	Nd	<0.002	0.614	0.655
4	Ife Ibadan Road	Nd	<0.002	0.018	0.499
5	Ikire Ibadan Road	Nd	<0.002	0.032	0.952
6	Oyo Ibadan Road	Nd	<0.002	0.877	1.183
7	Ibarapa Road	Nd	<0.002	0.504	1.103
8	Oyo Iseyin Road	Nd	<0.002	0.519	0.765
9	Oyo Shaki Road	Nd	<0.002	0.352	1.057
10	Lagos Ibadan Road	Nd	<0.002	0.084	0.989

ND= Not Detected.

.6.DISCUSSION

Meanwhile, all samples were neither lead nor cadmium contamination may have resulted from lower exposure to these contaminants; it might be toward irregular plying of the roads by heavy duty vehicles or probably too old vehicles while plying those roads.

Moreover, the water used for processing the Lafun as stated by (Lenutech, 2003) might not be contaminated by lead pipes used in water supply. Also, as we have known that the preparations

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of cassava flour (Lafun) were made locally, those women might used well water or stream to prepare this cassava flour which are free from lead and cadmium.

From the result, we discovered that, it was only contaminated with copper and zinc the exposure to these element are resulted from natural and anthropogenic sources as stated by (Lemitech, 2003) and this varies throughout the samples used in these experiment, however, higher level of contamination may have resulted from higher exposure to the natural and anthropogenic source of these contaminants.

Toxicity of Copper can inhibit the enzyme dilidroptul hydraze, an enzyme dilidroptul hydrataze, an enzyme involved in haemoporesis, and too much of Copper in water can damage marine life, the observable effect of these higher concentration on fish and other creature is damages of gills, liver, kidney and the nervous system. (Wikipedia,2006).

However from the result of these experiment some of the contamination level of the heavy metal in the samples are small compared to the permissible level, but since heavy metal tend to bioaccumulate, this contaminates due to frequent exposure can over shot the required level over time, making the consumption of lafun dangerous to human and animal healthy, since it is a traditional food eating by most tribe in south western Nigeria and it is also used as feed for livestock.

7. CONCLUSION

Cassava Flour (Lafun) dried by the road side were observed to contain some heavy metals (Pb, Zn, Cu and Cd etc) contamination and this was because the cassava flour (Lafun) has been exposed to heavy metals contamination, which are residues of combustion from motor, bikers, cars, buses, lorries and trailers that ply these highways and when consumed could bioaccumulate in living organisms and become hazardous to human and animal health.

However, the cassava flour (Lafun) sold in the market which contain high heavy metal containments reflect that the sample were not exposed to these heavy metal contaminants.

8. RECOMMENDATION

From this work it will be necessary to provide safer means of drying lafun, which will reduce exposure to heavy metal contamination like lead and cadmium which seems to be the main threats to human from heavy as stated by Jarup (2003).

These can be achieved by local farmers' cooperatives or government, by providing lawn far away from the road for drying cassava flour (lafun). However safer water should be used when processing cassava flour and zinc which are also sources of exposure of these metal to food. Longer period of soaking of cassava tuber in water should be allowed as this will help reduce or eliminate the cyanide and make lafun safe from cyanide poison.

Further study can however be carried out on this project to evaluate the daily in take of lafun by individual who eat lafun regularly as this will help to determine the level of safety in consuming lafun products and meals.

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