

THE APPRAISAL OF LOCAL FOOD PACKAGING MATERIALS IN NIGERIA

Adejumo, B.A. and Ola F.A.

Department of Agricultural Engineering, P.M.B 4000, Ladoke Akintola University of Technology,
Ogbomoso Nigeria.

ABSTRACT

Packaging is a complex subject and its role to the food industry and to the consumers includes protection, containment, transportation, preservation, and advertisement to the food industry. Defective packaging has the potential of negating all the food processor has attempted to accomplish by the most meticulous method of manufacturing processes. Nigerians have diverse ready-to-eat foods, diet and drinks varying from one tribe and geographical locations to another, with different packing materials and methods adopted. The aim of this work is to appraise the various properties of the local food packaging material used in Nigeria with particular reference to its suitability to the packaged food. A survey was carried out to ascertain the various type of local packaging materials used in Nigeria; samples of locally prepared and packaged foods were purchased from various sales outlets in Ogbomoso town, southwest Nigeria; the samples were stored at room temperature. Results shows that the common type of materials used to package food in Nigeria includes discarded bottles and jars, old stock of paper prints, leaves, maize-sheath, glass-sided boxes, jute sacks, poly sacks, polyethylene bags among others. The advantages of these materials includes availability and low cost price; while the disadvantage includes easy contamination of packaged food ,easy deterioration of packaging materials, easy spillage of packaged products, poor shelf-life of packaged food among others. It is observed that the role of packaging is not accomplished in the use of these materials; also no standard of regulatory body has been effective in ensuring the safety of ready-to-eat food.

KEY WORDS: Bottles and jars, food, glass-sided boxes, leaves, sack, paper, plastic bags.

INTRODUCTION

Packaging is a complex subject, it has been defined in several ways and its role to the food industry and imperativeness to the consumer highlighted to include protection, containment, transportation, preservation and advertisement to the food industry. Karel and Heidelbaugh (1975) in their view indicated the imperativeness of food package as an essential element requiring adequate attention to forestall the potential of defective packaging negating all a food processor has attempted to accomplish by the most meticulous forms of manufacturing processes.

Food packaging is known to employ a very wide variety of materials including the rigid metals (Cans and drums), flexible metal (aluminum and tin foils), glass (jars and bottles), rigid and semi-rigid plastics (canisters and squeeze bottles) (BPF, 2006). Others include flexible plastic of a wide variety of types that include pouches, and meat wrappers, rigid board, paper and wood products. Flexible paper and laminates or multi-layers may combine paper, plastic and foils to achieve properties unattainable with any single component (Porter, 1986). Food packaging has indeed been adjudged to assume a complex form in recent centuries; sophisticated industries have evolved to meet up with the divergent needs of food products. As technological know-how appreciates, several renown food industries in conjunction with several technological universities have immensely re-oriented the food packaging phenomena (Oyelade, 2005).

Several earlier workers have highlighted factors that influence the choice of food packaging materials such as geometric properties (shape and size), chemical property (pH), Physical properties (color, aero and hydrodynamic properties.) and thermal properties (Porter, 1986). Essentially, the geometric features of food are known to be important in packaging, in controlling fill – in weight, freezing and canning among others. The pH level of the food product intended to be packaged known to be either its



Plate 1: Roasted ground nut packaged in bottles

degree of alkalinity or acidity is of considerable importance. This is important because acidic food products have the tendency to react with certain element of the packaging material, which can lead to a sort of contamination (Porter, 1986). The colour, aero and hydro – dynamic properties due to their influence on food products particularly in terms of general acceptability are also relatively significant in packaging technology. Accordingly, the density and porosity of the food material to be packaged determines greatly how the packaging material will be. The porosity of the material has tendency to influence the moisture sorption characteristic of the food products stored, hereby having a cumulative effect on the shelf - life of the food products.

Factors known to influence the choice of packaging material of food products include permeability characteristic, mechanical strength, light transmission and temperature change. Thus, the degree of permeability of the packages to water vapor, gases and volatile odor compounds according to Porter (1986), is pertinent in packaging consideration. Food with high equilibrium relative humidity such as meat and cheese will tend to loose moisture to the atmosphere, which can result in a loss of weight and deterioration in appearance and texture. (Klicka, 1974). Products with low equilibrium relative humidity tend to absorb moisture particularly in high humidity atmospheres and this can cause significant textural distortion

Foods with high fatty acids require a greaseproof package to prevent grease or oil spoiling the appearance of the pack and possibly damaging the printing and decoration. Grease proof and vegetable parchment papers and hydrophilic films provide varying degrees of grease proofness for different application (Hernandez-Munoz *et al* 1999) Also; package material should be able to withstand the change in temperature which is likely to be encountered without any loss in performance or appearance. Therefore the rate of change of temperature and the type of heat may influence the choice of packaging material (Guise, 1989).

Shelf-life is explained in relation to the period of time during which the food product will remain safe and retain desired sensory, chemical, physical and microbiological characteristics and comply with any label declaration of nutritional data, when stored under the recommended conditions (IFST, 1992). Shelf life of a product is determined by a great deal of developmental work to arrive at what is termed adequate and satisfactory. Over the years, the forecasting of shelf – life has become increasingly important with serious consequences if incorrect. It is recognized that each type of food products needs its own procedure and methods by which such forecasting is done (Blendford, 1992).

The importance of shelf-life should therefore be tenaciously considered with respect to each of the significant groups involved in the food chain. The groups include the consumer, growers, other material suppliers, manufacturers, distributors (wholesalers and caterer) and retailers. For the distributors, wholesalers, and caterers in particular, the shelf life of a food product is intimately linked to the distribution systems in addition to the basic facts that different types of products require different types of distribution. Also in any given distribution systems, changes in the climatic conditions, handling practices and abuse can have drastic effects on products shelf-life. A total quality in the



Plate2 (a): *Agidi* (made from maize wrapped in leaves) (b) *Agidi* with fungi growth after 4 days of storage

system will need to extend right through the distribution system and it has potential of becoming the weakest part of the chain which stretches from manufacture to the consumer. In relation to this, there are special problems of distribution in the rural areas. The wholesale and catering sectors also have the potential of representing major vulnerable areas within the food chain. This is because where sufficient control is lacking, valuable shelf-life can be lost (IFST, 1992).

However in Nigeria there are diverse and numerous types of locally produced ready-to-eat foods sold in public places for immediate consumption. The packagings of these foods are usually meant for containment with little or no attention paid to the safety of the consumers and the shelf-life of the food. The hygienic state of the packaging materials and its appropriateness for the food products are not considered in its selection. The role of packaging in the food industry which includes protection, containments, transportation, preservation and advertisement are not achieved in all most all of the packaging method used in Nigeria. This in turn results in a huge loss of the food product not only during packaging processes but also during transportation and sales. The only regulatory body in Nigeria, “National Agency for Food and Drug Administration Control” (NAFDAC) has made tremendous progress in controlling the safety aspect in some of the food industry in Nigeria, such as in the confectionaries, sachet water industry and pharmaceutical industry. However, little or no efforts are made on the local food industry which is the most common in the country. There is a need therefore to analyze the properties of the various types of food packaging materials used and their suitability to the packaged food

MATERIALS AND METHODS.

A survey of the various types of locally available food packaging materials was carried out to investigate and determine (i) the properties of the various types of food packaging materials, (ii) their advantages and disadvantages, (iii) the effects of these materials on the food products,(iv) their suitability for the food products,(v) health and safety standards. The experiment was set up in the process laboratory of the department of Agricultural Engineering LAUTECH, Ogbomosho. Fresh samples of locally prepared food items were obtained from the sales outlets in the local markets, in Ogbomosho. The collected food items were then packaged in different packaging materials and stored at a temperature range of 28.5 to 32.0°C and a relative humidity range of 65.5 to 75.0 %. The ambient condition was determined using a HM 34C Humidity and temperature meter. Observations were made

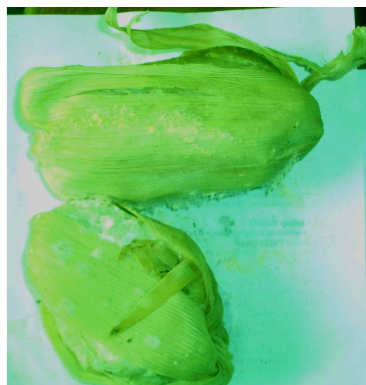
of the variations in the physical properties of the food and the packaging material to ascertain their suitability for the packaged food.

RESULTS AND DISCUSSIONS.

The results of the survey showed that virtually all the food products packaged by the local processors and vendors in Nigeria are unlabelled. No indication is given of the name of the products, its source or its composition nor any information on appropriate storage conditions or instruction for use. This is one reason street foods are displayed open and unwrapped. Sellers and consumers alike take this for granted.



Plate 3(a): *Donkunu* wrapped in maize sheath storage



(b) *Donkunu* having fungi growth after 4days of storage

The packaging materials used by food vendor in Nigeria include both flexible and rigid types. A large proportion of ready to eat foods are packed in soft or flexible materials including broad leaves, paper and plastic film wraps. The principal hard or rigid containers used on a large scale are glass and bottles. Glass-sided boxes, cane baskets and jutes or woven plastic sacks are also used in the bulk packaging of products such as smoked fish and *gari*, flour respectively. The various types of food packaging materials, types of food packaged, their characteristics, advantages and disadvantages are as classified and discussed below:

Packaging in hard containers.

Jars and bottles.

Glass containers used for food includes old jars and bottles that originally held manufactured products such as beer, soft drinks, cream and pomade. They are obtained from dealers in discarded containers, who collect them from homes, and in some cases, from refuse dumps. Jars and bottles are used even if they have minor defects at the top. They do not have any special crown or cover. Products packaged in bottles and jars includes roasted groundnut, as shown in Plate 1(a), palm wine, "*kunu*"(local drink produced from cereals),*Burukutu*"(local alcoholic drink produced from cereals),local gin, "*Zobo*"(local drink produced from *Roselle* plant) among others.

In general, the food packaged in bottles and jars contains natural or added sugar and therefore attract flies. Unfortunately, the products packaged are not sterilized before or after it is packaged and may remain uncovered during sales. With the exception of few drinks, which are strong liquor, the products have a very short shelf life at ambient temperatures and are meant to be sold within a day.

Glass containers are re-used as long as they remain undamaged. They do not react with foods and can be washed. Products packed in glass have an aesthetic appeal. Products sold in glass containers are not labeled. Purchase and use therefore depends on previous experience with or knowledge of the foods.

Glass-sided boxes.

A variety of ready to eat foods are displayed for sale in large boxes with transparent glass sides. Over the last few years these boxes have become popular for the sale of pastries and other fried or baked foods such as puff-puff, *Akara*, (beans-cake), groundnuts, pop corn, doughnut, pies, and so on. These items previously were kept in open trays, large pans and bowls and many vendors still use these containers.

The base and top of the boxes are made of wood, which holds one or more glass in place. The boxes are available in sizes of about 20x30cm with a height of 10 to 30cm or larger. They may be opened either at the top or from the sides. These boxes protect the food from flies and dirt. This has improved the way in which foods are displayed to customers. However, it may be warm and damp inside the boxes and frequent opening and closing admits flies. Also, the foods may be handled many times by different customers for inspection before purchase, such practices provides avenues for contamination



Plate 4(a): *Iru* (locust beans seed) wrapped in leaves. (b) Decomposed *Iru* with maggot after storing for 5-days

and microbial growth. However some of these boxes which are stationary are usually lighted with electrical bulb to provide warmth for the product and to make it visible at night.

Packaging in flexible material.

Leaves.

Leaves commonly used for wrapping food include those of *Thespesia populnea* (malvaceae family), *Marantodea spp* (marantaceae family) and plantain (*Musa sinensis*) and the sheaths of maize (corn, *Zea mays*). Some items are packaged raw before cooking, e.g. *moimoin*, *ekuru*, while others are wrapped in leaves after cooking while they are still hot e.g. *Agidi*. as shown in plate 2a. Fungi growth occurs in the product after four days in storage as shown in figure 2b. *Donkunu*, which is another maize product are usually wrapped in maize sheath (plate 3a), the product also shows fungi growth after three days of storage as shown in plate 3b. *Iru*, which is a local food seasoning is produced from fermented locust beans seed, are usually wrapped and sold in leaves as shown in plate 4a. The product shows the presence of maggots after three days of storage at ambient atmospheric conditions as shown in plate 4b. Products wrapped in leaves after cooking generally have a shelf life of two to three days. Cooked rice and beans are stored in bulk in a large pan and sold wrapped in leaves of *T. populnea*. They cannot be stored for more than 12 hours in the leaves.

Leaves for packaging are poorly handled and transported. They are often dirty and are kept in the open with little or no provision for washing before use. They may therefore be a source of microbial contamination of food. When broad leaves are stored for more than a week they deteriorate through drying out or decay.

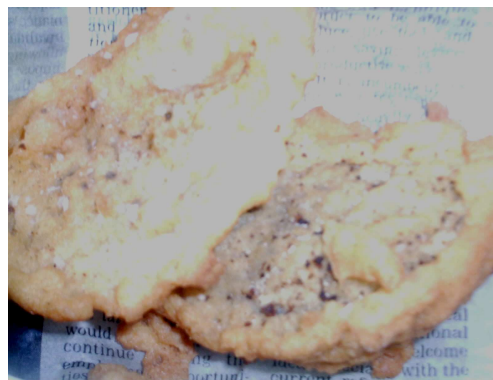
Paper.

Paper is used extensively to package a variety of ready to eat foods; with newsprint the most, commonly used. Paper wrappers are not pre-formed into any shape, but pieces are torn from a bigger sheet depending on the type of products. *Akara* (Beans-cake) are usually displayed in open trays and sold wrapped in newspaper (plate 5a). The newspaper print usually stains the food wrapped in them. The *akara* shows fungi growth after three days of storage as shown in plate 5b.

From the point of view of sanitation, the quality of paper is generally poor. Any old newspaper, multi-wall Portland cement sacks, magazine and old stationery from schools and offices are used. The Paper is not stored properly and cannot be cleaned. Such poor hygienic practices coupled with the harmful effect of printing ink make the use of paper for wrapping food a health hazard. The product packaged in paper includes *Akara*, fish (smoked or fried), pastries such as doughnuts, meat pies, cakes, puff-puff etc, bread, yam (fried or roasted) groundnut etc. The foods that are wrapped in paper are normally displayed in a pan, tray or transparent glass box and are wrapped in paper when purchased. The paper facilitates handling of the product but provides very little protection from damage or spoilage. Parcels may be loose and the food can easily spill out.



Plate 5 (a) *Akara* wrapped and sold in newspaper



(b) Decomposing *Akara* with mould growth after 3-days of storage

Plastic bags.

Transparent plastic films formed into bags are becoming increasingly important in the packaging of a variety of foods. Low density polyethylene (commonly called polyethylene) is the best known. The adoption of these bags in packaging has significantly improved the display of ready-to-eat foods from aesthetic and hygienic point of view. Unfortunately, many food vendors are not familiar with the suitability or otherwise of the various types of plastic films for different products. This can however lead to deterioration in quality of the food during storage.

Polyethylene bags are manufactured locally and are available in different sizes, ranging from narrow strips of 3x5cm to larger bags measuring 25x40cm. These films wraps are desirable for packaging food because they are much less permeable to water vapour and gases than paper and leaves and are chemically inactive with food. They are used to package both solid and liquid foods. Polyethylene bags are useful for dry products such as *gari*, sugar, milk and cocoa powder e.g. *bourvita*, as the items remain dry for a long time if properly sealed. Since heat-sealing devices are not readily available, for many vendors, the open ends of the bags are usually tied into firm knots after the food is inserted.

Bread and other pastries are packed in polyethylene bags on a large scale. Many vendors expose their products to the sun while sealed in the bags. Moisture condenses inside the bags, and this facilitates mould growth. Sometimes air is blown into bags with the mouth to open them. This introduces vapour and microorganisms, which sets the stage for spoilage when foods are placed in the bags.

Home-made ice lollies, which are commonly sold in plastic cups and beverages such as *kunu zobo*, normally served in calabashes, are now sometimes packaged in small polyethylene bags for sale. Water is also sold in plastic bags in response to official directives aimed at curbing the unhygienic practice of using a single cup to distribute water to many customers. Some vendors package vegetables such as carrot, cabbage and tomatoes, in polyethylene bags with tied ends this speed the rate of deterioration since the exchange of moisture and gas with the atmosphere is cut off.

Heavier-weight polyethylene film wraps have limited application for food except for bulk packaging or covering such items as cooked rice, boiled yam, boiled corn, porridge and others that require heat and moisture to be retained.

Sacks.

The commonly used sacks in Nigeria are the jute and poly sacks. They are used to packaged crops such as cocoa, groundnuts, maize, guinea corn, rice, beans, *gari* among others. They are locally manufactured or obtained from discarded stock. It makes bulk packaging and transportation of crops easy. However, it gets easily torn due to continuous handling and re-uses leading to losses of products during storage and transportation

CONCLUSIONS

Food packaging materials used in Nigeria are though cheap and readily available, but are however unhygienic, easily depreciable and leads to losses of the packaged food. The packages of most ready-to-eat foods primarily serve as containers for the products. They are normally not intended as a means of extending shelf-life. The development of suitable packaging materials for most traditional staples is hindered by lack of standards. Variations exist in the composition, shape, weight, and methods of preparation of products from different sources; and so it is not easy to design simple, inexpensive ready-made containers for such a wide range of items. There are no regulatory bodies controlling the packaging and sales of ready-to-eat food, hence putting the health of the consumers at risk. The Nigerian government should put in place a body to regulate the packaging and safety standards for ready-to-eat foods. This will help in safe guarding the health of a common Nigeria.

REFERENCES

- Blenford, D. F. (1992). In Shelf Life of Foods Guideline for its Determination and Prediction. A Publication of the Institute of Food Science and Technology. U.K.
- British Plastics Federation – BPF (1st Dec.2006): Plastic packaging www.bpf.co.uk.
- Guise,B (1989). Microwave Pasteurization. Food Processing.58 (6):37-38
- Hernandez-Munoz,P;Catala,R and Gavara,R (1999). Effect of Sorbed Oil Food Aroma Loss Through Packaging Materials. Journal of Agric.Food Chem..47(10) 4370-4374.
- IFST (1992). Shelf – Life of Foods – Guidelines for its Determination and Production. A Publication of the Institute of Food Science and Technology (U.K).
- Klicka, M.V(1974). Space food and their development.In:Encyclopedia of Food Tech.AVI Publishing Co.Westport Connecticut.
- Karel, M. and Heidelbaugh, N. D. (1975). Effects of Packaging and Nutrients in Nutritional Evaluation of Food Processing. 2nd Edition. AVI Publishing Co. Westport, Connecticut.
- Oyelade, O. J. (2005): Moisture Sorption Phenomena and their Effects on Film Packaging of Cassava, (*Manihot esculenta*, Crantz), Yam (*Discorea rotundata*, Poir) and Maize (*Zea mays*, Linn) Flour. Unpublished Ph.D Thesis. Department of Agric Engineering, University of Ibadan, Nigeria.
- Porter, N. N. (1986). Food Science. 4th Edition. AVI Publications. Westport Connecticut. 590 – 597

Adejumo, B.A. and Ola F.A: Continental J. Engineering Sciences 3:13 - 20, 2008

Boko, M and Heideveld,A (1997) Introducing Leaf Packaging in the Netherlands, A Survey.A UNB/ UVA
/ UNEP-WG-SPD Collaborative Project, National University Benin (UNB)

Received for Publication: 20/01/2008

Accepted for Publication: 05/03/2008

Corresponding Author:

Adejumo, B.A.

Department of Agricultural Engineering, P.M.B 4000, Ladoke Akintola University of Technology,

Ogbomoso Nigeria.

E-mail:- funmibitan@yahoo.com