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Methodological Procedure and Research Design for the study entitled "Nanotecnnology"- A Great Valuable Boon for Food Packaging

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METHODOLOGY

The present study entitled**" Nanotechnology"-A Great valuable boon for food packaging**

has been planned to be carried out with these following 3 phases

I. Preparation of Bakery products

II. Shelf life and Nutrient analysis

III. Consolidation and tabulation of data I.PREPARATION OF BAKERY PRODUCTSPackaging:

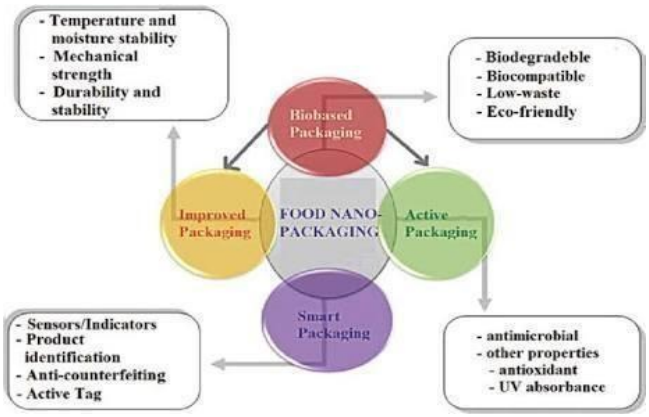
According to **Robertson (2017),** It is the Scientific method of enclosing the food materials/goods in a container to ensure the delivery of goods to the ultimate consumer in a best condition intended for their use.

Nano packaging applications in food industry can be utilized to detect bacteria, in foods or destruct the organisms which produce strong flavors and color quality and thereby increasing the barrier properties of the food stuffs. Nanotechnology is a new emerging trend in novel food packaging technique. The use and advantage of Nano packaging in foods is as follows:

- Increase the food shelf life.
- Minimize food spoilage.
- Ensures, food safety and stability.
- Reduces the problem of food shortage.
- It repairs the tears in packaging and finally
- It improves the health benefits of people.

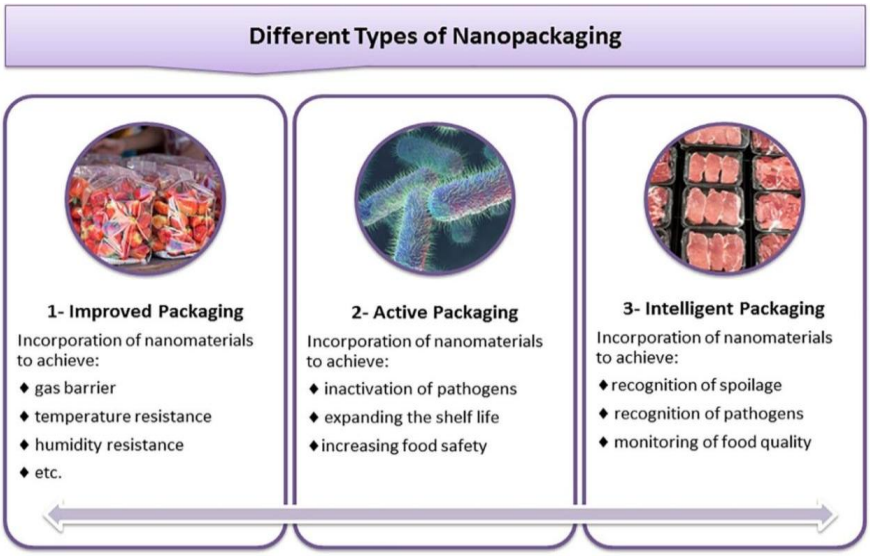
In the present study **Bakery products** has been selected for different types of Nano packaging such as **MAP** modified atmosphere packaging, **active** packaging and **smart/intelligent** packages. These **3** kinds of **Nano packages** were selected because of its effective physical and chemical barrier properties then, promotes excellent, goods shelf life.

It has been planned to be carried out in, **Darling Bakery, Vellore** because of its well-equipped nature and facilities, familiarity of the investigator, and also due to the cooperation of the worker



Bakery samples of standards and experimental are adopted with different kinds of Nano packaging materials is as follows:

s. no	Standard Food samples	Types of packaging used
A	Bread	Plastic foil covers are used
B	Biscuits	Grease proof packages are used
C	Cakes	Ordinary polyethylene plastic boxes are used
D	Muffins	Parchment plastic papers are used
E	Doughnuts	Wooden containers are used
s. no	Experimental Food samples	Type of nanopackaging used
A1	Bread	Modified atmosphere packagaging such as LLDPE,Linear low density polyethylene packages are used
B1	Biscuits	LLDPE packages are used
C1	Cakes	Active packaging such as Sachets and Pads are used
D1	Muffins	Intelligent/Smart sensors are used
E1	Doughnuts	Intelligent/Smart sensors are used



SHELF LIFE AND NUTRIENT ANALYSIS

Determining the shelf life of processed foods is one of the main problems faced by food companies when launching a product to market, or when modifying some of its ingredients. This problem is especially considerable when it comes to non-perishable products, where food needs many months, or even years, to deteriorate. That is why it is very important to employ methods that correctly estimate the shelf life of products.

We understand shelf life to be the time during which a food maintains characteristics and a level of quality that is suitable for human consumption. In the food industry, the shelf life of a food is the time between the production or packaging of the product and the time when it becomes unacceptable under certain environmental conditions (Ellis, 1994) and when the consumption ofsaid food implies a risk to consumer health.

The Directive 2000/13/EC of the European Parliament and of the Council of 20 March 2000 on the approximation of the laws of the Member States relating to the labelling, presentation and advertising of foods defines shelf life as the time from production to expiration, the end of the life of a food is when it exceeds the levels of microbiological contamination, loses its physical- chemical qualities and changes its organoleptic qualities.

From the point of view of food safety, the shelf life of the food depends on four main factors:formulation, processing, packaging and storage, which we will explain later. In countries such as Spain, each marketing company is responsible for establishing and guaranteeing the shelf life of the food it places on the market given the importance and impact on consumers' health; making a mistake on the guarantee of the shelf life of the food carries serious consequences such as product recall, consumer complaints, market mistrust and brand reputation problems.

The expiration date and best by dates of foods

Prior to understanding the methods to determine the shelf life of foods, we must take into account two elementary concepts: the expiration date and the best by date.

The expiration date is indicated on perishable products with biological risk(s), meaning its consumption after that date can generate some degree of food poisoning. This date depends largely on factors such as optimal storage conditions, water activity, microbiological criteria or oxidation.On the other hand, the best by date, which is applicable to more durable and stable products, indicates when a product begins to lose its physical qualities such as colour, smell or taste, but its consumption remains safe and presents no microbiological risk for the consumer.

There are several factors involved in the deterioration or loss of the original quality of a food. These factors can be divided into two types: intrinsic (inherent to the nature of the food itself) or extrinsic (external conditions facing food), and are determined by different quality parameters: organoleptic, nutritional, hygienic, physical, chemical or microbiological.

The intrinsic factors that affect shelf life are those that respond to the formulation of the food. In the food industry, it is imperative that the manufacturer has the following knowledge about its products:

- Raw materials
- Composition and formulation of the product (additives used)
- Water activity
- Total acidity and pH value
- Potential Redox
- Available oxygen

Taking all this information into account, the producer can choose the systems that maximise the life of a product according to the needs that it may have. For example, the oxidation of edible oils is a significant problem for the food industry due to the considerable increase in the use of fat and polyunsaturated oils (Frankel, 2010), so it is important to know the nutritional quality and the possible processes that the different raw materials have gone though, and to determine what antioxidants can slow down the oxidation process.

The extrinsic factors that affect the shelf life of the food are those that are present in the process, packaging and storage of the product. Mainly they are:

- Exposure to sunlight

- Temperature
- Humidity
- Damage to packaging
- Distribution and places of sale

During the different manipulation processes of the product, it is necessary to control its interaction with the components of the external system. To control of the process used every detail counts: the light permeability of the packaging, the distribution of humidity and the relative temperature, both in storage and in transportation, are the main external factors to bemonitored and optimised.

Methodologies to determine foods' shelf life
The methods most used today to estimate the shelf life of foods are:

Direct method
These are real-time studies that consist of storing the product under conditions similar to those that it will actually face, to monitor its evolution in regular intervals of time. The main advantage of this method is that it creates a very accurate estimation of the time it takes for a product to deteriorate; however, they are studies that usually take a long time and do not consider the fact that storage conditions of a product are not always stable over time.

Challenge Test
This method consists of experimentally introducing pathogens or microorganisms into the food during the production process, so that the product is exposed to the real conditions it will suffer in real life. The main disadvantage of this type of test is that the effects caused by the studied parameters are the only things analysed, and the fact that the product can be faced with multiple factors at the same time is not addressed. In addition, they are studies that are quite complex and difficult to implement.

Predictive microbiology
This methodology studies the different microbial responses of foods to varying environmental conditions, based on mathematical and statistical models, in order to predict the behaviour of the microorganisms in the product. This type of study, widely used when developing a new product, does consider the possible changing conditions of a product, however, its major limitation is that it implies greater complexity for the manufacturer and that the results correspond to a simulation, which may not be accurate.

Accelerate shelf life tests
In these tests, conditions such as temperature, oxygen pressure or moisture content are modified to accelerate spoilage reactions of a food. These predictions allow one to predict the behaviour of foods in certain conditions and to estimate how they will evolve under certain storage conditions. Accelerated tests allow the inclusion of changing environmental conditions and concentration variations of the ingredients that they are composed of. These studies are very versatile, low cost for the manufacturer and allow for the comparison of different scenarios. Obviously, since it is not an exact representation of reality, there is some margin of error in the obtained results.

Survival method
It is a type of study that is based on the opinion of the consumer about the physical characteristics of the product. It consists in knowing the attitude of people towards the same product with different dates of manufacture, to determine if they would consume it or not. This method seeks to establish a relationship between the shelf life and the perceived quality of the product. Although it is not a method to accurately estimate the shelf life, it is important to do it in a complementary way to establish the best by date of a product.

In the present study**, 5 kinds** of Bakery items such as were selected for Nano packaging and therefore they are named as standard and experimental samples such as A.,A1,Bread, B.B1,Biscuits,C.,C1 ,Cakes, D,D1Muffins,E,E1,.Doughnuts Respectively. Standard samples wereadopted with ordinary food packages.

Nano based bakery samples were assessed for its shelf through microbial analysis of various proper channels. Based upon the literature review &supportive studies,each sample need a timeduration of 15 to 20 days,to assess its shelife through

DIRECT METHOD

From the shelflife analysis among 5 differnet categories of both standard and experimental samples are proceed to

determine 2 findings such as follows:
Which kind of bakery products got best shelf life, and good acceptable characters .Those best shelf life accepted samples of both standard and experimental samples were analysed for its nutritional quality.

We also compares simultaneously which kind of packaging was best wheather normal ordinary ones or Nan packaging goods were good.

s. no	Bacterial analysis	Medium used
1.	Enterobacter &Salmonella	VRBGA Voilet Red bile glucose agar medium
2.	Clostridium Perfringes	TSC Tryptose sulphite cyclo serine agar medium
3.	Camphylobacter	Bolton broth media
4.	Staphylococcus aureus	Braid Parker agar media
5.	Lab &E.Coli	MRS,Man,Ragosa,Sharp agar media
6.	Pseudomonas	CFC cetrimide fucidin cephaloridine
7.	Fungal analysis	Effective PDA Potato Dextrose agar medium has been planned to be used for fungal organisms determination

Nutrient analysis:
Nutritional analysis is the process of determining the nutritional content of food. It is a vital part of analytical chemistry that provides information about the chemical composition, processing, quality control and contamination of food. It ensures compliance with trade and food laws.

The Best accepted shelf-life, of standard and Nano based Experimental food packaging samples were evaluated for its nutritional quality through AOAC (Association of Official Analytical Chemists) in terms of both Macro (Energy, CHO, Protein, Fat & Moisture), Micro (Iron, VitaminC and Calcium)**.**

S.no	Macronutrients	Method used
1.	MacronutreintsEnergy Estimation of Gross energy of foods were determined by GE*ED/100 is planned to be used	GE=Gross energy ED =Energy of digestability
2.	Protein	Biuret method Protein of the sample = OD test *con.std/OD test
3.	Carbohydrates	HPLC METHOD
4.	Fat	Soxhlet method
5.	Moisture	Mw / M sample*100

S.NO	Micronutrients	Method used
1.	Calcium	Flame Photometer
2.	Iron	Radioisotopic method
3.	Vitamin C	2,6 Dichlorophenol indophenol method

CONSOLIDATION AND TABULATION OF DATA

The data obtained from Shelf life and Nutrient analysis of each category, of Nano based food products were tabulated, analyzed, and interpreted statistically .In the area of statistics **Chi square test & paired comparision T test** has been planned to be carried out to determine the difference and means score of food samples.

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