

Smart Packaging Technology with Culture-Glasses

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Abstract: Packaging products include any product in its container with packages that will be offered for sale or by which information is passed on to consumers. Packaging can be described as a coordinated system with the aim of preparing goods for transportation, distribution, storage, sale and consumption. Packing the other hand is the art, science and technology to prepare goods for shipment and sale and on the other hand, means to ensure product safety in the delivery of end-users with the lowest average cost is in the best condition. Now the question is thought that the culture of a modern society and how much progress is being able to accept the use of technology and at the same time will be effective and efficient. The achievements of this study is to examine nanotechnology, smart packaging moderately priced, make culture, socialization pointed out repeatedly. In this study, using descriptive-analytic review of the application of nanotechnology to enhance the culture has been used to build intelligent packaging. Advances in intelligent packaging to increase shelf life of products downstream industries, the goal of many hosting companies. The system will be able to tear packaging and small holes due to environmental conditions environment (such as changes in temperature and humidity) restoration and consumers aware of the destruction of the product.

Key words: Nano, packaging, culture, technology, destruction, downstream industries

INTRODUCTION

One of the most important and effective factors in the industry which has an influence on what the customer selects and buys is packaging. In fact a product's packaging is its clothing, its identification it acts as the silent seller somehow. It can also be very effective on improving and increasing the value and meaning of the product in the customer's mind, guaranteeing the health of the product, enhancing the customer's ease, reducing the costs and so on (Feyz and Selahshoor, 2008). Packaging is the first feature of the product which catches the customer's eyes. It either leaves a good or bad impression because it is the first thing the customer sees. There are two aspects which are considered when it comes to packaging being applicable and attractive. A packaging is applicable when it is cheap, protects the product and facilitates movement and arrangement. On the other hand an attractive packaging has a unique design, color, shape and texts written on it. A designer shapes the identity of the product with packaging and that is why it is considered to be strong tool for marketing and selling goods.

Both nationally and internationally speaking, packaging is a great tool because it plays a key role in increasing and decreasing the stored products and ultimately, it is important as far as maximizing the productive firms is concerned. The focus has been on the

economic firms for years regarding the reinforcement of the competitiveness in national and international markets. They use different designs, graphics, colors and appropriate packaging to have the upper hand compared to their competitors. An appropriate packaging can act as the silent salesman, since it does not only play a role in the production area. As regards packaging, the marketing managers are supposed to establish a relationship with the customer and encourage the customer to buy the product. The decision they mutually make with production managers can be effective in selecting the best method for packaging and in marketing. Studies conducted by large enterprises on marketing and strategies for increasing sales have shown that packaging is the most effective factors on attracting customers and selling strategy in national and international markets (Rai *et al.*, 2009). Therefore, using up to date technologies will be crucial for improving the packaging industry particularly in the downstream industries for them to increase their sales and exports.

This study, aims to investigate the nanopackaging method in downstream industries. It's a shame that these valuable and priceless products which are the legacy of our tradition become prepared for production by experts and skilled artists and craftsmen but at the final stage, their packaging is not monitored well. Although, packaging of a product is the symbol of the culture and values of a country and it introduces the product no great effort has been made to improve the packaging used

by downstream industries. In this research, the nanotechnology used for packaging and the application of polyethylene in making the raw materials for packaging have been discussed as well as the application of polymers in general by considering their specific features. After reviewing the place of modern technologies and materials in the structure and covering structural packaging, we have explained the cultural tendencies of the society and what is people's approach to this type of technology.

MATERIALS AND METHODS

The method selected for this study has been deductive reasoning method along with the analytical-descriptive measures. This research aims to investigate the application of nanotechnology and nanoscience in the packaging of downstream industries and to review the effect this technology has on the culture of using packaging which will be discussed as follows.

Factors of formation of nano in the world: Nanocomposites and the improvements which have been observed in the area of science and technology in the past few decades have proven that these materials with dimensions of approximately 10-100 nm have been the key to solving many problems.

An inclusive definition of the nanocomposites is as follows; it is compound made of distinct substances, microscopically. These components can be recognized separately or one of the components is in a nanoscale. One of the well-known composites is "concrete" which is comprised of two components: cement and sand. Another scientific achievement is associated with food packaging. Nano-sensors have been designed in such a way that when gases which make the food go bad are emitted, the color of the packaging changes which is an indication of the corruption of the food and it shows that microbes have entered the packaging.

If we want to use this approach in associated with downstream industries, it is natural for downstream industries such as inlay to consider a few things. Some of the things they must consider is the strength at the time of transportation and movement, resistance against high and low temperatures (not reacting to heat for instance, lack of expansion or contraction), determination of a proper location for them to be put at and for the product to be fixed. An important issue in the packaging of downstream industries is the ion migration/diffusion. Atmospheric gases, water vapor or natural substances

that are mixed with a substance at the time of packaging or the material used for packaging can penetrate almost any substance. Nano-polymers are divided into the three categories which will be discussed as follows.

Advanced nanopolymers: Here, we will introduce nanoparticles that simultaneously increase strength and flexibility, prevent the entering and exiting of Oxygen (O₂) and Carbon dioxide (CO₂) which lead to the creation of humidity and destruction of product. Clay nanoparticle is one of the most applicable and famous nanoparticle which will be discussed as follows.

Nanotechnology in packaging and the effect of the culture of society: Here, given all of the previous reviews, this question comes to mind to what extent the developing countries would encounter the cultural tendencies associated with nanotechnologies and what will be the consequences and whether or not they will be accepted (Farhangzadeh and Jamshidi, 2011).

The results of previous studies on the packaging of downstream industries and lack of proper packaging for the precious legacy that this is for our country it has been aimed to investigate the place of downstream industries in Iran and how much they recognize, it and consider it valuable.

Culturally, speaking what is obvious in the society nowadays is that in most developed countries a great portion of the country's budget is allocated to the packaging industry and knowledge and goods with low quality enter the market in attractive and accepted packaging for the customers to like.

Unfortunately in our country, we face the reality that the products of downstream industries enter the market in inappropriate, vague and unidentified packages which are not much desirable and are presented to the consumers. Although, these products are the outcome of the hard work of experiences and skilled artists and craftsmen in our country they are not as appreciated as they should be.

There is often a single packaging which is proper for the culture of each country and is the symbol of that country's identity. Thus, when a suitable packaging is defined for a product, the most important thing to have in mind is whether that specific packaging would be attractive, effective and appropriate if the product was to be exported to other countries with different cultures and traditions or not. The two important factors here are the packaging's color and design since they are the first thing that the customers will see. Take the color white for instance it is the symbol of happiness in a country and

the symbol of sadness and sorrow in another. Therefore, it can be concluded that in terms of culture what the countries have in common and the totality of the issue must be considered (Kermaninejad, 2003).

Society's awareness of the advantages of suitable packaging: Promoting the application of downstream industries with standard, scientific packaging that observe the international standards and creating healthy competition in the national and international markets are some of the goals of specialization of principal packaging of the products of downstream industries. Similarly, the purpose is to supply the products better and protecting them from the risks of movement.

Smart industrial packaging with nanotechnology in traditional food: Nanotechnology is the science of studying and using nanoparticles in a 1-100 nm scale. This technology has had great influence on the food packaging industry. We can get new ideas for technical specifications and resistance of containers, detecting pathogenic factors and strategies for producing active and smart packaging. Currently, potential application of nanotechnology has been practically known in each sector including food industry, agriculture, food processing, food packaging and food supplements (Tang *et al.*, 2008ab).

Dynamic economy in smart packaging: One of the important parameters affecting the advancement and growth of developed countries and their success in the daily increase of the production as well as their taking over world markets is having standard packaging and presenting products in very attractive packages and coatings. The culture of packaging products for presenting and selling products in various world markets is a culture which has become particularly important over the past few years and it has turned into a significant factor that plays a crucial role in the rate of sales and competitive score of the products of the production sectors (Arvanitoyannis *et al.*, 1996). The more beautiful the package of a product is the more it includes the specifications of that product and the better, it introduces the product, the better it would be sold in the market. The most important point here is that the package must be in compliance with the psychological aspects of the customers. The importance of this matter becomes evident when a proper and beautiful package attracts the buyers and overshadows its low quality to a large extent. In these cases, the buyer easily passes on the goods in improper or simple packages and buys the product which has a nicer one even if it is of lower quality. Packaging is the

face of a product because that is how the buyer identifies the product. It sends the producer's message to the buyers and establishes a relationship between the two and it informs the customers. The economic capacities that are hidden in the culture of a society can be exploited, one of which is the packaging. Unfortunately, the majority of ordinary people believe that an elegant, suitable and beautiful package makes the product more expensive, the traditional class of the society in particular. These people continue to use uncategorized products which don't come in packages. In today's world, technology is constantly growing and the competition is become stiffer each day; hence, the packaging culture can be considered as the culture of consumption. In fact it can be said that an attractive package which has the essential standards in terms of health, protecting the quality of the product and being desirable for the consumer would make the manufacturer better prepared for succeeding in their target market. It is important to note that when the specifications of a product are categorized, packaging is an item like advertisement which is associated with the easiness of consuming the goods and maintaining it. It is considered to be an advantage for attracting the customer. Of course, it is necessary to mention that a nice package won't add to the value of the product and the manufacturer must not force the buyer to pay more because of it. In fact, a suitable package can be an advantage that would attract the customer to that particular product among others. Therefore, there must not be an added expense like there is for advertisement. In terms of the weight of the packaged product, care must be taken that the weight of the package is not considered when the weight of the product is being calculated and the weight of the whole product is its net weight (Kermaninejad, 2003).

RESULTS AND DISCUSSION

Reasons for making proper smart packaging: Standard and suitable packaging of a product can have numerous health-related or social advantages and it can guide the consumer to using the product optimally. If the culture of packaging becomes widespread among manufacturers, and if all of them believe that they need to present products in suitable packages and if the consumers consider using products with nicer packages a priority, the entire society will definitely benefit from this culture in the long-term. Generalization of this culture has driven the manufactures to produce every product in a specific package with the name and address of the factory. They are also required to write down the date of production and expiration of the product. One of the greatest advantages of this is to attract brokers and dealers and finally to

decrease the prices. On the other hand, using packaged goods leads to the growth of new shops and elimination of traditional ones. This will probably prevent the business units from developing in non-business spaces and environments. Using proper packages has other benefits too, one of which is price stability and uniformity throughout the society. Also presenting the packaged goods and their standardization can lead to the advancement of electronic business throughout the society and retail and many buyers order the product they need through internet or by phone and to the elimination of many intercity trips and it solves many of the problems in the society such as traffic or the ascending process of gas consumption (Stephen, 2006). Using packaging for distributing goods reduces the time interval between production to distribution to consumption and that is how the production is always accurately supervised. Using standard packages for products prevents the unstandardized, unhealthy and harmful goods to enter the market. In addition, the rate of supply can be controlled by supervising the distribution centers. As it was already mentioned, the fact that using nice and standard packages has become a tradition has advantages both for the manufacturer and for the consumer. Using a frame called package in the short term makes the work of the producer way harder but it will definitely have advantages in the long term. In this case, the manufacturer will look for new methods and strategies to be innovative.

Effective factors on packaging: As it was already mentioned, packaging is an advantage for the product to remain the best and to survive in the market. However, packaging is influenced by various factors such as economic and technical factors and population. Each of these factors affects the type, quality and quantity of packaging separately or in association with others. Economic factors have an impact on the packaging of a product including mass production, presence of a competitive market, increase of the number of service and production units, growth of per capita income and consumer's seeking diversity. Care must be taken that having a high volume of production makes packaging more economical. The manufacturers make a suitable and attractive package for the goods and deal with the added expenses only when they are in a competitive environment and believe that they are fragile. This happens when the market is filled with the products presented by their competitors or when the competition is producing the same product. The mentioned economic condition is generally focused on the manufacturer but the two other factors are directly associated with the

consumers. Enhancement of the per capita income has made people's lives more luxurious and it has made them love using packaged and elegant products. On the other hand, people's seeking diversity is one of the most evident characteristics of human beings. It is an issue which must be always considered by the producers in order for them to be able to make their production compatible and to change the type of packaging. That is how they will make their products attractive for the consumers. In addition to the economic factors, population has a considerable effect on the packaging and on making a change; because the manufacturers usually focus on populated cities and invest in their needs and tastes of the costumers. The more populated an area is the more competitive the market would be. In these cases it becomes more important for the producers to survive. Therefore, population can be considered as a factor that impacts packaging. Various technical factors affect the packaging of the goods. For instance, diversity of packaging is believed to be affected by this factor. Technology is a factor which has a great effect on packaging, variety and its evolving process (Rai *et al.*, 2009). On one hand when a product is being presented to the market, there is another effective technical factor which is usually seen more in large shops and that is when the buyers can see the products themselves and select the product they need without being influenced by the things that the salesman says. In these shops, the packaging of the product and its attractiveness are way more important since that is how the product would stand out among others. There are other factors that have a great influence on the choice the buyer makes are the product's being well-known, the price of the goods, consumer's experience and being impacted by the advertises.

Customer's taste regarding smart packaging: It must be kept in mind that the main role of smart packaging is to directly target the taste of the consumers and attract their attention. They are also full of advantages for the goods that need packaging. In this regard, some specifications can be defined for packaging, each of which is effective either alone or in relation with others. These specifications help the product be more successful in the market. Packaging is in fact a kind of advertisement for the product. It can be considered as a great advertisement as well as having those features. If a product came in a suitable package, its transportation would be facilitated and it would be easier to keep it. On the other hand in the case of corruptible goods which are usually eatable materials, selecting a proper and healthy package would

increase the life span of the product. In some cases, the packaging of a product even facilitates its consumption (Aghajanzadeh and Maghsoodloo, 2013).

Reduction of the costs of packaging using nanotechnology: If we take a look at each sector of our country, we will see that lack of a proper packaging is a key factor when it comes to weakness of production and rate of sales of the products. In Iran, packaging is just a trend. Although, managers and ordinary people are more or less familiar with the necessity of a suitable packaging, no specific and purposeful strategy has been determined for it yet. A reason for this matter might be the fact that packaging is expensive. The packaging sector requires a development that would decrease its costs.

Finding special, new and innovative methods for presenting the products of the downstream industries to the customers is a very important point to increase their rate of sales. Therefore, the two inseparable factors that result in the prosperity and increase of the sales of productive goods are the packaging of the product and customer satisfaction and acceptance. Unfortunately, in our country the products enter the markets with non-national brands and signs and in used cartons in a way that they are known well and this has been the common method for years and will probably continue to be the most common one. Neither the cultural heritage, the unions and the downstream industries cooperatives have taken any effective measures nor the rural cooperatives have spent sufficient time. The private sector has not been very influential in this regard either. Starting and developing the packaging industry in Iran cannot be traced back to more than 50 years ago. Nonetheless, the development of the industry and the industrial culture highly depend on the advancement of packaging (Henriette and Azeredo, 2009).

The cultural contrast between traditional and smart packaging: According to the previous researches and recorded information and what can be seen in today's society, lack of an appropriate packaging for Iranian downstream industries is made by experts and skilled specialists in this area. Unfortunately they are being presented to national and international markets with low quality because they don't have the proper packaging which is the symbol of the culture and it is the identity of a society. Most of the traditional food used in Iran have improper, undefined packaging including saffron, dried fruit, processed meat, cheese, pastries, cereals and dairy products produced in the provinces, etc. The important purposes of packaging traditional food are increasing the life span of the product, protecting the food from

corruption because of internal and external factors, oxidation, better and easier transportation and ultimately, improving the marketing of the product (Choudalakis and Gotsis, 2009).

In order to export materials to national and international markets, it is necessary to use modern technologies and nanotechnology which are common these days in the developing countries. By taking into account this fact an appropriate packaging would be one that wouldn't endanger the environment. Therefore, the materials that revives the cycle of nature by returning to it would be proper and in this process a suitable economic approach must be chosen. The packaging technology not only increases the life span of the food products but it also is the reason why in a country like USA, only 4% of people can both supply the food needed by all of the people with their activities and export a portion of products to other countries (Liyaghati *et al.*, 2012).

The culture of using nanopackaging: The products of Iran's downstream industries are packaged in the production sector by mostly small producers and in workshops with low area in a traditional way. On the contrary, the production has a mechanism in other countries. This weakness is caused by lack of investors in the packaging sector of the downstream industries; whereas an exponential growth can be seen in the food sector because there are enough investors in this section. Iran alone is not capable of mass production in the production sector of the downstream industries. This is because of the cultural habits of buying these products in a workshop and the investors are not interested in investing in these industries. The culture must change and people must be educated so that, they would understand that products which are packaged immediately after production are healthier and of higher quality. When people accept this an increase will be seen in the demand for goods with nice packages. In addition to this method, the prices in the packaging sector must be controlled because packaging is an additional activity in the production and the costs are high in Iran. More efforts must be made to increase production in our country so that the costs would be reduced (Liyaghati *et al.*, 2012).

Creating the culture of packaging the products of the downstream industries: The culture of packaging products for presenting and selling products in various world markets is a culture which has become particularly important over the past few years and it has turned into a significant factor that plays a crucial role in the rate of sales and competitive score of the products of the

production sectors (Arvanitoyannis *et al.*, 1996). The more beautiful the package of a product is the more it includes the specifications of that product and the better it introduces the product, the better it would be sold in the market. The most important point here is that the package must be in compliance with the psychological aspects of the customers. The importance of this matter becomes evident when a proper and beautiful package attracts the buyers and overshadows its low quality to a large extent. In these cases, the buyer easily passes on the goods in improper or simple packages and buys the product which has a nicer one even if it is of lower quality. Packaging is the face of a product because that is how the buyer identifies the product. It sends the producer's message to the buyers and establishes a relationship between the two and it informs the customers. The economic capacities that are hidden in the culture of a society can be exploited, one of which is the packaging (Dainelli *et al.*, 2008).

CONCLUSION

There must be more serious reviews about reforming the structure and advancing the packaging system in the stiff competition of national and international markets for various goods so that better decisions would be made in this regard. An organization must create a uniformity in modern and advanced technologies and nanotechnology in order for an organization to succeed in the competition. This is not possible without having a systematic approach in packaging in a uniformed system. We can see a considerable improvement in the packaging if nanoparticles are used and it is by using a systematic approach to packaging that a comprehensive packaging system would be created. All in all, previous investigations have compared three substances polyethylene, poly vinyl chloride and nanoparticles which can be used in the packaging industry. By reviewing these studies, it was specified that given that the nanocomposites are culturally and publically accepted, they now have a wider and more substantial application in the society. In addition, it is necessary to note that the steps to achieving a package using nanoparticles is way less expensive and way more economical than that of polyethylene and poly vinyl chloride. One of the most principal reasons for minimizing the application of poly vinyl chloride and its derivatives in packaging are the physical features it has and the fact that it reacts quickly (Rai *et al.*, 2009).

Nanotechnology is now ready to be used in numerous areas of the industry including packaging. It can promote the product and widen its borders in the geographical markets as well. It is clear that if new

technologies are managed accurately they can play a key role in improving the culture and economy of the packaging of downstream industries. Therefore, packages with humidity and oxygen adsorbent are especially significant for business (Henriette and Azeredo, 2009).

RECOMMENDATIONS

The following strategies and recommendations are presented in order to improve the packaging of downstream industries; creating the culture of packaging with nanoparticles in accordance with its importance in transportation, maintaining, distributing and buying products and how it is consumed;

Establishing a strong relationship between the principles of ordering the product, supplying, buying, consuming, transporting and storing the product to minimize the problems with its packaging; reinforcing cooperatives that export the products of downstream industries. These cooperatives include graduates, experts and producers of the domain of art and industry of these products by considering a proper and economical packaging; preparing and providing proper sources of raw materials and providing craftsmen with them; (Arvanitoyannis *et al.*, 1996). Reviewing the role of village's downstream industries in entrepreneurship and employment to improve tourism; establishing a direct relationship between art and industry and effective cultural tendencies of a society; using new packages, including smart packaging for food in order to meet the needs of consumers, producers and the developing product (Ahvenainen, 2003; Chaudhry *et al.*, 2010).

REFERENCES

- Aghajanzadeh, S.S. and Y. Maghsoodloo, 2013. Application of active smart packaging of other cooking products. *Promotional Sci. Q. J. Packag. Sci. Technol.*, 1: 36-45.
- Ahvenainen, R., 2003. *Novel Food Packaging Techniques*. Woodhead Publishing, Sawston, Cambridge, ISBN:1-85573-702-7, Sawston, Cambridge, ISBN:1-85573-702-7, Pages: 589.
- Arvanitoyannis, I., A. Nakayama, E. Psomiadou, N. Kawasaki and N. Yamamoto, 1996. Synthesis and degradability of a novel aliphatic polyester based on l-lactide and sorbitol. *Polym.*, 37: 651-660.
- Chaudhry, Q., C. Laurence and W. Richard, 2010. *Nanotechnologies in Food*. RSC Publishing, New York, USA., ISBN:978-0-85404-169-5, Pages: 229.
- Choudalakis, G. and A.D. Gotsis, 2009. Permeability of polymer-clay nanocomposites: A review. *Eur. Polym. J.*, 45: 967-984.

- Dainelli, D., N. Gontard, D. Spyropoulos, V.D. Zondervan and E. B. euken *et al.*, 2008. Active and intelligent food packaging: Legal aspects and safety concerns. *Trends Food Sci. Technol.*, 19: 103-112.
- Farhangzadeh, S. and H. Jamshidi, 2011. Recycling Poly. *Res. Educ. Q. J.*, 1: 4-12.
- Feyz, D. and A. Selahshoor, 2008. *The Role of Packaging in Marketing*. 1st Edn., Semnan University, Semnan, Iran.
- Henriette, M.C. and D. Azeredo, 2009. Nanocomposites for food packaging applications. *Food Res. Intl.*, 42: 1240-1253.
- Kermaninejad, F., 2003. *An Outlook to the Design of the Package*. 1st Edn., Karin von Ompteda, Tehran, Iran.
- Liyaghati, L., M. Azizi and M. Jokar, 2012. Application of nanocomposites in food and packaging industries. *Mon. J. Nanotechnol.*, 1: 14-18.
- Rai, M., A. Yadav and A. Gade, 2009. Silver nanoparticles as a new generation of antimicrobials. *Biotechnol. Adv.*, 27: 76-83.
- Stephen, F., 2006. *Seal Strength and Package Integrity the Basics of Medical Package Testing*. TM Electronics, Inc., Boylston, Massachusetts.
- Tang, S., P. Zou, H. Xiong and H. Tang, 2008a. Carbohydr polym, Ecosustainable Polymer Nanomaterials for Food Packaging. *J. Food Packag.*, 72: 521-521.
- Tang, S., P. Zou, H. Xiong and H. Tang, 2008b. Effect of nano-SiO₂ on the performance of starch-polyvinyl alcohol blend films. *Carbohydr. Polym.*, 72: 521-526.