

TECH-KNOWLEDGE

The Official PMG Engineering Newsletter



**FOOD & BEVERAGE
INDUSTRY**

**ENGINEERING
& DESIGN**

**SCIENCE &
TECHNOLOGY**

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Active and Intelligent Packing



Introduction

The ability to package food has made our lives easier in many ways. Packaging is important to contain foods, protect it from external elements such as adulteration by water, gases, microbes, dust, to name a few, and to disseminate information to customers about the contents inside it. Although traditional packaging covers the basic need of food containment, advances in food packaging are both anticipated and expected to solve modern problems. One such issue is spoilage during transit; It has become a significant area of concern, recently. Even though supply chain and logistics networks has improved rapidly in this decade, innovation in packaging that can detect as well as prevent spoilage of agro-products will further reduce this problem, thereby preventing post-harvest losses. In India itself, post-harvest losses accounts for around 30% of overall agricultural production. This, coupled with erroneous grading while packaging, makes a severe impact on the farmers income. Thus, it is of utmost importance to invest on the research and development of unconventional yet novel packaging materials and technology.

With growing knowledge in polymer and materials sciences, it is now possible to fabricate "intelligent" polymers as food packaging materials with added functionalities that is both useful and necessary. Two such recent advances are Active and Intelligent packaging materials.

Active Packaging

The active packaging systems are developed with the goal of extending the shelf life of foods and increasing the period where the food remains of high quality. These technologies include some physical, chemical, or biological actions which change interactions between a package, product, and/or headspace of the package to get the desired outcome.

1. Scavengers

Compounds such as oxygen and ethylene affects the freshness of food products. For instance, an increase in the level of oxygen leads to oxidation of the product, thereby making it rancid and stale, and the release of ethylene by climacteric fruits can cause a series of chain-reactions, making the whole lot ripe before it is due.

2. Antimicrobial packaging

Utilization of antimicrobial agents in food packaging is beneficial to prevent the growth of microbes and bacteria that can be found in a packaged food or packaging materials and thus increases the shelf life of the food products. Research carried out in this field show that antimicrobial films are more effective as compared to the direct addition of antimicrobial agents to foods because the antimicrobial agents slowly gets released from the packaging film surface to food products with the required concentration to prevent microbial growth.

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Intelligent Packaging

Intelligent packaging is an emerging food packaging technology that is improving the traceability, safety, and quality of food. It is described as the science and technology that introduce the communication tools for a food packaging system to monitor changes in the internal and external environmental conditions of the system as well as the packaged food, to communicate the status of the system to the stakeholders of the supply chains including producer, retailers, and consumer.

1. Time Temperature Indicator

It is a well known fact that, the quality of a food material is severely dependent to its temperature history from production to consumption. These indicators can monitor the accumulative effect of temperature on food quality. They are attached on the surface of food packages and integrate the exposure of the packaged food to temperature by accumulating effects of such exposures along the entire cold chain. The working principle of these indicators is based on different enzymatic/ mechanical/ chemical reactions between two or more materials, and as a result, the irreversible discoloration of indicator as an explicit response takes place.

2. Gas Indicator

It is an adhesive label placed on the surface to show changes in the composition of the gas inside the package. These type of indicators shows the presence or the absence of carbon dioxide, oxygen, or ethylene. This kind of indicators needs to be in permanent contact with the food and the atmosphere inside the package to function properly.

3. Biosensors

Biosensors are devices that can detect specific biological analyses and converting their presence or concentration into some electrical, thermal, optical or other signals that can be easily analyzed. A typical biosensor consists of three basic components: bioreceptors, transducer, and electronic system. These biosensors can be integrated into the packaging material to detect several components such as ethylene, microbes, etc.

4. Radio frequency Identification System

RFID technology presents an advanced data carrier system which has the capability of data storage up to 1 MB, non-contact and non-line-of-sight ability to collect real time data. The advantage of integrating RFID includes traceability and promotion of quality and safety of food. The RFID technology can be applied in the food industry in the fields of supply chain management, monitoring conditions of foods, and ensuring food safety.

Conclusion

Increasing demand for continuous monitoring of the food quality and extending the shelf-life of food products had led to emergence of developed types of packaging methods as Active Packaging and Intelligent Packaging technologies. These packaging technologies complement the present methods and further add values by adding more functionalities required for modern-day living.

“5S” Plan in Office



Introduction

The 5S methodology (Sort, Store, Shine, Standardize, Sustain) was originated in Japan and was first implemented by The Toyota Motor Corporation. The methodology was developed to make just-in-time (JIT) manufacturing possible. The founder of 5S is a Japanese inventor Sakichi Toyoda. Implementation of 5s helps us to know the amount of a product that is needed when it is needed. Having an organized workplace for the smooth running of a business is very important. 5S is an important tools that can be applied in an organization. It results in a workplace that is clean, uncluttered, safe, and well organized to help reduce waste and optimize productivity.

“5S”- Implementation plan

1. Step 1: How Well is Your Business Doing?

- Do people in workplace struggle to locate documents or files, whether in physical or digital format?
- Are there loose, sagging electrical cables in the workplace?
- Are there files, drawers, and cabinets that are unlabelled, or do they contain unmarked content that is hard to identify?

2. Step 2: The 5S Methodology: Broken Down

- **Sort (Siri)**

The first step is to sort this means that all the unwanted things should be removed from the workstation. Eliminate all duplicates, unnecessary equipment, infrequently used items, and trash. This saves time, space, and labor costs.

- **Store (Seiton)**

Now all the equipment that is needed assign a proper place for all equipment, work in progress, and raw materials, keeping ease of reach, identification, and proximity to work surface in mind as you do.

- **Shine (Seiso)**

Clean everything every day. Doing this keeps things ready to be used when needed. A clean workspace is a productive workspace, and Seiso means “to clean or shine.” Floor, walls, and equipment must be cleaned daily one must ensure that all items are restored to their designated place. One must make sure that his workplace is clean. This should be a part of your daily tasks and should not be postponed until it becomes a habit.

- **Standardize (Seiketsu)**

One must ensure the conditions of the work area do not return to the original, Make the above three 5's part of your daily procedures each day. Implement them in your organization with the help of signs, banners, shadow boards, tool holders, etc. Make sure that all employees understand their roles and responsibilities and are empowered to perform all the tasks.

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• Sustain (Shitsuke)

Make a habit of properly maintaining correct procedures to avoid backsliding. Implementing these steps is a continuous process. It is important to ensure that they are done each day to prevent going back into old habits. The previous 4 steps must be Continued over time.

3. Step 3: The Action Plan

5s implementation can be done by giving training to employees to understand the system. Firstly, to start with the top three 5s Requirements.

- Take a picture of the Current Status of workplace.
- Now sort the things that are needed and that are not needed.
- Things should be organized in a proper way so that there is a designated place for everything.
- Prepare list of items that dont have any use in current scenario and need to be sorted. This could be any items that is of no longer use, and need to be sorted basis donating them, recycling, or throwing them away.
- Take second picture after the entire day's work, for review.
- After two weeks employees should take the third picture and compare it with the previous ones. Organizations must set up audits to check how the 5S principles are being met as well as to ensure the plan is moving forward.
- After two months, again check how workplace looks and schedule another peer review.



Conclusion

By following above means, any orhganisation can make sure that 5S is implemented successfully and everyone is following the procedure and contributing. This shall lead to a sence of responsibility to keep the place clean.





Tailoring preferences: The inventive path of the dairy sector

The dairy industry is undergoing a period of extraordinary transformation, mostly due to shifting customer preferences, growing concerns about sustainability, and breakthroughs in technology. The category is positioned for more exciting development as it continues to evolve annually. From the rise of single-serve formats for single consumers to the health-driven appeal of A2 milk, the premiumization of dairy products, innovation in flavours and textures, the emergence of plant-based alternatives, and the revitalization of dairy staples, the category is ready for more exciting developments.

Redefining convenience: Single-serve dairy. Single-serve packaging options have become increasingly important in the dairy business as a response to changing customer lifestyles and household structures.



AI is making food safe in shipping and buying.

From the time of farming through processing, shipping, storage, and retail distribution, food is susceptible to contamination. Artificial intelligence (AI) has aided food manufacturers in responding to growing customer concerns about what they eat in recent years.

Technology use for safer eating has received support from the US Food and Drug Administration (USFDA).

"End-to-end traceability across the food chain, with businesses willingly implementing tracing systems, is the ultimate objective. Harmonising tracing efforts to facilitate interoperability and identifying workable solutions for businesses of all sizes are top priorities, according to the FDA. "Under the New Era of Smarter Food Safety one of FDA's goals is to encourage stakeholders, including technology providers, public health advocates, entrepreneurs, and innovators from all disciplines to develop traceability hardware, software, or data analytics platforms that are low-cost or no-cost to the end user."



The New Zealand Food Safety Authority is now looking into Indian spice brands.

After two Indian spice brands were banned in Singapore and Hong Kong for allegedly containing prohibited carcinogenic chemicals, the New Zealand food safety authorities is also looking into Indian spice brands. Media sources state that after receiving criticism in other nations, New Zealand's food safety regulator announced that it is looking into potential contamination in spice goods from well-known Indian firms MDH and Everest.

This was the most recent in a string of ongoing inquiries following the two brands' prohibition for allegedly having excessive concentrations of the carcinogen ethylene oxide, which prompted Singapore to order the recall of the Everest spice mix. Ethylene oxide is a chemical that is known to cause cancer in humans, and its use for food sterilisation has been phased out in New Zealand and other nations, according to the acting director general of the food safety regulator in New Zealand.

WEEKS HIGHLIGHT

NON-TECHNICAL CONTENT



12 MAY

MOTHER'S DAY

Saluting the fearless heroes who stand tall in the face of danger. Happy Firefighter Day to our courageous first responders

MAY

DID YOU KNOW?



SUGAR GRINDING PLANTS

1/4



Sugar grinding plants are industrial facilities that are used to grind and mill sugar into various forms, such as granulated sugar, powdered sugar, or icing sugar.

- These plants typically consist of a series of machines and equipment that work together to grind, sift, and package sugar.
- Some sugar-grinding plants may also have additional equipment for flavoring or blending sugar with other ingredients, depending on the specific requirements of their customers.
- Sugar-grinding plants are used in a variety of industries, including food processing, confectionery, and bakeries. They are often used to produce high-quality, consistent sugar products that meet the specific needs of their customers.

Some of the food products that are commonly processed using sugar-grinding plants include:

1. Granulated sugar
2. Powdered sugar
3. Brown sugar
4. Specialty sugars: Such as demerara sugar, muscovado sugar, and turbinado sugar.

2/4



Working Principle

- The process of sugar grinding typically involves several steps. First, raw sugar is washed and prepared for milling by removing any impurities or debris.
- The sugar is then fed into a series of milling machines, which break down the sugar crystals into smaller particles.
- Once the sugar has been milled, it is sifted through screens to remove any remaining impurities or particles that are too large.
- The sifted sugar is then sent through a series of rollers or pulverizers, which further refine the size and texture of the sugar particles.



Grinding Machine

3/4



Market Scope

The global market for sugar grinding plants is expected to grow at a steady rate due to the increasing demand for sugar products in emerging economies, as well as the growing popularity of sweetened food and beverages.

Key growth factors:

1. **Increasing demand for sugar products:** Due to factors such as population growth, urbanization, and changing dietary habits.
2. **Growing popularity of processed food and beverages:** Processed food and beverages often contain high levels of added sugar to improve taste and flavor.
3. **Technological advancements:** The development of new milling and grinding technologies has led to the development of more efficient and cost-effective sugar-grinding plants.
4. **Increasing demand for natural and organic sugar products:** With the growing concern about health and wellness, there is an increasing demand for natural and organic sugar products.

4/4

Fact 1

Sugar grinding plants utilize advanced machinery to pulverize sugar crystals into fine particles of consistent size. Through precise control of grinding parameters such as speed, pressure, and temperature, these plants achieve optimal particle distribution and uniformity.



SUGAR PROCESSING & REFINING PLANTS

1/4



Sugar processing and refining plants are facilities that specialize in the production of refined sugar from raw sugar cane or sugar beet. The process of sugar production involves several stages, including extraction, purification, crystallization, and drying.

- Processing typically involves a combination of filtration, ion exchange, and crystallization techniques.
- The final product of sugar processing and refining plants is typically granulated or powdered sugar, which is used in a wide variety of food and beverage applications. Sugar processing and refining plants are found all around the world, with major producers located in countries such as Brazil, India, and Thailand.

Some of the most common food products that are processed using sugar processing and refining plants include:

1. Confectionery
2. Baked goods
3. Beverages
4. Dairy products
5. Cereals and snacks
6. Sauces and condiments

2/4



Working Principle

- 1. Extraction:** The first step in the process is the extraction of juice from sugar cane or sugar beet. This juice contains sugar, as well as other impurities such as minerals, organic matter, and water.
- 2. Purification:** The juice is then purified through a series of filtration and clarification steps to remove the impurities and excess water. This process may involve the use of chemicals such as lime and carbon dioxide to neutralize acids and precipitate impurities.
- 3. Concentration:** The purified juice is then boiled to evaporate the water and concentrate the sugar, resulting in a thick syrup called molasses.
- 4. Crystallization:** The molasses is then cooled and seeded with sugar crystals, which encourage the growth of additional sugar crystals. This process results in a mixture of sugar crystals and molasses, which is then separated by centrifugation.
- 5. Refining:** The raw sugar obtained from the centrifugation process is then transported to a sugar refining plant, where it undergoes further purification to remove any remaining impurities and produce the final product. This process typically involves a combination of filtration, ion exchange, and crystallization techniques.
- 6. Packaging:** The final product of sugar processing and refining plants is typically granulated or powdered sugar, which is then packaged for distribution to food and beverage manufacturers.

3/4



Market Scope

- The industry is dominated by a few large players, with major producers located in countries such as Brazil, India, Thailand, and the United States.
- The market for sugar processing and refining is expected to grow in the coming years, driven by the increasing demand for sweeteners in the food and beverage industry.
- However, the industry also faces several challenges. One of the main challenges is the volatility of sugar prices, which can be affected by factors such as weather patterns, government policies, and changes in consumer preferences.
- In addition, the industry is also facing increasing scrutiny from consumers and regulatory bodies over the health effects of sugar consumption.
- To stay competitive in the market, sugar processing and refining plants are investing in technology and process improvements to increase efficiency and reduce costs. They are also exploring alternative sweeteners, such as stevia and monk fruit, to meet changing consumer preferences.
- Despite the challenges, the industry is expected to continue to grow in the coming years, driven by the increasing demand for sweeteners in the food and beverage industry.

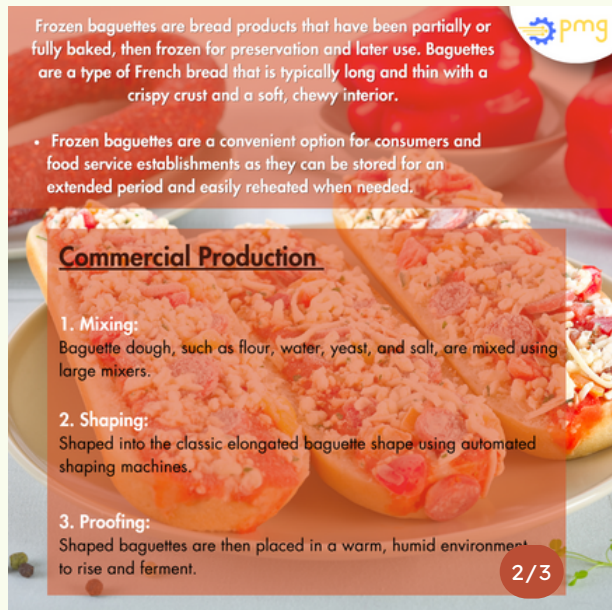
4/4

Fact 2

Pioneering the realm of sugar refinement, processing plants employ cutting-edge technology and intricate methodologies. These facilities meticulously transform raw sugar into refined products through a series of meticulously orchestrated stages, including clarification, filtration, evaporation, crystallization, and centrifugation.



1/3



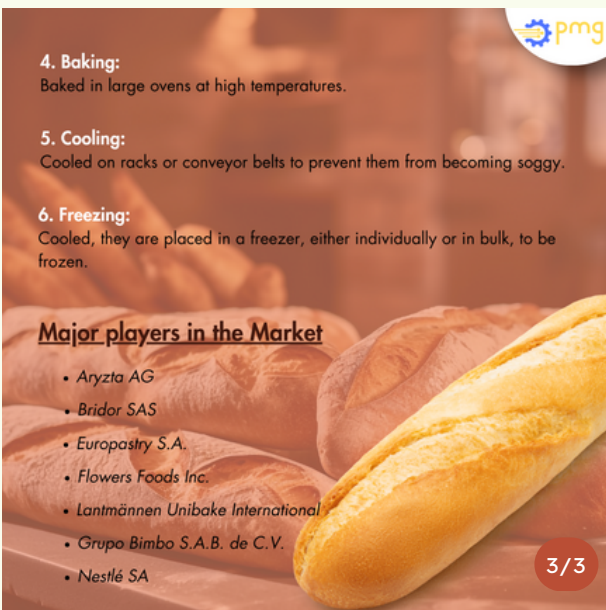
2/3

Frozen baguettes are bread products that have been partially or fully baked, then frozen for preservation and later use. Baguettes are a type of French bread that is typically long and thin with a crispy crust and a soft, chewy interior.

- Frozen baguettes are a convenient option for consumers and food service establishments as they can be stored for an extended period and easily reheated when needed.

Commercial Production

- 1. Mixing:**
Baguette dough, such as flour, water, yeast, and salt, are mixed using large mixers.
- 2. Shaping:**
Shaped into the classic elongated baguette shape using automated shaping machines.
- 3. Proofing:**
Shaped baguettes are then placed in a warm, humid environment to rise and ferment.



3/3

- 4. Baking:**
Baked in large ovens at high temperatures.
- 5. Cooling:**
Cooled on racks or conveyor belts to prevent them from becoming soggy.
- 6. Freezing:**
Cooled, they are placed in a freezer, either individually or in bulk, to be frozen.

Major players in the Market

- Aryzta AG
- Bridor SAS
- Europastry S.A.
- Flowers Foods Inc.
- Lantmännen Unibake International
- Grupo Bimbo S.A.B. de C.V.
- Nestlé SA

Fact 3

Employing advanced preservation techniques, frozen baguettes undergo meticulous processing to uphold their quality. After baking to perfection, rapid freezing at temperatures below -18°C halts microbial activity while maintaining texture. Vacuum sealing prevents moisture loss and freezer burn, ensuring product integrity.



FROZEN SNACKS

1/3

Frozen snacks are pre-packaged, frozen food items that are designed to be quickly and easily prepared for snacking or as a light meal. These snacks are usually designed to be convenient, flavorful, and satisfying, and they come in a wide variety of styles and flavors.

- Frozen appetizers: Served as a starter or appetizer before a meal. Examples include mini quiches, chicken wings, and stuffed mushrooms.
- Frozen finger foods: Easy to eat on the go or while watching TV. Examples include mini pizza bites, chicken nuggets, and mozzarella sticks.
- Frozen desserts: Sweet treats that are meant to be eaten as a snack or dessert. Examples include ice cream bars, frozen fruit bars, and frozen yogurt cups.
- Frozen meals: Frozen food items that are meant to be eaten as a meal. Examples include frozen pizzas, burritos, and potstickers.

Major players in the Market

- | | |
|-------------------------|-------------------------|
| a) Conagra Brands, Inc. | d) McCain Foods Limited |
| b) Nestle SA | e) Kellogg Company |
| c) General Mills, Inc. | f) Dr. Oetker GmbH |

2/3



Commercial Production

Sourcing and Preparation of Raw Materials:

Include ingredients such as flour, vegetables, meats, and dairy products.

Mixing and Processing:

Mixed in a processing facility. This can involve baking, frying, or other methods of cooking, depending on the type of snack being produced.

Freezing:

Frozen in a commercial freezer. The temperature of the freezer is typically around -18°C to -24°C to ensure that the snacks remain frozen until they are ready to be cooked.

Packaging:

Packaged in suitable containers, such as boxes, bags, or individual wrappers.

3/3

Fact 4

Frozen snacks undergo rapid freezing processes to temperatures below -18°C , suspending microbial activity and preserving texture. Vacuum sealing prevents moisture loss and freezer burn, maintaining product quality. Advanced freezing techniques minimize ice crystal formation, ensuring optimal texture retention. These meticulous procedures ensure that frozen snacks retain their taste, texture, and nutritional composition, offering consumers convenient and satisfying options.

Frozen Pasta



1/3

Frozen pasta is a type of pasta that has been cooked and then frozen for preservation. It is a convenient option for people who want to have pasta on hand but don't have time to cook it from scratch. Frozen pasta is available in a variety of shapes and sizes, including spaghetti, fettuccine, penne, and ravioli.

- Cooked in boiling water until it is al dente or cooked but still firm to the bite. It is then drained and immediately chilled in ice water to stop the cooking process.
- Stored in the freezer for several months and can be cooked in a variety of ways. One common method is to thaw the pasta in the refrigerator overnight and then heat it in a saucepan with your favorite sauce.

Major players in the Market

1. Nestle SA.
2. Conagra Brands, Inc
3. General Mills, Inc.
4. Dr. Oetker GmbH
5. The Schwan Food Company
6. Barilla Group

2/3

Commercial Production

1. Pasta Production:

Involves mixing flour, water, and other ingredients to form a dough, which is then rolled out and cut into the desired shape.

2. Cooking:

Cooked in boiling water until it is al dente, or cooked but still firm to the bite.

3. Chilling:

Chilled in ice water to stop the cooking process and prevent the pasta from becoming overcooked.

4. Freezing:

Packaged and frozen to preserve its quality and freshness.

5. Packaging:

Involve placing the pasta in cardboard boxes, plastic bags, or other types of packaging, depending on the specific product and the needs of the manufacturer.



3/3

Fact 5

Utilizing advanced preservation methods, frozen pasta undergoes thorough processing to uphold its quality. After preparation, it is promptly frozen at temperatures below -18°C, arresting microbial growth and retaining texture. Vacuum sealing safeguards against moisture loss and freezer burn, maintaining product integrity. Advanced freezing techniques minimize ice crystal formation, ensuring pasta texture remains intact.



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