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AFSTI Chennai Newsletter

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FOOD SCIENCE & TECH

- Artificial Intelligence
- Nanotechnology
- Food Technology Trends
- Food Trucks

ASSOCIATION OF FOOD SCIENTISTS & TECHNOLOGISTS (INDIA) - CHENNAI CHAPTER

Food Technology Division, Department of Biotechnology, Anna University, Chennai

AFST(I) – Chennai Chapter Newsletter (July 2024)

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Editorial

Dear Food Professionals,

Greetings from AFST (I) Chennai Chapter!

We from AFST(I) Chennai chapter are deeply saddened by the demise of Dr. M.S. Swaminathan, the father of India's Green revolution and a renowned Indian Agricultural scientist and Ex. President of AFST(I) Dr. Raghuramiah B, Director of Food Ingredients Specialities.

The consumer awareness on millets has been reviving. Many awareness programs are being conducted by Government and academic institutions widely across the country. The revival of new and traditional millet processing techniques is being the focus. This is not only to enhance consumption of millets by common people in their everyday diet but also to imbibe and give an emphasis on a healthy and traditional way of food culture and life. This also promotes the catering institutions and restaurants to consider including the millets based new and traditional products in their regular menu cards. The Food processing corporations and industry entrepreneurs have already come up with several recent innovations in beverages, baked goods, dairy products, culinary products and so on made predominantly with millets.

Overall, it looks like, the millets as magic ingredients, can influence the health and wellbeing of general mass in a positive way. History returns in new ways and opens up new avenues of food consumption and opportunities we are sure this will drive the industry and economy as a whole. Care should be taken to keep food in optimum, as too much of anything could be dangerous.

I request and welcome the members of our Chapter to kindly inspire by sharing your expertise and experiences in the field as short essays or articles or small write-ups. We will greatly appreciate your efforts and support.

Thank you very much!

Warm Regards from,

Editorial team

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Guidelines to the submission of articles for the newsletter

1. Your content must cover technical/scientific subject relevant to food science and technology.
2. The article must be concise, original and written in 800-1200 words or maximum of 2 pages
3. Articles beyond 1200 words or 2 pages will not be considered for publication
4. Brief profile (up to 50 words) of the author/authors must be added in the end of the article along with the author's contact details (email ID and mobile number) and a recent passport size photograph
5. Following details of the author/authors are required to be included in the profile:
    a) Authors' full names followed by current positions/designation and current organization **(mandatory)**
    b) Education background including institution information and year of graduation (type and level of degree received)
    c) Work experience
    d) Current and previous research interests
    e) Memberships of professional societies and awards received (mainly AFSTI)
6. Articles could be of the following types: Original research manuscripts, reviews, comment. However, the contents must be free from plagiarism
7. The articles have to be submitted in the word document format in the Calibri font (12 size)
8. Images and graphics need to be sent (preferably in PNG format and high resolution) as a separate attachment to include in the article
9. References need to be included for any article involving scientific and technical content
10. The views expressed in the articles reflect the author(s) opinions and do not necessarily are the views of the publisher and editorial board. The published material, editorials and all other content is published in a good faith. Editorial board of the newsletter cannot guarantee and accepts no liability for any loss, conflict of interest or damage of any kind caused by the newsletter and errors and for the accuracy of details made by the authors.

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Vacuum Frying

Conventional Deep frying (CDF) is an ancient food processing technique widely used in Food industry to prepare snacks. The consumers are tempted to try deep-fat fried products, owing to their exceptional flavour and crunchy texture. The disadvantage of CDF is that fried food has high oil content of about 35 to 45% which makes it unhealthy.

Vacuum frying (VF) is a deep fat frying process, which is done in a closed system. VF is an alternative processing technique to deep frying to produce low fat products. VF process is done at lower temperature below 100° C and pressure less than 6.65 Kpa. Low temperature and absence of air during frying retains original color, texture & flavor of the product. The low frying temperature and minimal exposure to oxygen are reasons for the benefits of the vacuum fried products. VF technology has reduced oil uptake of around (50%) in food products compared to CDF. Final appearance and texture of product is comparable and similar to CDF and in addition to it, the finished product has low acrylamide content than CDF method. VF products contains comparatively lesser oil content, as the low pressure during the process allow air to diffuse into the porous structure and prevent oil absorption and finally leads to lower oil content than CDF products. VF product has low moisture content and low water activity, which increases the product shelf life. Frying temperature of oil is less than 100℃, which retains oil properties and reduce toxic component formation in the oil. The oil stability is better than CDF. But the main disadvantage of VF process is the higher investment cost.

Dr. Kavitha Ravichandran
Food Product Consultant/ Faculty/Auditor

Food Facts and Myths

Freezing – Myths

It's a myth that freezing food kill all the harmful bacteria that causes food poisoning.

Freezing, prolongs the shelf life of a product. But cooking food to the proper internal temperature is the best way to kill harmful bacteria. Hence Freezing alone cannot have an impact.

Cutting Boards – Myth

Myth is that plastic or glass cutting boards do not have harmful bacteria like wood cutting boards.

Cutting board regardless of the type of surface that comes in contact with foods has the potential of holding harmful bacteria. Irrespective of the materials all cutting board should be washed and sanitized after each use. In fact, wooden cutting boards are biodegradable when compared to plastic ones.

Trans-Fat – Myth

Myth is that cooking of oil leads to creation of trans-fats.

Trans fat is not generated during cooking of oil. Hydrogenation of oils is the reason for formation of trans-fats.

Coconut oil – Myth

Coconut oil increases cholesterol levels and is not good for health.

Recent researches demonstrate that coconut oil increases the good cholesterol (HDL) levels which is beneficial to health. This good cholesterol helps lower the bad cholesterol (LDL) levels and in reality, clears the blockage in the arteries, thereby protecting the heart. It is also true that the medium chain fatty acids present in coconut oil increases the rate of metabolism.

Dr. Kavitha Ravichandran
Food Product Consultant/Faculty/Auditor

Artificial Intelligence (AI) and Food Industry (Part II)

Consumer Facing Applications of Artificial Intelligence

But what about consumers in the food industry? Can AI help them as well? Here is four ways AI does just that:

1. **Food Discovery and Recommendation Engines:** Food discovery and recommendation engines based on AI are now assisting consumers in making educated decisions about what to eat by learning about consumer taste preferences and then recommending you curated dishes.

2. AI-Powered Chatbots: Food establishments can now use AI-powered virtual assistants and chatbots to guarantee that clients do not have to wait too long while making inquiries or customizing orders. These bots have come a long way from the days of their inception and have now been optimized to a great degree, resulting in a better client experience.

3. AI-Based Kiosks: Self-ordering robots powered by AI are now providing a better experience by lowering customer wait time and eliminating the need to stand in line to pay. That's because AI can take consumer orders and process payments can be made using integrated card readers, eliminating the need for human intervention.

4. AI Robots: Robots are commonly accepted in the food processing industry due to their sterile nature, a characteristic that is critical in reducing the number of food-borne illnesses. According to a survey, the use of robots in the food processing industry increased by 29% from 2015 to 2019. Robots are also making an appearance in restaurants, boosting the speed and capacity of food preparation as well as reducing the time it takes for meals to be delivered.

AI is improving the efficiency and quality of the food sector in many ways, and the technology promises to bring about many more improvements in the near future. Due to its potential to decrease waste, anticipate product markets, enable around-the-clock efficient and effective monitoring, improve sanitation, control costs, and increase revenue, AI's position in the food sector is becoming increasingly robust.

THE IMPACT OF COVID-19

The coronavirus pandemic has significantly impacted the food manufacturing industry, including upending food manufacturing operations, halting production, and slowing economic and technological progress. Simultaneously, the outbreak has highlighted serious gaps in the food supply chain. "Many of these gaps are a result of an increasingly spread out and complex supply chain, as well as high demand for faster processing and transparency, which is especially crucial in response to COVID-19.

The COVID-19 pandemic led to millions of infections and deaths worldwide, changing dramatically what we perceived as norms and impacting society, health systems, governmental policies, and businesses. The food sector is no exception, as the consequences of this "Black Swan" socio-economic has changed the way we think, buy and consume food by accelerating pre-existing innovation trends marking a "before" and "after" period. In the short term, the pandemic affected the sector by causing labour problems (e.g., lack of workers due to illness and quarantine measures), the shutdown of factories, food shortages on shelves, and some cases stress of cash flow for the active businesses. Food and food supply chain safety was the first emergent issue under consideration, requiring an increasing number of precautionary measures as long as we move from farm to fork. Sustaining food production through COVID-19 brought challenges, including clustering of cases in agricultural food production and food processing industries.

What became evident during the crisis is that advanced and more digital traceability is a powerful tool in comprehending the implications of the supply chain in the case of a public health emerging event.

During that period boosting the immune system was a priority for consumers. This trend has accelerated within the COVID-19 era, and consumers' interest in sustainable, healthy, organic, and functional foods has been increasing rapidly. Moreover, products that are considered by consumers to boost their immune system (e.g., camomile, kombucha) had experienced a 3- to 4-fold increase in sales . A survey of 23,000 European shoppers indicated that 72% of consumers have changed their eating habits in the post-lockdown era to follow more healthy patterns. Following consumers' needs, food companies are commercializing products with bio actives, creating a trend towards seeking recognition of food bioactives as immune-boosting agents that encompass forging more collaborations between governmental bodies and academic institutions to address this need.

On the other hand, the pandemic had led to an instantaneous lack of critical information about consumers' preferences, attitudes, and bottlenecks in the post-lockdown period. The induced disruptions in the food supply chain have increased the risk for food fraud, whereas finding convincing evidence about the real health benefits of nutraceuticals and functional foods became critical. This gap highlighted the emerging role of digitization using data analytics and Artificial Intelligence (AI) to support the real-time needs (e.g., remote monitoring and management decision tools) of the food industry, smart agriculture, supply chain, and food security. Moreover, the proliferation of new technologies helped digitize the food supply chain and increased traceability systems' investments to mitigate risk, improve efficiency, and underpin sustainability initiatives. Sectors benefiting from the challenges of COVID-19 include companies producing non-perishable foods and processed food companies.

Subsequently, this has led to the increasing focus on innovative technologies like implementation of AI to make the food sector sustainable to meet the opportunities which has raised from the COVID-19 pandemic.

OVERCOMING CHALLENGES IN IMPLEMENTING AI IN FOOD INDUSTRY

Because cost is often the No. 1 barrier to implementing automation and robotics, original equipment manufacturers and machine suppliers can benefit from collaborating with robotics providers to design more efficient packaging line configurations. To overcome barriers to implementing AI, food manufacturers should make incremental improvements to start automating capabilities at a smaller scale. By seeing the benefits of automation, manufacturers can build their way up to full-scale automation over time. AI technology is still in infancy stage, there is a growing need for specialized skill sets around gathering and analyzing data. As a new technology, many companies are hesitant to invest until it is well known the true value or capability of AI to deliver. AI technology required increased transparency and more involvement of consumers in decision making. This challenge is because food and beverage companies are known to guard their secret recipes fiercely.

SLOW TO ADOPT

Despite its capabilities and advantages of AI, the food manufacturing industry has not been quick to jump on the automation bandwagon. "Although the food manufacturing industry has made significant technological advancements over the years, the food supply chain has simultaneously become more complex and demanding and requires the entire supply chain to automate in order to meet demand, The earlier we adopt AI in food industry, the more future proof the business will become.

CONCLUSION

Artificial intelligence is making the food industry more efficient and better and promises to yield many more new changes in the near future. AI's role in the food industry is becoming increasingly important due to its ability to reduce waste, predict markets for products, enable round the clock efficient and effective monitoring, augment sanitation, manage cost and increase revenue. Researches are ongoing to proffer solutions to the challenges of artificial intelligence and increase its adoption.

About author:

Mr. Kumaresan V, Chairperson and CEO of Veloo Food Solutions Pvt Ltd, based in Chennai.

Nanotechnology- A Novel Innovation in Food Industry

Nanotechnology is a modern and novel invention that has been used to numerous industries, such as agriculture, food production, and medical. As an advanced technology in the fields of food processing, safety, and packaging, nanotechnology is of significant interest to the food industry. Currently, there are only a few food industries integrating some sort of nanotechnology. According to experts, nanomaterials are fundamentally distinct compounds that pose threats to the environment and human health and need for new types of safety monitoring condition. If the difficulties it poses can be overcome, nanotechnology has significant potential to improve food quality, safety, and shelf life. The physical and chemical characteristics of a nanomaterial will differ noticeably from the original material when the structure of the material is altered and the particle size is decreased below 1-100 nm. Similar to other fields, food industry is relying heavily on nanotechnology as a potential technology for problem-solving through creative approaches to food safety, food processing, food packaging, and functional foods.

Applicability of nanotechnology in food

Nanotechnology is utilised in food processing in a variety of ways to enhance flavour, colour, texture, and nutritional value. The incorporation of nanoparticles into food packaging results in an improvement additionally, the active ingredients of nano emulsion formulations can be utilized for generating biodegradable coating. The nano packaging films improves the quality and nutritional value to extend the shelf life of food in the packages as well as increases the functionality, stability and food quality (1). Numerous nanoparticles are thought to have antibacterial properties, which has considerable potential for food packaging. In functional food the applications of nanotechnology are concentrated on nano-sized nutritional supplements, nutraceuticals, additives, vitamins, antimicrobials, antioxidants and preservatives (2). Nanosensors play a vital role in the food industry, particularly in the areas of food quality and safety. Nanosensors convert physical quantities into signals, where the foodborne pathogens, food spoilage, toxins vitamins, pesticides, and unwanted taste or smell can be easily detected and analyzed.

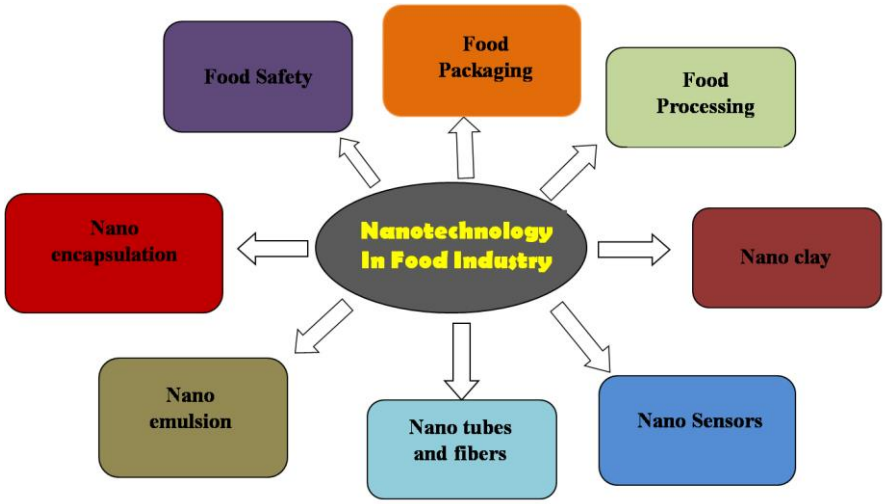

Fig. 1 Applicability of Food Nanotechnology

Nanoparticles can be utilized as gelating and viscosifying agents where they are used in the form of nanocapsulation to increase the bioavailability of nutraceuticals; nanoencapsulation of flavor is used to improve the taste of food; nanoemulsions are used to improve the availability and dispersion of nutrients (3). Nanocapsules can be used as nano food additives or nutritional supplements to modify undesirable flavor and taste to the better distribution of insoluble additives without adding surfactants or emulsifiers (4). Nanoemulsions can be used for the delivery of nutraceuticals, coloring and flavoring agents, and antimicrobials in the form of hydrophobic active substances. Another type of nanoparticle is nanoclay, which is made up of layered mineral silicates that can form complex clay crystallites by the stacking of these layers. Nanoclay is mostly used in food packaging due to its natural nanolayer structure that acts as a barrier for gas and moisture. Nanotubes and nanofibers are being used in the food industry. Nanotubes are formed from several global proteins from milk, and have the application in enzyme immobilization processes. Nanotubes can be used as encapsulating agents due to their ability to withstand pasteurization conditions. With growing nanotechnology applications in the food sector, the application of nanofibers is more suitable in food packaging which improves mechanical, barrier and optical properties of packaging.

Methods for synthesizing nanomaterials

There are three kinds of approaches for the production of nanoparticles. They are physical, chemical and biological methods. Physical Method consists of Mechanical Method, Pulse Laser Ablation, Pulsed Wire Discharge Method, Chemical Vapor Deposition, Laser Pyrolysis and Ionized Cluster Beam Deposition. Chemical Methods include; Sol-gel method, Co-precipitation method, Inert gas condensation method and hydrothermal synthesis. Biological Methods comprises of Synthesis using microorganisms, Synthesis using plant extracts and Synthesis using algae. Due to their affordability and environmental friendliness, microorganism-based nanoparticle production has attracted increased attention in recent years. Extracellular biosynthesis and intracellular biosynthesis are the two processes used to create nanoparticles from microorganisms. The production of nanoparticles shows the critical role played by plant extracts. Synthesis of nanoparticle by algae extract using Aqueous Solvent by heating or boiling it for a period of time. The biomolecules peptides, pigments and polysaccharides are accountable for the reduction of metals. This method of producing nanoparticles is also known as green synthesis or a green process.

Forms of nanomaterial

Nanomaterials classifications include nanoparticles, nanocapsules, nanoclays, nanoemulsions, nanotubes, nanofibers, and nanolaminates. Each of these nanomaterials has potential uses in the food sector and can be produced in a number of ways which has its own functional applications (1). Numerous nanoparticles have antibacterial properties, which has considerable potential for food packaging. For example, silver nanoparticles have high antimicrobial activity and are used as an active system in food packaging (5). Other nanoparticles such as zinc oxide, titanium oxide, and silicate nanoparticles are also used to reduce the flow of oxygen inside the packaging containers. Zinc oxide is another nanoparticle that has been recommended as “GRAS” by the FDA and can be used as a food additive or ingredient in daily applications (6). In addition, there are many other nanoparticles include copper, magnesium, copper, gold, cadmium, selenium, and chitosan which also have antimicrobial activity (7).

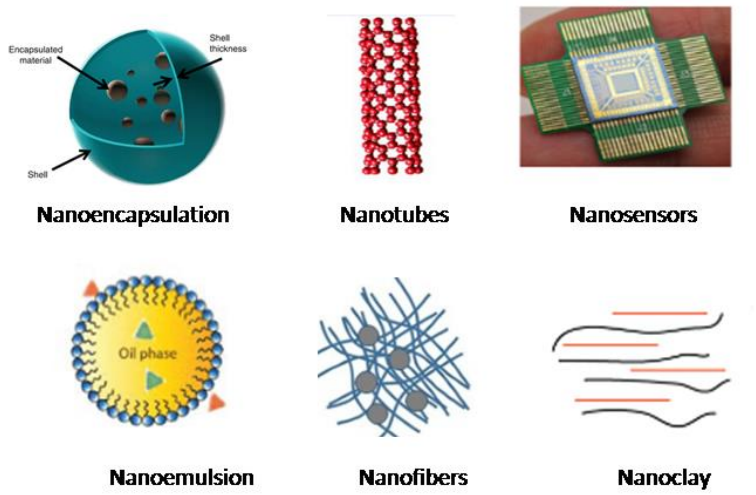

Fig. 2 Forms of Nanomaterial

Conclusion

The field of nanotechnology discusses current developments and prospective outcomes of advanced nanomaterials in food sector considering processing, packaging, security, and storage. Nanotechnology applications improve the food bioavailability, taste, texture, colour retention, salt reduction and consistency, by modification in particle size, possible cluster formation, and surface charge of food nanomaterials. As long as nanomaterials are manufactured and used, there is always a risk that they will cause DNA damage by entering the food chain. There have not been many in vivo investigations, into how nano foods have an effect on both human and animal health. In order to promote consumer acceptance, proper labelling and legislation should be recommended for the marketing of nanofoods. More such in vivo research can be done in these nanotechnologies that benefit the human health and wellbeing.

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Indian Food Tech Ecosystem And Trends

INTRODUCTION:

Technology plays a vital role in revolutionizing the growth of food industries, from the area of production to distribution. The recent advances in India enhance how the industry handles production, distribution, and consumption using automation, AI, and other technologies. Therefore, Trends in the Indian food industry become more profound, pervasive, and widespread with each passing year. Agriculture activities help humans to raise the most principal food crops with an ideal animal population to achieve environmental balance. It is becoming more automated, using digital and advanced technology to produce food and raw materials.

ADVANCEMENT IN TRENDS

A. **AGRICULTURE**: Automation in agriculture is an emerging subject across the world. In recent times, Artificial Intelligence has been seeing a lot of direct applications in farming AI-powered solutions will not only enable farmers to do more with less, but they will also improve quality and ensure faster go-to-market for crops. To overcome human handling errors, industrial automation evolved. Automation is completely based on artificial intelligence (AI) or machine learning (ML) or deep learning (DL) algorithms. Using the AI-based system, food production and delivery processes can be efficiently handled and enhance operational competence.

TRANSFORMING THROUGH DIGITALIZATION

Figure 1 *Digitalization*

1. Artificial Intelligence: The use of artificial intelligence technology in agriculture can increase productivity and efficiency [1]. Artificial Intelligence is being used to identify and detect diseases, precision farming, communicate dates, soil preparation, fertilization based on soil tests, seed treatment, and optimal spreading depth.

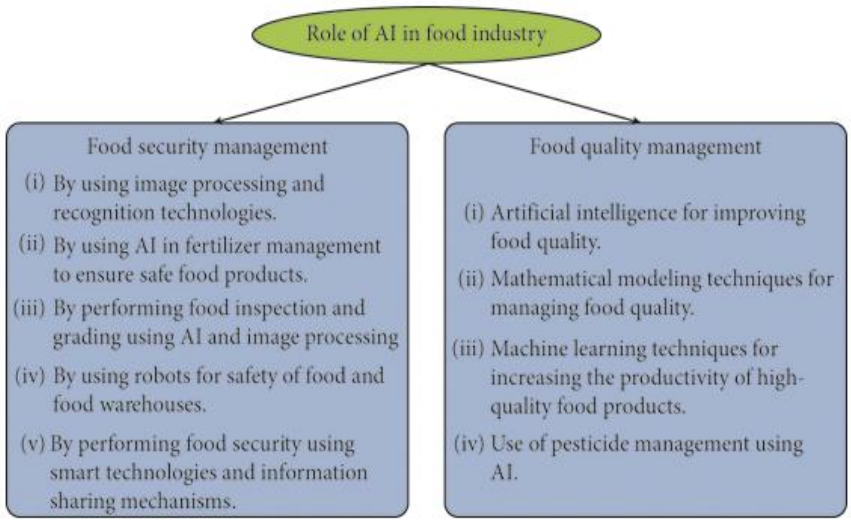

Figure 2- The Role of AI in the Food Industry

2. Smart Farming: Smart Farming represents the application of modern Information and Communication Technologies (ICT) into agriculture, leading to what can be called a Third Green Revolution [4]. Trends involved in Smart farming: Soil monitoring and Robocrop.

2.1. Soil monitoring - Sensors placed in the field can collect data on various parameters such as temperature, moisture levels, soil nutrient levels, and sunlight intensity. This data can then be fed into machine learning algorithms, which can analyze the data and provide insights into the optimal conditions for crop growth and soil health. From these data, the learning algorithms also discover trends and patterns useful for understanding soil conditions [3].

The use of AI technology for crop and soil monitoring is very helpful in getting information about crops' health and soil quality.

2.2. Robocrop - The outbreak of the coronavirus pandemic has drastically affected fruit harvesting with all the restrictions and lockdowns. Flying robots with AI mechanisms can identify the right fruits for plucking and help in picking them autonomously. These fruit-picking robots can help fruit farmers save huge money and reduce fruit wastage globally. Flying robots can work throughout the days and nights to pick up only ripe fruits at the right time.

Usage of Drones - In India, Garuda Aerospace became the first company to receive Agri Drone Subsidy for their agricultural drones. Thus, drones are being advocated primarily as automated spray devices that can be tasked with pesticides, etc. Spraying over crops reduces health hazards associated with manual spraying and saves time, resources, and human labor [2].

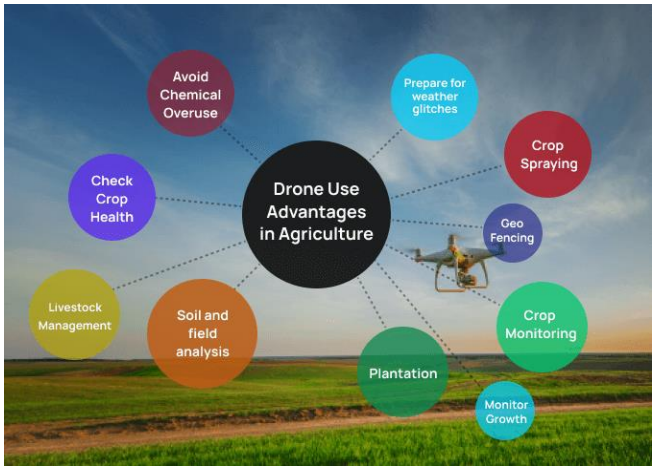

Figure 3 - Advantages of drone in agriculture

Benefits of advancement in trends - agriculture:

1. Artificial-intelligence-based food tracking systems will enable us to sell food ahead of it turning into waste. By using this, more farmers and people can connect for buying food products [1].
2. The farm-based food supply chain management uses computer vision technology to manage and examine each process; then, the food waste will be decreased rapidly.
3. Implementing these technological solutions enable reliable management and monitoring of farms.

B. AUTOMATION IN FOOD INDUSTRIES:

Food processing transforms raw agricultural products into desirable products for consumption. Thus, Automation allows processors to carry out food production with maximum accuracy and efficiency and maintain the required quality control of the product. Automation is technology-related to applying mechanical, electronic and computer-based system to operate and control production. The automation technology included; [5]

- Automatic machine tools to process parts
- Industrial robots
- Automated material handling and storage system
- Automated inspection system for quality control
- The computer system for planning, data collection, and decision-making to support manufacturing facilities [6]

Benefits of Automation in Food:

(1) Improved Traceability: Automation improves traceability, by providing valuable data to manufacturers to ensure regulatory compliance, and brings down the compliance cost. Thus, supporting the continuous enhancement of overall quality, safety, and profitability.

(2) Brand Consistency: Product Consistency is achieved with automation thus safeguarding the brand's reputation. Also, automation improves the production process and reduces the risk of product recalls.

(3) Emphasis on Personnel Safety: When hazardous tasks such as picking up heavy objects and other potentially dangerous or monotonous tasks are performed by robots and other automation solutions, the safety and welfare of the human workforce are addressed.

CONCLUSION:

Adopting a holistic ecosystem approach to address challenges faced by the Indian agriculture sector, the food industry is utilizing the basic level of artificial intelligence. Every day the role of AI is becoming vital due to its

capability to escalate hygiene, food protection, and waste management system. Food wastes are a serious cause of environmental problems, agricultural production till the consumption of food waste is caused majorly by inefficiencies in the food supply chain, thus AI, automation, digitalization, and various technologies help to reduce food waste.

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Food Truck And Convenience Food

ABSTRACT

The idea of a food truck is still a relatively new trend in India, but it has long been popular in the culinary industry in the west. A place and its inhabitant's culture are fundamentally shaped by their food. Whether someone lives in India or abroad, food plays a significant role in their lives. Most often, when we think of street cuisine, we imagine little booths along the streets. These are the place where there are lots of people enjoying the cuisine that is provided while you wait, satiating the everlasting gourmet that resides inside them. The demographic representation of this activity in India comes in the form for all age groups. These unique food lanes are present in every community and serve as a draw for people to eat street food. Young people are starting to become interested in the food truck industry, and many business people from different backgrounds are getting into it. For people who want to launch a new food company but lack the funding for brick and mortar setups, food trucks appear to be a potential choice.

KEYWORDS: Food Trucks, Business, Food Safety, Food convenience, Mobile food service

INTRODUCTION

A huge vehicle outfitted to prepare and serve meals is called a food truck. Some, like ice cream truck, offer pre-packaged or frozen food, while others have integrated kitchens and cook meals from scratch. French fries, hamburgers, sandwiches, and other local fast food items are typical. As a result of pop-up restaurant craze in recent years, gourmet food trucks with wide range of cuisines and ethnic menus have become especially well-liked. The street food sector, which provides meals to an estimation more than 2.5 billion individuals daily, will led by food trucks, mobile canteens to operate on American military installations. Food trucks are becoming more and more popular since they are not only accessible but also bring back fond memories. The rise of food trucks in recent years was fueled by a number of post+ recessionary causes. The number food vehicles in the United States has reportedly increased as a result of a mix of economic and technical considerations, as well as the " hip" or "chic" nature of street cuisine. Additionally, food trucks are used for promotional purposes as well as special occasions like weddings, filming locations, and business meetings.

CHALLENGES AND OPPORTUNITIES

The globe over, the food truck industry ranks as one of the trendiest. The National Restaurant Association Report projects that sales will increase by encouraging 3.7% annually over the next five years. This concept in the rapidly changing restaurant industry is projected to bring in $ 2.7 billion. This company's primary benefit is that it is movable by nature. The owner of a food truck may drive anywhere and sell his or her goods by announcing the forthcoming location on social networks. Customers may schedule their meals according to their preferences and eat where and when they like. The history of the food truck industry begins in antiquity, when food was first sold on the streets of Rome by street sellers using wooden carts. Food trucks today serve a number of diverse ethnic and trendy cuisines in addition to plain street food. Millennials, who appreciate simplicity, good price, and delectable cuisine, are the group that is most drawn to these food trucks. Consuming healthier food alternatives and learning about how food trucks came to be are the two main goals of their project. All Indian metropolises have adopted the mobile food concept, and tier two towns like Mumbai and Gujarat are starting to follow suit.

FOOD SAFETY

Food truck (FT), food safety is a significant concern. These vehicles are open to the elements and frequently lack the necessary infrastructure to guarantee safe production of foodstuff. Additionally, a lot of meals are readily available to a range of demographics, including vulnerable groups like kids, pregnant women, those with impaired immune systems, the elderly, and others who are more susceptible to FBDs. Additionally, FTs frequently avoid proper food safety control and supervision because to their mobile and transient character, which may motivate the hiring of workers who are less trained or certified, raising the risk of FBDs. Due to the expanding number of FTs in metropolitan areas and the paucity of data pertaining to the degree of KAP (Knowledge, attitudes, and self-reported practices) among their food handlers.

In order to regulate the manufacturing process and deliver safe food, it is crucial to implement tactics that effectively assess food production and avoid contamination. From this vantage point, it is essential to create and enforce a system of food hygiene in which food owners produce and distribute food safely, as well as have a thorough understanding of the hazards involved in doing so and how they can handle them. As a result, for food to be handled properly, handler's education, abilities, and awareness of their vital role and duty in food safety are crucial. Drinking water or food contamination with bacteria or toxins is the cause of food borne diseases (FBDs), which frequently result in severe clinical symptoms and, in extreme circumstances, death. Despite efforts by governments and the food industry to provide foods that is clean and sanitary, FBDs continue to pose a serious threat to global morbidity and death and are avoidable. The World Health Organisation (WHO) says.

FOOD TRUCK CONVENIENCE

The favourable effects that FTs have on both the local and global economics, the food industry is predicted to continue to thrive. In addition to providing a source of revenue, work, and the chance to launch their own business, the FT activity provides owners and vendors logistical and economic benefits over traditional brick and mortar places. In addition to providing simplicity and accessibility, FTs have grown in popularity owing to its hedonistic and social qualities, since they supply consumes with high-quality, reasonably priced meal alternatives as well as a time for celebration and group bonding.

The basic premise is that because food trucks are mobile and their position is unpredictable to customers, they experience a spatial information friction. Congestion, parking issues, or mechanical issues can prevent a food truck from arriving at a predetermined destination on time. Because it enables the food truck to give away its location live from the road, wireless internet technology lowers this barrier. This raises need for food trucks by lowering consumer ambiguity over a food truck's location.

The clear evidence for how technological advancements might enhance consumer diversity in cities by reducing geographic data frictions linked to items made locally using the food truck business as the setting. The following details: In order to address a spatial information spatial information friction, food trucks use technology. Additionally, the spread of technology is linked to the raise of the food truck industry. Food trucks also exploit their mobility to satisfy customer's desire for variety.

CONCLUSION

Food truck operators in India must periodically adapt to changing client tastes, keep qualified employees on hand to prepare food, maintain a clean, sanitary atmosphere, assure quality in service, and other factors due to the intense rivalry among food truck company owners in the country. Food trucks are growing more and more popular and are ingrained in the culinary culture. Because food trucks need for trying out fresh sources

of food and food cultures with recent college graduates, it is predicted that the number of food trucks operating on the roadways will continue to rise. The foundation of this concept is in the advantages of work benefits, time, space, cost, and mobility to grasp the preferences, satisfaction, and experiences of the consumer. Young people are starting to become interested in the food truck industry, and many business people from different backgrounds are getting into it. For people who want to launch a new food company but lack the funding for brick and mortar setups, food trucks appear to be a potential choice. Municipal, country, and state health authorities should meticulously review their food inspection and monitoring procedures to reduce the risks of food borne diseases and infections.

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Nano In Food Processng Aids

ABSTRACT:

One of the cutting-edge technologies, nanotechnology surely has a positive impact on many industries, like the agriculture industry, biotechnology, engineering, architecture, the medical area, food safety, and food technology, among others. In order to produce high-quality Nano-based goods for the enhancement of agriculture produce, food preservation, target-specific medicine transportation, and hard material with lower weight, nanotechnologies, nanomaterial, and nanoparticles research are crucial. Food and food products easily deteriorate over time. Higher is offered by nanotechnology.

KEYWORDS: Nanotechnology, Nanofood, Food production, Safety, Packaging, Toxicity, Health.

INTRODUCTION:

The word nanofood refers to food that has been grown, produced, processed, or packed, using tools or techniques from the nanotechnology fields, or to which artificial nanoparticles has been added. The food industry has been transformed by nanotechnology, which is increasingly viewed as an appealing technology. Developed as well as developing countries have an interest with spending further into this technology has an extensive variety of potential for the creation and use of systems, materials, or structures with novel properties in a variety of industries, including food, medicine, agriculture, and others.

NANO IN FOOD PROCESSING:

Food processing is the process of preserving food by transforming t to a usable or edible form. It is the collection of procedure and process used to turn natural resources into finished and partially finished goods. It includes procedures such as washing, chopping, cooking, pasteurizing, fermenting, freezing, etc. in order to increase shelf life, food additives are also added during food preservation. Toxin removal, disease prevention, food preservation, and food consistency improvement for better marketing and distribution are other aspects of processing.

The food ingredients with nanostructure are being created with the promise of better consistency, taste, and taste. The degree of food waste caused by microbial infection has been reduced thanks to nanotechnology, which is also extending the shelf life of various types of food items. The following characteristics are expected in an ideal delivery system: (1) the ability to provide the compound that is active exact at the target location; (2) assurance of accessibility at the desired time and specific rate; and (3) effectiveness in maintaining the active ingredient at suitable levels for a longer amount of period (in storage condition). When used to the creation of capsules, emulsion, biopolymer matrices, simple solutions, and association colloids, nanotechnology offers effective delivery methods with all the aforementioned properties.

ANTICAKING AGENT:

Anticaking agents can work in a number of ways, such as by competing with the host powder for moisture, coating particles with moisture-resistant layers, creating smooth surfaces to reduce friction between particles, and preventing crystal growth. Sio2 is a thickening ingredient (also known as an anticaking agent) that is used in both non-food and food items. It also preserves the flow characteristics of powdered products including sugar from icing salts, condensed milk, spice, and dry mixes. Additionally, chemicals have been added to

granular and powdered meals for avoiding caking, including aluminium silicates, calcium aluminosilicate, sodium bicarbonates, sodium silicates, and many more.

ANTIOXIDANT AGENT:

Antioxidants are a family of molecules that interact with radicals that are free and transform them into harmless compounds. This reduces oxidative stress and s crucial for the treatment of disease brought on by free radicals. However, limited absorption, difficulty bridging cell membranes, and disintegration after delivery limit the efficacy of antioxidant. They therefore have a constrained supply in the body.

NUTRACEUTICAL AND BIOAVAILABILTY:

Food contains bioactive ingredient that strengthen immunity and stave against disease. Despite having larger amounts of bioactive compound, most foods have low potencies. This is due to the insoluble, bioavailability, and stability of the substances in the gut as well as the intestinal tracts weak permeability and retention duration.

NANOFILTRATON:

The usage of nanofilters, which may be used to take the color out of beetroot juice while keeping the flavor, is another example of how nanotechnology is being employed in the food industry. To avoid foodborne disease, nanotechnology is used in production healthier foods that are low in salt, sugar, and fat.

NANOEMULSION:

The aqueous particle liquid with oil-in –water emulsion characteristics known as a nanoemulsion is made up to solids spheres with surfaces that are both lipophilic and amorphous, and it has very small droplets sizes between 10 and 1000nm. The small size of nanoemulsions makes it easier for a large surface area to form or be present, which can be important for meaning interaction with various bioactive substances taken in the digestive system.

NANOENCAPSULATION:

With the use of Nano-emulsification, Nano-structuration, or Nanocomposites, chemicals are packed into tiny structure to enable the controlled released of the core. Different types of nanotechnology (liposomes, tiny particles, micelles, nanospheres, nanoemulsions, and nanochleates) have been utilized depending on the application.

FOOD PACKAGING AND FOOD PRESERVATION:

Food is packaged in such a way as to ensure that is safety for eating while also ensuring that the foods quality is maintained. The primary goal of packaging is to protect food physically against impacts and vibration, microbial invasion, and temperature while also creating a barrier that scavenges oxygen and other gases that cause deterioration. To lesson environmental damage, packaging should ideally be composed of biodegradable materials. Due to the emergence of nanotechnology in the food packaging sectors, this concept has become a reality. Some of the techniques that need to be taken into consideration when food is packaged include the use of high barrier polymers, the use of antimicrobial, and contamination detecting techniques.

APPLICATION:

Application of nanotechnology in the food sector can be used to provide stronger flavors and colors, increase the barrier characteristics, and increase safety by detecting bacteria in packaging. Nanotechnology has a

tremendous deal of promise for benefits both inside and outside of food products. Nanotechnology is used to increase barrier qualities and to detect infection and chemicals in food products with reference to food safety. Additionally, food packaging utilizes nanotechnology extensively.

CONCLUSION:

The use of nanotechnology could alter our way of life. This is due to the almost limitless potential it offers to bring about significant improvements in almost every area, including the food business, building, computer technology, medicals, and new energy sources. In conclusion, the development of nanotechnology and Nano science has had a profound impact on human existence. The health of humans and the environment are affected by this cutting-edge technology in both positive and harmful ways.

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Food Analytics

INTRODUCTION

Food analytic is a method used to determine a chemical or physical property of a food substance that can be calculated with closed mathematical equation. There is a wide variety of food analytical techniques used for analysis, from simple weighing to advanced measurements of food samples.

FOOD ANALYTICS METHODS

1. To determine the geographical origin of food products:

By nature, food products have a land-based, and therefore geographical origin. Chemo metric analysis of the data provided by analytical instruments which have the ability to establish links to the food origin. The techniques include,

Mass spectrometry techniques (mass to charge ratio of ions)

- Isotope ratio mass spectrometry (IRMS) is a technique that can distinguish chemically identical compounds based on their isotope (13C/12C, 15N/14N, 18O/16O and 2 H/1 H) content.
- Inductively coupled plasma mass spectrometry (ICP-MS) is a tool for the quantitative determination of a range of metals and non-metals (inorganic elements) in a wide variety of samples at trace (ppb–ppm) and ultra-trace (ppm–ppb) concentration levels.
- Proton transfer reaction mass spectrometry (PTR-MS) allows quantitative on-line monitoring of volatile organic compounds.

Spectroscopic techniques

- Infrared spectroscopy (IR) is the measurement of the wavelength and intensity of the absorption of infrared light by a sample.
- Fluorescence spectroscopy used to identify and analyse fluorescent compounds at very low concentration levels (in the parts per billion range) while providing information about structure, formulation, and stability
- Atomic spectroscopy can be used to analyse the vaporised atoms of metals and non-metals in a variety of samples.

All these techniques integrate the chemo metric analysis to determine the geographical origin of various food products.

2. To determine the bisphenol A in food:

Bisphenol A (BPA), 2,2-bis(4-hydroxyphenyl) propane, is one of the highest volume chemicals in the world. A wide variety of food contact materials stand out among their uses, mainly derived from polycarbonates (infant feeding) and epoxy resins (internal protective lining for food and beverage cans) and surface-coating on drinking water storage tank. The effects of BPA are mediated by both genomic and non-genomic estrogen-response mechanisms, with the disruption of the cell function occurring at doses as low as 1 pM. The analytical techniques include,

- Electrochemical detection of BPA is based on the electroactivity of the phenolic groups present in the molecule. LC–ED has been used for the determination of BPA in biological fluids and water.
- Immunochemical methods to the determination of BPA in foods is rather recent. It has focused on the analysis of liquid foods, mainly milk, water and food simulants, using polyclonal mammalian and chicken antibodies in enzyme linked immunosorbent assays (ELISA). The detection limits ranged from 0.05 ng mL−1 to 500 ng mL−1, mainly depending on the immunogen and the type of antibody produced.

3. Neural networks (NN)

Branch of machine learning, employs layers of algorithms to process data, understand human speech, and visually recognize objects.

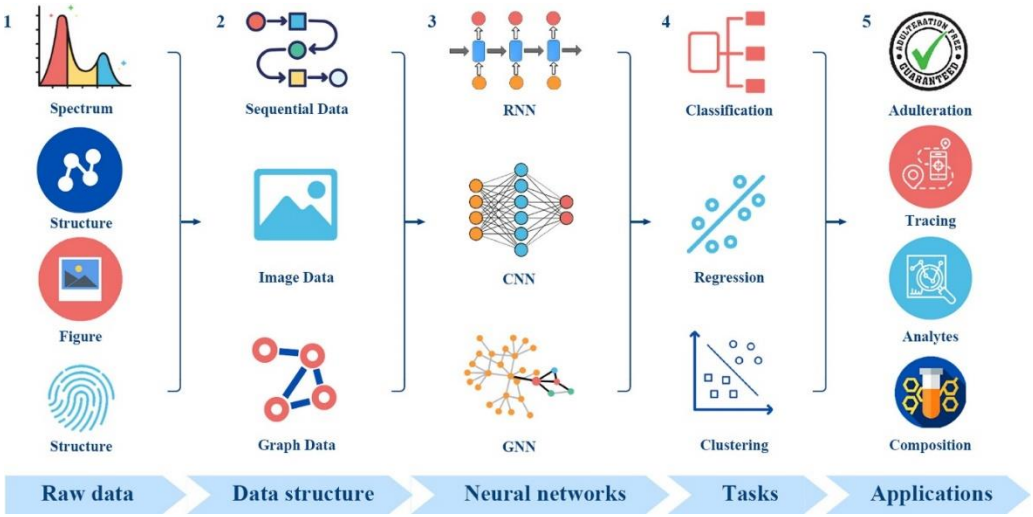

Figure 1

Neural network tasks include: classification tasks aim to *qualitatively* determine the class of the target objects, The regression tasks aim to *quantitatively* determine the property of the target objects, the Clustering task - grouping a set of objects in such a way that objects in the same group are more similar (in some sense) to each other than to those in other groups.

NN algorithms have high flexibility in detecting Food adulteration, Quantitative analysis, Geographical origin detection, Variety identification. NN has been applied to the prediction of indicators based on the structure of molecules and processing of raw chromatographic data (descriptive or graphic) for more accurate results

4. Surface enhanced Raman spectroscopy (SERS)

It is the rapid, sensitive and specific detection technique. Surface enhanced Raman spectroscopy (SERS), which combines the benefits of Raman scattering with the electromagnetic and chemical enhancement induced by metallic nanoparticles, is capable of detecting very low concentrations and even of single molecules.

By combining this approach with a lipophilic sensor layer (LSL), the detection of the illegal water-insoluble food dyes, such as Sudan III in presence of riboflavin, as water-soluble competitor, is possible.

CONCLUSION:

Food analytics includes the development of sensitive, effective and roburst methodologies to ensure food quality, traceability and safety. The newly developed analytical methods have increasingly shown to be the promising solution to the demand of reducing or eliminating reagents harmful to human health. The development of analytical methods in food greatly influences the characteristics and functional perspective of food, which lead to the development of different food products with a safety discipline.

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Improved & Sustainable Food Production

INTRODUCTION

Nearly one billion of the seven billion people who currently live on the planet are undernourished and eat inadequate amounts of protein, lipids, and carbohydrates. A further billion people are undernourished as a result of diets deficient in essential micronutrients like iron, zinc, and vitamin A. To improve sustainable food production, implementing techniques like transport proteins, one health initiatives for secure, safe, and sustainable food systems,

Targeting transport proteins that are embedded within membranes is crucial to increasing how effectively plants absorb and utilise water and nutrients. These proteins are crucial for getting sucrose, the plant's currency for energy, where it is needed. They also regulate drought tolerance and transport mineral minerals. Transporters are also essential to the systems that let plants endure unfavourable conditions like acidic or saline soils. Over the past 20 years, developments in physiology, genetics, and biophysics have greatly advanced our knowledge of the molecular underpinnings of plant nutrition and how plants react to stress. In this article, summarises how to improve the sustainable production.

ALUMINIUM TOLERANT CROPS FOR ACID SOIL

Aluminium present in the soil is non-toxic complexed forms at pH levels above 5. But when soils are acidic, Al^{3+} ions are released, which makes plants poisonous. Major grain crops have natural genetic diversity in Al^{3+} tolerance. It was observed that numerous species' inherently occurring tolerance mechanisms involved the outflow of organic anions from roots. Members of two families of transport proteins, which are essential to this mechanism, export the organic anions from inside root cells to the extracellular medium surrounding the roots. The sensitive tips are shielded and the roots are able to expand unhindered by the organic anions released by roots, which chelate Al^{3+} into a non-toxic form

There are two main tactics that plants employ to deal with this poisonous cation, according to the finding of transporters that mediate Al^{3+}tolerance. $Al^{3+}$is stored inside cells in the vacuole in one technique, and is barred from cells by chelating the poisonous ion that surrounds plants in the other. The genes encoding these transporters are a crucial component along with management techniques like soil liming to promote soil fertility in the development of (Al^{3+}) tolerant crops, using this plan to increase yields in acidic soils.

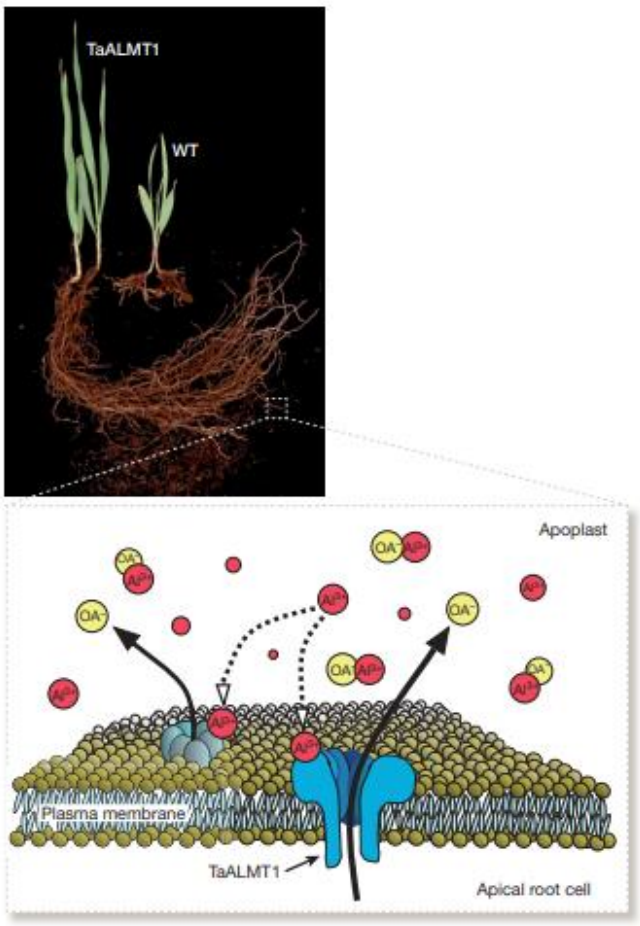

Fig -1 Engineering plants for enhanced aluminium (Al^{3+}) tolerance.

PUMPING IRON AND ZINC

Due to inadequate dietary intake of these vital nutrients from plants, about two billion individuals worldwide have iron and zinc deficiencies. Because metal ion concentrations in different tissues and compartments are kept below strict physiological limits by coordinated absorption, transport, and storage, creating crop cultivars with higher micronutrient concentrations, a strategy known as biofortification is difficult. The removal of the grain's outer layers during polishing also effectively eliminates all of the micronutrients from crops like rice, leaving only the starchy endosperm. For example, increasing iron influx into the endosperm by means of the iron-nicotianamine transporter Oryza sativa yellow-stripe or increasing iron translocation by overproducing the metal chelator nicotianamine and phytosiderophores have led to greenhouse-grown rice with three- to fourfold higher levels of iron (Fe) in polished grain. The iron content increased more than sixfold when nicotianamine overproduction and increased ferritin expression were combined. By combining the strategies, polished rice was produced in paddy fields with Fe concentrations that were 4.4 times higher than those of non-transgenic seeds, with no yield penalty.

Metal tolerance protein is another interesting option for use in biofortification because it carries divalent cations into the vacuole as well. Thus, a variety of techniques are being employed to boost the micronutrients zinc and iron in edible plant tissues, although additional advancements are required.

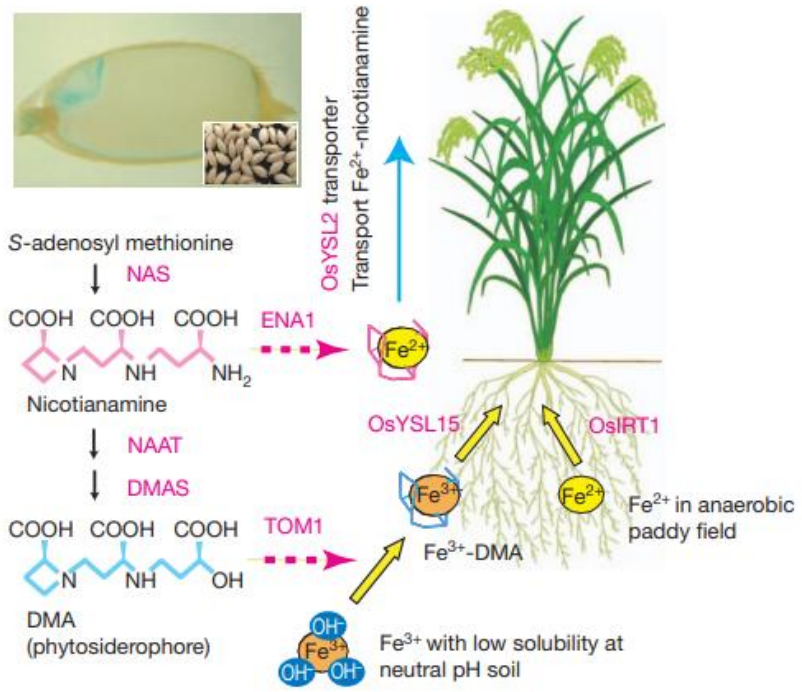

FIG -2 Iron transport in rice.

ENHANCING PHOSPHATE USE EFFICIENCY

A macroelement called phosphorus (P) is crucial for crop yield and for the growth of plants. The biogeochemical characteristics of the soil have an impact on the availability of inorganic P, or orthophosphate, which restricts crop output on roughly 70% of the world's agricultural soils. Thus, the manufacturing of orthophosphate fertilisers, which are made from rock phosphate, a limited and non-renewable mineral resource. In order to ensure the sustainable use of orthophosphate, which is essential for human nutrition, it is anticipated that only 20–30% of the P fertiliser applied is utilised by cultivated plants.

Phosphate efflux transporter, a key factor in the control of orthophosphate homeostasis, is necessary for orthophosphate transfer to the shoot and offer techniques for enhancing orthophosphate distribution within plants. In addition to taking orthophosphate directly from the soil, the majority of crop species have the ability to create symbiotic relationships (known as arbuscular mycorrhizae) with soil fungus. Through large hyphal networks, these fungi seize orthophosphate and transport it to symbiotic compartments in the root, where plant orthophosphate transporters convey this ion to the root cells. Functioning plant symbiotic orthophosphate transporters are necessary for both this mechanism and symbiosis maintenance. For breeding plants with increased orthophosphate acquisition and usage efficiency and that benefit the most from their fungus symbionts, phosphate transporters are crucial targets.

SUSTAINABLE FOOD SOURCES

Additionally, there is a growing demand for plant-based proteins as a result of consumer dissatisfaction with animal sources of protein. Greenhouse gases emissions from animal-based diets are higher than those from plant-based foods. Subsequently, linked to climate change are greenhouse gases. Due to the requirement to produce more animal feed, it is anticipated that the growing demand for animal-based protein would increase the pressure on land.

Alternative plants, aquatic photosynthetic creatures, microbes, and insects are among more cutting-edge suppliers of protein. The cactus pear has promise for growing in arid and semiarid regions, requires less inputs (water, fertilisers) than conventional sources (cereals, legumes), and offers the chance to valorise biomass that is typically regarded as waste (cladodes). Aquatic photosynthetic organisms such as microalgae, cyanobacteria, and duckweed have advantages over food crops such as year-round harvesting, high biomass yields. By increasing the protein content of organic substrates, microorganisms can potentially valorise biomass that is currently discarded (such as cladodes, marine waste, and waste products). Insects are less competitive for land, consume less water, emit less NH3 and greenhouse gases, have a higher percentage of protein in their bodies, are edible, and are more easily digested than conventional livestock.

SUSTAINABLE FOOD PROCESSING

Future directions in the field need to focus on developing zero discard/loss/waste technologies as well as sustainability, which is a given and essential component of food processing. The use of liquids under negative pressures, pressure freezing-air drying, high hydrostatic pressure-assisted freezing and thawing, re-evaluation of strong magnetic fields, or expansion of pulsed process application beyond pulsed light and electric fields are a few examples of future directions. The use of nanotechnology in food has the potential to support sustainable food supply networks. Understanding and manipulating matter at the nanoscale are included in nanotechnology, which makes it possible to change a product's material qualities to better suit its intended use.

Encapsulated ingredients that protect delicate bioactives (such as omega-3 fatty acids and vitamins) and increase nutrient delivery are examples of nanotechnological innovations in the food and agriculture sector. Other innovations include smart sensors for better management of food safety and nanocomposites that enhance the barrier properties of packaging materials. Superior packing materials have the ability to reduce wastage in the supply chain, and smart sensors aid in quick decision-making for suitable interventions. To assist the adoption of nanotechnological advancements and consumer acceptance, an evaluation of the safety of nanostructured materials will be necessary in conjunction with suitable regulation and law.

CONCLUSION

This study offers fresh ideas for improving human nutrition through biofortification and more sustainably using the scarce soil nutrients. The Brassica family of plants, which includes mustard and oilseed rape (canola), produces glucosinolates, which are powerful chemicals that protect plants against herbivores and plant infections. By identifying cadmium transporters and utilising a molecular marker to choose genotypes that accumulate low levels of cadmium, it has been possible to generate rice with practically cadmium-free grain. Utilising cutting-edge techniques that consume less water and energy should be incorporated into the design of sustainable engineering systems and processes. Develop sustainable, effective, and responsible food packing, storing, transporting, and delivery methods for enhanced food processing; use alternate energy sources and production/processing based on biological systems and with PAN principles.

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