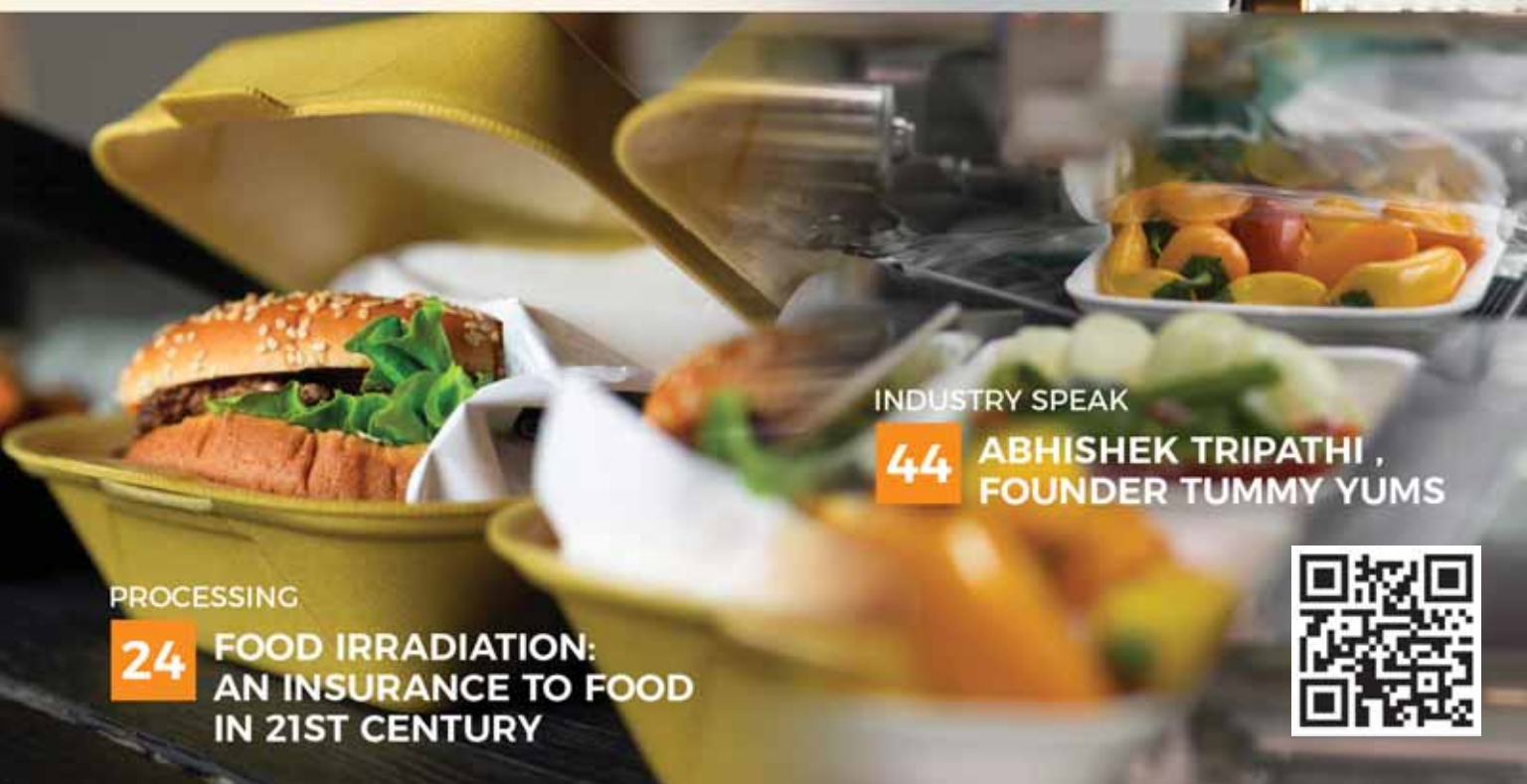
INDIAN EDITION

Price ₹250

Vol. 12 • Issue No. 6 • June 2021

food MARKETING & TECHNOLOGY इंडिया

FOOD PACKAGING
IS FOR BRANDING AND FOR FOOD SAFETY



Linear Curd Filling Machine

Model : LF 5

- With Intelligent Servo Indexing
- Servo Driven PLC Controls
- Fills - Seals 5 Cups at a time
- Capacity : 6000 Cups per hour.

We also manufacture Rotary Cup / cone filling machine for Ice cream, Yogurt, Cheese, Margarine, Shrikhand, Ghee, Peanut butter, Lassi, Jam, Milk Powder and other similar products.

50 years of experience has made our machines more accurate, reliable and user-friendly. Among our prestigious customers, we have Amul, NDDB, Mother Dairy, Vadilal, Havmor, Hatsun, Heritage, Gowardhan, Cream bell, Britannia, Nestle, HUL, Tetra Pak, Alfa Laval, GEA who have awarded us with repetitive orders during the last **50** years.

Celebrating 107th Year
1913 - 2020

PWS ENGINEERS PVT LTD
Panchal Estate, Nr. Madhubhan Resort, Anand – Sojitra Road, **ANAND** 388 001 (Gujarat) India.
Phone : 02692 – 261424 / 261716 / 261849 / 261948
Email : pws@pwsengineers.com, Website : www.pwsengineers.com

DESIGNED FOR PERFORMANCE

Our commitment to quality has driven us to draft a quality manual which has procedures listed out for checking all the components that go into the assembly of a filter. All filters & accessories offered by us are subjected to as many as 10 quality checks by qualified engineers/technicians. This ensures that these components indeed are designed for performance to the fullest satisfaction of the customer. This is in tune with our company's proclaimed objective stated in our Quality Management System.

Customer complaints (if any) are attended to on priority basis, feedback from the customers are recorded & monitored, which in turn helps us serve the customer better.

Get in touch with us for filtration systems which are truly 'DESIGNED FOR PERFORMANCE' ™

Kumar Process Consultants & Chemicals Pvt. Ltd.

URS is a member of Registrar of Standards (Holdings) Ltd.

An ISO 9001:2015 certified company

www.siddharthads.com

Clear solutions for your filtration problems since 1978

4 & 5, Bhagtani Enclave, Sonapur Lane, Off. LBS Marg, Bhandup (W), Mumbai 400 078. INDIA. Tel. + 91 22 3552 3562
Mobile: 90047 06047, 98923 12343. **email: info@kumarfilter.com www.kumarfilter.com**

Publisher's Note

Did you know Indian sweetmeats have different spans of shelf life like packaged food? Of course, you would be interested to know what can be stocked and consumed for a longer period. For instance, strawberries have a high degree of perishability owing to their high respiration rates that lead to the loss of organoleptic traits. High sensory quality and microbiological constancy are important elements in upholding the commercial marketability of fresh produces.

There are increasing demands for longer shelf-life and enhanced quality retention for foods because of economic globalization. The advent of new food products on the market with the need of consumers to continuously observe their quality until consumption, in addition to the requirement for cutting food corruption during preservation time, have led to the development of some modern packaging technologies.

Packaging of a product not only guarantees a safe and protected reach to the end-user but also considerably affects the way the product is offered to the consumers from the marketing viewpoint. New technologies such as intelligent packaging, active, smart packaging, and modified atmosphere packaging are substituting traditional systems such as canning.

The importance of active packaging to the world food packaging community is certainly getting an extravagant amount of publicity. But isn't this always the situation when a food packaging know-how arises from the shadows and appears to do some magic to preserve food substances for some unbelievable period?

One thing is clear, packaging of perish fruits and vegetables must provide protection, ensure safety, and retain the quality of produces. According to numerous studies, active packaging has proven to be an exceptional method to attain these requirements by interacting with produces and manipulating headspace atmosphere inside package through the use of oxygen absorbers, ethylene absorbers, moisture absorbers as well as using antimicrobial agents. Other than active packaging, intelligent packaging, especially freshness indicator, can communicate the condition and quality of produces with consumers. The use of both intelligent packaging and active packaging can efficiently extend shelf life and deliver high-quality produces at consumer ends.

As a real fresh-like product, they preserve their natural properties as well as maintain the original characteristics of freshness, fragrance, identity, and nutrition. An important challenge is to visualise and pass on these benefits to consumers.

Since the proper visibility of the food is essential to validate product freshness, the features of the visual language of the final product have to be comprehended and described. This means that the food has to be designed together with its package in order to get a package system which is not only active but also interactive. The new package system could be well-thought-out as a smart and intelligent packaging and could be the solution to this challenge.

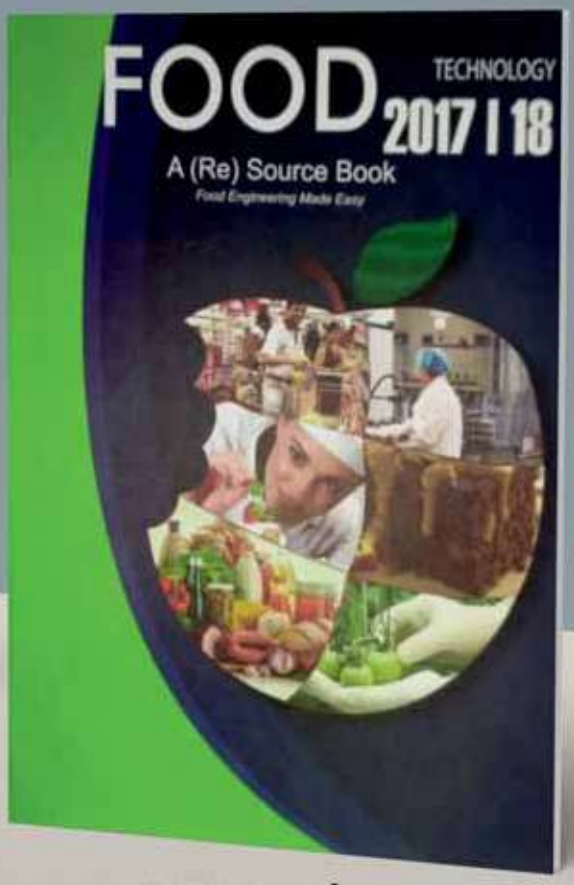
Intelligent packaging is able to carry intelligent functions like sensing, detecting, tracing, recording and communicating to enable decision making to prolong shelf life, enrich the quality, enhance safety, provide information and warn about likely problems. Though the use of sensors on the outer face of the pack is deemed intelligent to show spoilage and provide a better indicator of the shelf life of the product, the technology is also expensive to be implemented for commodity products like milk, fruit juice and other categories of beverages.

This is certainly an exhilarating area of technology which has got efficient contemporary consumer reaction. Yet, it does give a chance to the Indian packaging industry to assume some basic R&D to recognise the food product where this technology can be implemented and curtail wastage of such food products.

Linda Brady Hawke

food MARKETING & TECHNOLOGY इंडिया

Big Offer



₹2400/-

~~₹3400/-~~

₹1000/-

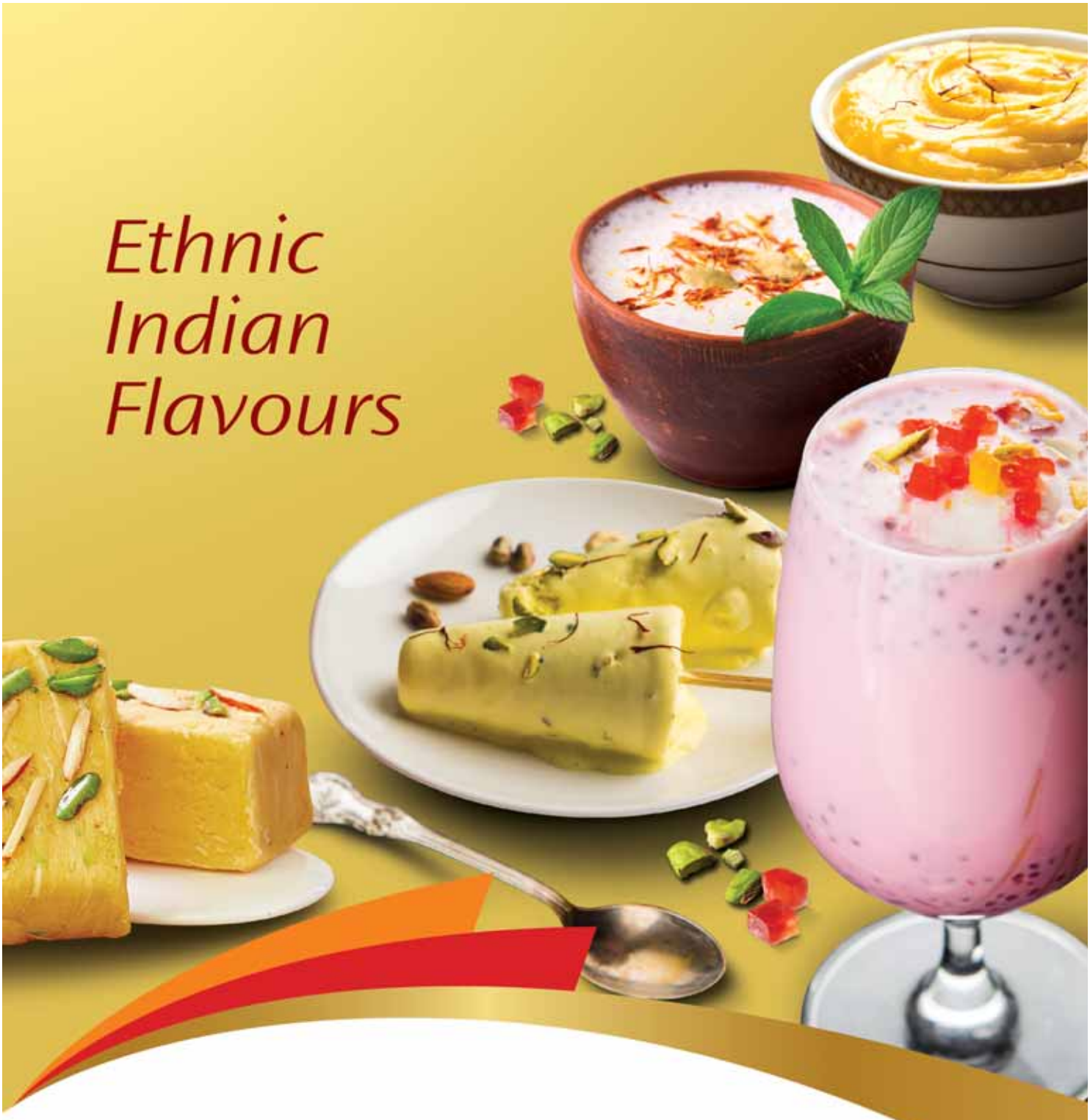
₹2600/-

(One Year Print Subscription + (Re) Source Book)

To avail this Offer Call +91-7827892179 or email at info@fmtmagazine.in

Contents

June 2021



Sonarome offers an exciting range of ethnic Indian flavours like kulfi, ras malai, mawa, kheer, gajar halwa, namkeen lassi, gulab jamun and many more.

40 YEARS
OF DELIVERING
ON COMMITMENTS

sonarome
India's No.1 flavour company

Sonarome Private Limited
One Sonarome Way
KIADB Industrial Area, Doddaballapur
Bangalore 561 203, India
FSSC 22000 & GMP CERTIFIED COMPANY

T +91 80 68902200
F +91 80 68902299
sonarome@sonarome.com
www.sonarome.com

Partner
iff

Nestlé Document Describes Majority of Firm's Food and Drinks Portfolio as Unhealthy

Nestlé has said in an internal document that more than 60% of its mainstream food and drinks portfolio does not meet a "recognised definition of health", according to a report by the Financial Times.

The company says that it is working on updating its nutrition and health strategy after the Financial Times reported seeing a presentation that was circulated among top Nestlé executives earlier this year.

The food giant is also said to have acknowledged that "some of our categories and products will never be 'healthy' no matter how much we renovate".

According to the Financial Times, the presentation said that only 37% of Nestlé's food and beverages by revenues, achieve a rating above 3.5 under Australia's health star rating system. The system scores foods out of five stars and Nestlé described the 3.5 star threshold as a "recognised definition of health".

The newspaper says that the data excludes categories like infant formula, pet food, coffee and medical nutrition, and therefore accounts for about half of the company's total annual revenues.

"Nestlé is working on a company-wide project to update its pioneering nutrition and health strategy," said a Nestlé spokesperson.

"We are looking at our entire portfolio across the different phases of people's lives to ensure our products are helping meet their nutritional needs and supporting a balanced diet."

Nestlé claims to have reduced the sugars and sodium in its products by about 14-15% in the past seven years and that it has been working "over decades" to improve the nutritional footprint of its products.

The spokesperson added: "We believe that a healthy diet means finding a balance between wellbeing and enjoyment. This includes having some space for indulgent foods, consumed in moderation.

"Our direction of travel has not changed and is clear: we will continue to make our portfolio tastier and healthier."

Tata Sons Acquires Majority Stake in Online Grocery Service BigBasket

Indian conglomerate Tata Sons has bought a majority stake in online grocer BigBasket, according to a report by Reuters.

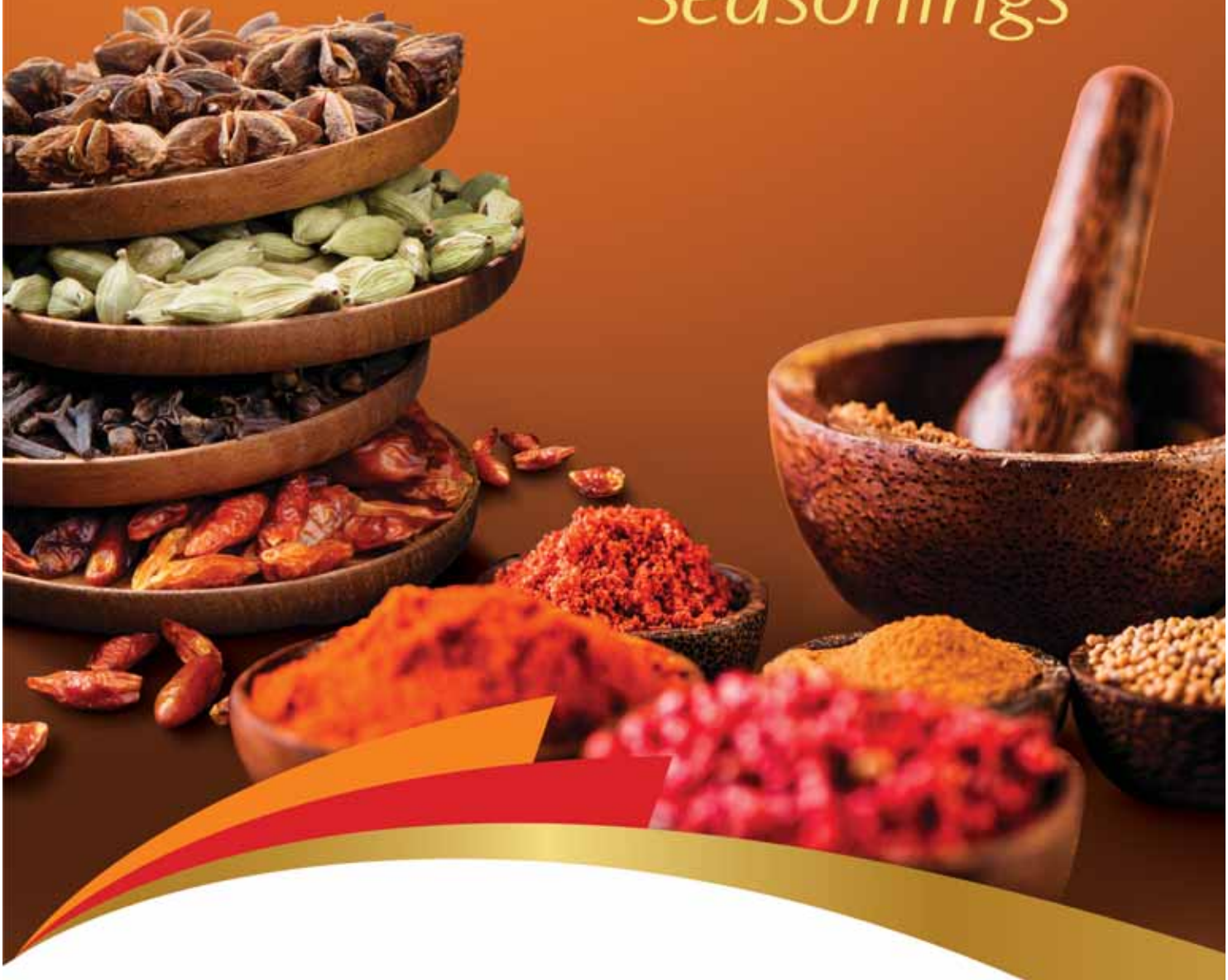
The controlling interest in the Indian business was purchased by Tata Digital, a unit of Tata Sons.

Earlier this year, the acquisition of an up to 64.3% stake in BigBasket by Tata Digital was approved by the Competition Commission of India, the country's antitrust body.

Media reports, cited by Reuters, have said the deal is worth around INR 95 billion ($1.31 billion approx.) and will involve buying out Alibaba's stake.

The Chinese technology giant became the biggest shareholder in BigBasket around three years ago, after participating in a $300 million funding round.

Ethnic Indian Seasonings



Sonarome offers an exciting range of mouth-watering spice blends and seasonings for use in snack foods and savoury products.

40 YEARS
OF DELIVERING
ON COMMITMENTS

sonarome
India's No.1 flavour company

Sonarome Private Limited
One Sonarome Way
KIADB Industrial Area, Doddaballapur
Bangalore 561 203, India
FSSC 22000 & GMP CERTIFIED COMPANY

T +91 80 68902200
F +91 80 68902299
sonarome@sonarome.com
www.sonarome.com

Partner
iff

Tetra Pak Optimal Integrated Solutions Help Cut Water Usage & Carbon Emissions

Tetra Pak showcases its new UHT 2.0 heating portfolio and Tetra Pak E3/Speed Hyper packaging equipment on World Milk Day in support of this year's theme of sustainability and Dairy's commitment to innovation to reduce environmental footprint.

Tetra Pak's new UHT 2.0 portfolio with OneStep technology and E3/Speed Hyper reduce water and steam consumption, creating less waste water and therefore also lowering the cost of its removal for Dairy manufacturers. Adding a Water Filtering Station unit to E3/Speed Hyper helps recover 5500 litres of water per filling machine running hour (up to 95%), while contributing to lower water consumption. With water scarcity on the rise, wastewater is increasingly becoming a pressing industry concern. Up to a fifth of the customers are based in high or extremely high-risk water areas and the company is prioritising action to address this.

Alejandro Cabal, vice president Packaging Solutions, Tetra Pak, said, "As part of Tetra Pak's wider ambition to reach net zero emissions across the value chain by 2050, we want to be part of the solution to limit climate change for the global dairy sector. Addressing this through innovation and collaboration is vital."

Frederik Wellendorph, vice president Liquid Food, Tetra Pak, said, "We continuously innovate in both food processing and packaging to offer solutions which enable reduction in water consumption, carbon footprint and product losses."

Upgrades to UHT 2.0 portfolio will enhance automation possibilities and performance, with the offering representing the strongest in the industry. The new UHT 2.0 portfolio combined with OneStep technology cuts processing steps out of the production line without affecting end-product quality.

The E3/Speed Hyper represents the future of portion package production. It is the world's fastest aseptic carton filling machine, producing up to 40,000 portion packs per hour, using eBeam sterilisation technology to complete the task more efficiently and more rapidly than has previously been possible. This reduces the environmental impact and makes water recycling easier. It couples low-cost high-speed production with significant environmental advantages. While its increased capacity can reduce manufacturers' operational costs by up to 10%, it also represents a low carbon alternative to aseptic PET equipment – since electricity consumption and carbon footprint are both five times lower than for aseptic PET lines.

The announcement follows the company's 2020 pledge to not only reach net zero emissions in its own operations by 2030 but to also realise a net zero emissions ambition across the value chain by 2050. The company has planned a step-change in investment levels in sustainable innovation, committing at least €100 million annually over the next 5-10 years. This will help the company realise its goal of offering processing and packaging solutions with a minimal carbon footprint.

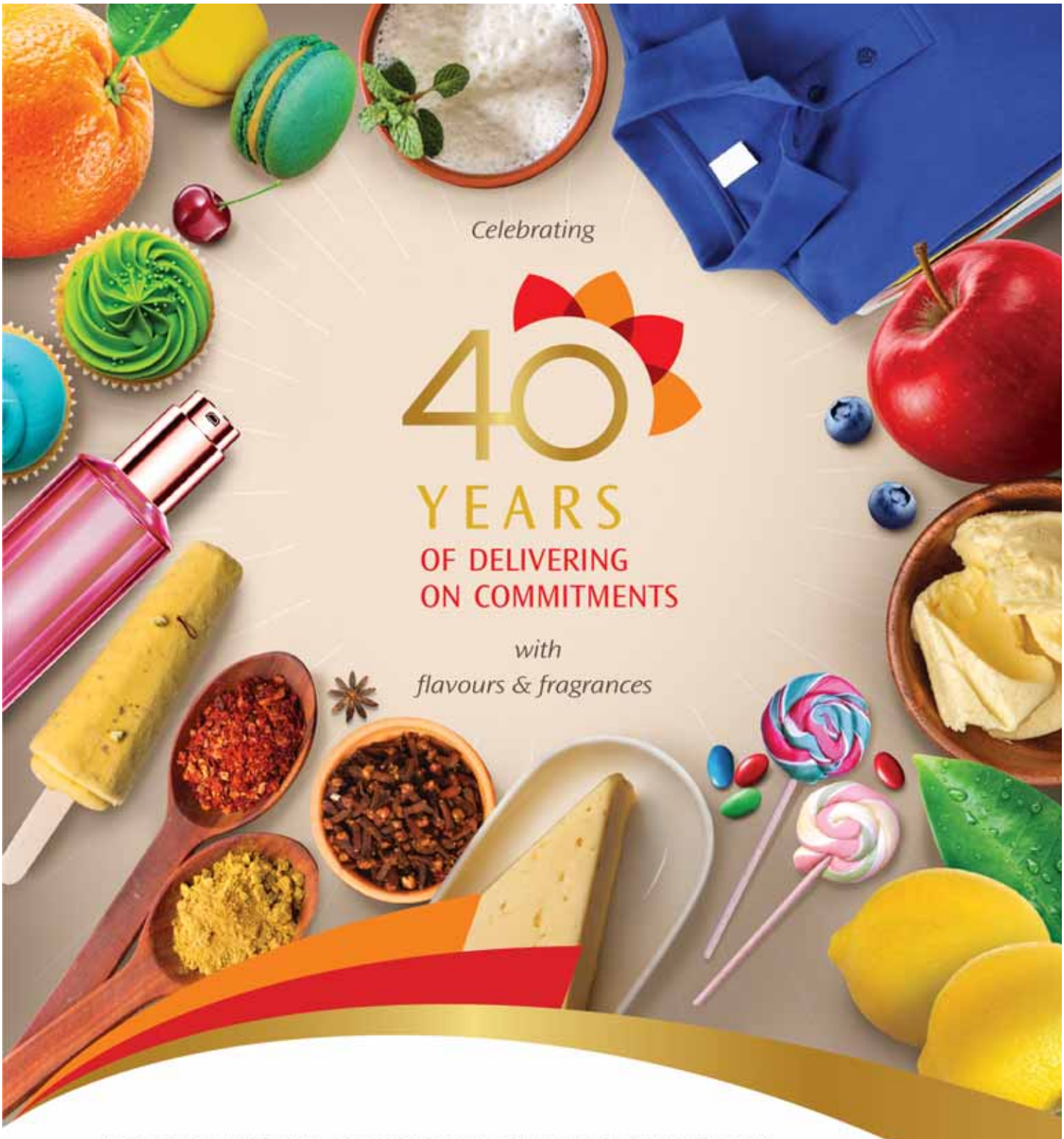
JK Masale Launches Online Delivery Platform JK Cart to Deliver Essential Items During Lockdown

JK Masale has launched its new pan India online delivery platform JK Cart to deliver essential items during lockdown, at a virtual press conference with brand ambassador Tollywood actor Priyanka Sarkar.

The second wave has hit the country with unprecedented ferocity and a subsequent lockdown again. Therefore, the company wants to encourage people to 'Stay Home, Stay Safe'.

The platform will deliver spices, cooking essentials and superfoods to beverages and dry fruits pan India, keeping safety and hygiene in mind.

Amit Jain, director marketing, JK Masale, said, "Online delivery has gained momentum since the previous lockdown as the need for essential items never die down. This year we have decided to go ahead with our own platform which is available on android and iOS along with the website of JK Cart. We have also ensured hassle-free return of items along with a pan India delivery and lucrative discount on products keeping in mind the current scenario.



Complete range of flavours, natural food colours, spice blends for food products and fragrances for body sprays, hand wash, sanitizers, cosmetics, soaps and detergents.

sonarome
India's No.1 flavour company

Sonarome Private Limited
One Sonarome Way
KIADB Industrial Area, Doddaballapur
Bangalore 561 203, India
FSSC 22000 & GMP CERTIFIED COMPANY

T +91 80 68902200
F +91 80 68902299
sonarome@sonarome.com
www.sonarome.com

Partner
iff

McDonald's and BTS Partner to Offer the Supergroup's Favorite Order

Get ready, because the Golden Arches are about to shine even brighter thanks to a new collaboration with 21st century global pop icons, BTS.

This one-of-a-kind menu "tour" will arrive in North and East India on 1st June and South and West India on 4th June, when customers can enjoy the band's signature order at participating restaurants across India. The BTS Meal includes a [10-piece] Chicken McNuggets®, medium World Famous Fries®, medium coke, and Sweet Chili and Cajun dipping sauces inspired by popular recipes from McDonald's South Korea.

"The band has great memories with McDonald's. We're excited about this collaboration and can't wait to share the BTS Meal with the world," says BIGHIT MUSIC, label of BTS.

Since 2013, BTS has topped music charts and brought people together from all over the world through their music and positive messages. In India, too, the band has quite a phenomenon fan following, especially among GenZ and millennials. India ranks among the top five or six countries contributing to music-video views of K-pop bands*.

"No matter who you are, everyone has a go-to order at McDonald's – even international superstars like BTS." said Rajeev Ranjan, Chief Operating Officer, McDonald's India – North and East. Connaught Plaza Restaurants Pvt. Ltd. operates McDonald's restaurants in North and East India. "This band is truly a global phenomenon with a fanbase that knows no borders, and we couldn't be more excited to bring the BTS Meal to our customers in India."

McDonald's India customers will be able to order the BTS Meal through McDonald's App, in-store, at the Drive Thru or via McDelivery (wherever allowed by the local authorities). So mark your calendars for June 1 and June 4, and be sure to keep an eye out on McDonald's social channels (Facebook, Instagram, Twitter and YouTube) for regular updates on this exciting partnership!

Kanchan Metals Launches New Pellet Frying Line for Food Processing Industry

India's leading food equipment manufacturing and food processing company has recently launched a Pellet Frying Line with Pre-Fryer for the growing snacks and food processing industry.

This product is developed for Fryums-Pellet Snacks, Namkeen ingredients like Sabudana, Vatana and other products that require dual stage Frying. The double wall fryer with submerge Fryer having Direct (with heat recovery system) and Indirect oil heating options results in fuel efficient Frying while adding Pre-Frying to existing Fryers results in increased production capacity, better product expansion and crunchiness.

The product's USP lies in full control on frying parameters and minimum space requirement. The line capacity of the Pellet Frying Line with Pre-Fryer starts from 300kg/hr onwards till 1000kg/hr. Pre-Heater technology helps to remove moisture of raw pellets by at lower tempt. The machine is inbuilt with system which is capable of handling a wide range of pellet shapes using a highly efficient frying process.

One of the best features, when compared with other systems, is the low maintenance component. Apart from this, it has an integrated clean in place (CIP) system which comprises automated systems used to clean the interior surfaces of the fryer.

Raghav Gupta, director, Kanchan Metals, said, "We are delighted to announce the launch of our new product called Pellet Frying Line with Pre-Fryer. This frying line is designed by our experienced professionals using modern technology and the best quality components in adherence with industry quality norms. The provided frying line is checked against various quality measures so as to ensure its quality. The products can be customised to meet the varied requirements for our clients."

Quality in process automation

Our competence for your application

We have been manufacturing products for automation technology since 1969. Our expertise in process products includes pressure, level, flow and temperature sensors. To make sure we satisfy the highest quality standards, we have an independent, accredited calibration laboratory. Hygienic materials and surfaces, protection rating IP 69K, EHEDG Certification and other approvals such as 3A Sanitary standards, FDA and EC 1935/2004 are only some of the high standards our sensors live up to in this sector.
We invite you to challenge us! ifm – close to you!

ifm electronic India Private Limited
Plot No. P-39/1, MIDC Gokul Shirgaon · Kolhapur - 416234 · Maharashtra
Phone: +91 231 267 2770 · Fax: +91 231 267 2388 · Toll Free: 1800 233 2065
E-mail: info.india@ifm.com · Internet: www.ifm.com

APEDA Seeks Law Firms' Assistance for Basmati Rice Intellectual Property

The Agriculture and Processed Food Export Development Authority (APEDA) has invited offers from law firms specialised in registration and protection of Intellectual Property to assist the Basmati Export Development Foundation (BEDF) and APEDA in the task of registration and protection of Intellectual Property in respect of Basmati rice in India and abroad.

The selected firm will be engaged initially for a period of two years, reads a notice issued by the APEDA while the bids can be submitted by May 31, 2021 (5 p.m.) to APEDA.

The scope of work includes advising BEDF/APEDA on the protection of Basmati and its varietal names which have been notified from time to time under the Seeds Act -1961 vis-à-vis the entire spectrum of Intellectual Property laws and assist in registration/protection of Basmati in India and abroad.

Monitoring of the national and international registers of trademarks and geographical indications (GIs) on third party efforts to register the Intellectual Property in Basmati and its varietal names, which have been notified from time to time under the Seeds Act -1961 and take requisite action in India and abroad.

And, action against potential threats to the name Basmati and its varietal names which have been notified from time to time under the Seeds Act -1961 in India and abroad through cease and desist notices, oppositions, cancellations, court actions or other modes of action along with representing BEDF/APEDA before the Courts of law in India and abroad, including the Geographical Indications Registry and the Trade Marks Registry and the Intellectual Property Appellate Board.

The notice says, the selection of the successful bidder shall be based on technical and financial criteria. A Committee in APEDA will carry out screening of the technical bid and will shortlist the bidders fulfilling the prescribed requirements. The shortlisted bidders will be required to make a technical presentation before the selection committee, before final selection.

Umami – The Fifth Taste

By Shreya Rajwade*

Ever wondered how 'Indian Chinese' cuisine overwhelmed India that now it is served in every corner of this country? Well the answer to it is that we Indians love 'Umami' taste. As kids we are taught about sweet, salty, bitter, sour as basic tastes. These tastes aren't challenging to identify. But 'Umami', the fifth basic taste is slightly complicated to distinguish than the rest.

Some examples of food high in Umami are- Soy sauce, meat, fish, tomato, tomato ketchup, pizza, pasta, Indian curries (butter chicken, dal makhani, etc.) and many more. Umami taste is known to give a feeling of satisfaction, satiety after eating. Umami can truly be identified as the taste of 'Yummy'!

It was a quite tough time for this taste to get scientific and social acceptance. Umami received scientific recognition in 1985, almost 77 years after it was first discovered by Kikunae Ikeda, who was a Japanese professor in 1908. The term 'Umami' comes from the Japanese adjective for delicious (umai). Even after getting recognition, umami was labelled as fifth basic taste in 2000 when an umami taste receptor of the brain was discovered.

There are several compounds which trigger the umami taste receptors. One such main compound is Glutamate (salt of Glutamic Acid). However, glutamate alone cannot produce sufficient flavour of umami, and so it arises from the synergy of glutamate and nucleotides (L-Glutamate, 5'-ribonucleotide) such as Inosinate (IMP) and Guanylate (GMP). IMP and GMP do not cause umami of their own. Our foods are often rich in glutamate, inosinate and guanylate. They are present in every living thing and are central to biology on the planet.

Glutamate is salt of non essential amino acid- Glutamic acid. Glutamate is present in food ingredients in either free form (Free Glutamic Acid) or in bound form (Glutamate bound to proteins). Bound form is tasteless and does not elicit umami response. For triggering an umami response, protein hydrolysis of bound glutamate is required.

Common food processing techniques such as dehydration, aging, fermentation and ripening help in protein hydrolysis and liberation of free glutamic acid (FGA). Therefore, methods of food processing can enhance the concentration of free glutamic acid in food. Eg. FGA of processed tomatoes i.e, tomato ketchup, tomato pastes, purees is twice that of fresh tomatoes. Hence, enhancing the natural glutamates in food ingredients can be great value to food processors.

	Food Products	Free Glutamic Acid FGA (mg/100g)
1.	Cured Ham	337
2.	Sardines	280
3.	Mackerel	215
4.	Scallop	140-159
5.	Parmesan cheese	1200-1670
6.	Fresh Tomato	140-246
7.	Processed tomato	230
8.	Soy Sauce	1264
9.	Green tea	668

After discovery of umami, Ikeda along with Saburosuke Suzuki (an iodine manufacturer) developed a new seasoning MSG (Monosodium Glutamate) to simply add umami taste in Japanese home cooked dishes. Ikeda decided to develop a mass production process for MSG from hydrolysate of wheat protein.

MSG is nothing but sodium salt of Glutamic Acid. It became popular all around the word as 'flavour enhancer' (E number 621). In India, right from restaurants to FMCG companies started using MSG. Increased usage of MSG initiated a debate on its safe usage without toxic side effects. The Food Safety and Standards Authority of India (FSSAI) banned 'Maggi' noodles, the most popular consumer product in India owing to high content of MSG. Later, FSSAI issued an order allowing the use of MSG considering good manufacturing practices being followed and that the consumers should be well aware of what they are consuming. Such decision was made as there is no analytical method to determine whether flavour enhancer is naturally present in the product or is added. Despite a lot of controversies over use of MSG, it is still 'generally recognized as safe' by the FDA.

India being a country of people who are born foodies, this taste has been an essential part of our cuisine unknowingly. Our Indian spices, the 'tadka' that's given to our food mainly consisting of asafoetida is a major contributor to umami. Apart from tomatoes, using onion and garlic have known to give umami to food.

Recentlynotjustresearchersbutgastronomists have taken interest in promoting this taste. Chefs and cooks are able to express the unique characteristics of umami taste accurately. Researchers and cooks have collaborated in broadening the knowledge of this taste. Yet, even 113 years after the discovery, this taste is still unknown to a lot of people in society. Sensory analysis is a field demanding utmost precision and thorough knowledge of the food chemistry. Umami being a base for most foods we consume, using umami rich ingredients will help attract a lot of consumer attention in the commercial food market as well as in household cooking. Looking at the evolving taste and likings of people around the world, there is ample scope for students to research in this branch of food science.

* Author is Food Technologist

Resistant Starch: A Boon for Healthy Foods

By Monica Oswal*, P.Divya** and P.SureshKumar***

INTRODUCTION

At present, magnificent significance is given to functional foods, which grant health advantages besides simple nutrition that impact to decrease the threat of non-communicable diseases. Resistant starch (RS) which is identified as a kind of dietary fibre could be used as an ingredient in functional foods. Both public health authorities and nutritionists agreed that consumption of foods rich in dietary fibre, which aids to get rid of obesity, coronary heart diseases, diabetes and cancer. With the higher CAGR of more than 10% every year, processed food industry is in search of easy-to-use functional compounds in the making of healthy foods in large volume.

RESISTANT STARCH

The term "Resistant Starch" is defined as the fraction of starch that is resistant to digestion by α-amylase and pullulanase enzymes in vitro and may be fermented in the colon. In general, resistant starch is the fraction of starch, which escapes digestion in the small intestine but may be fermented in the colon. The end-products of fermentation are carbon dioxide, hydrogen, methane, and short chain fatty acids (SCFAs). Chemically resistant starch is measured as the difference between total starch (TS) and the sum of rapidly digestible starch (RDS) and slowly digestible starch (SDS)

Resistant starch types

- **RS1 -** The compact molecular structure of starch limits the accessibility of digestive enzymes. The starch is physically inaccessible to the digestive enzymes as in seeds, grains and tubers
- **RS2 -** The starch granules are configured in such a way which prevents their digestion, for example, unripe bananas, raw potatoes, and high amylose maize starch
- **RS3 -** Gelatinized starch when cooled form starch crystals

(retrograded starch) which are resistant to digestive enzymes. This form of "retrograded" starch is found in foods like corn flakes, pasta, cooked and cooled potatoes (approximately 5%)

- **RS4 -** Chemical modifications like esterification, etherification and cross bonding resist enzymatic digestion of starch

Crops rich in resistant starch:

- **Lentils -** Lentils are one of the best sources of RS. According to scientists at the University of Illinois, about 25.4% of the starch in cooked lentils is RS and that nearly 48% of this RS reaches the colon intact.
- **Chickpeas -** Chickpeas, like other legumes, are perhaps one of the best food sources of RS and slowly-digested carbohydrate.
- **Potatoes -** If prepared correctly and left to cool, potatoes are an important source of RS. Actually, a study by the European Journal of Clinical Nutrition established a 57% increase in RS after refrigerating their spuds for 24 hours.
- **Corn -** It is the favored RS source for adults living with type 2 diabetes mellitus.
- **Oats -** Dry oatmeal is 11 percent RS.
- **Brown Rice -** Brown rice is whole-grain rice with the inedible outer hull removed. The amount of RS in rice is influenced by the cooking method and rice variety.
- **Under-ripe bananas -** A large raw under-ripe (green) banana will provides with 5.44 grams of RS. In addition, bananas contain inulin, a RS that serves as a strong probiotic promoting healthy gut flora as well as helping to control blood sugar.

Calorific value & Daily intake of Resistant Starch

Intake of resistant starch by the human population varies considerably. Calorific value of resistant starch is 8 kJ/g while that of rapidly digestible starch is 15 kJ/ g. To confer any health benefit daily consumption of 20 g resistant starch is recommended. In developing countries, the approximate intake of RS varies from 30 to 40 g/day.

Making of modified starch

Heat treatment

Starch when heated to various levels leads to the formation of modified starch. RS can be obtained by cooking the starch above the gelatinization temperature and drying simultaneously on heated rolls like drum driers or even extruders. Gelatinization of starch at 120 °C for 20 min, followed by cooling to room temperature can provide good yields of RS.

Enzyme treatment

RS can be prepared from high amylose starch by gelatinization followed by treatment of slurry with debranching enzymes like pullulanase and isolating the starch product by drying/extrusion

Chemical treatment

RS4 is obtained by treating starch with cross-linking agents. Cross linked starches are obtained by reaction of starch with bi- or polyfunctional reagents like phosphorus oxychloride, sodium trimetaphosphate, or mixed anhydrides of acetic acid and dicarboxylic acids like adipic acid.

HEALTH BENEFITS OF RESISTANT STARCH

Prevention of colonic cancer

Resistant starch escapes digestion in the small intestine and enters the bowel where it is fermented by the probiotic bacteria of lumen producing short chain fatty acids (SCFA), principally acetate, propionate, butyrate and gases like H2. Among them butyrate is specifically used by the colonocytes and inhibits the malignant transformation of intestinal epithelial cells in vitro, as it is the main energy source for large intestinal epithelial cells. This makes RS especially interesting in the prevention of colon cancer.

Hypoglycemic effects

The term glycemic index (GI) or glycemic response refers to the ability of a food product to raise postprandial blood glucose level. RS rich foods reduce postprandial blood glucose in humans and hence might play a role in providing metabolic control in diabetes II.

A RESISTANT STARCH RICH DIET SIGNIFICANTLY INCREASED THE PROBIOTIC LIKE LACTOBACILLI, BIFIDOBACTERIA AND STREPTOCOCCI POPULATIONS DECREASED THE ENTEROBACTERIA POPULATION AND ALTERED THE MICROBIAL ENZYME METABOLISM IN THE COLON OF RATS.

Hypocholestrolemic effects

Hypocholestrolemic effects of resistant starch in rats have been reported widely. Substantial reductions in total lipids, total cholesterol, low density lipoproteins (LDL), triglyceride-rich lipoproteins have been observed in rats feeding on resistant starch.

Resistant starch as a prebiotic

Prebiotics are those non-digestible food ingredients which beneficially

RESISTANT STARCH ACTS SIMILARLY TO FIBRE IN THE BODY AND IT IS A PART OF DIET FOR MANY. AS SUCH, THERE IS GENERALLY LITTLE RISK OF SIDE EFFECTS WHEN EATING RESISTANT STARCH.

affect the host by selectively stimulating the growth and/or activity of probiotics in the gastrointestinal tract. RS almost entirely passes the small intestine; it can act as a substrate for growth and viability of the probiotics.

A resistant starch rich diet significantly increased the probiotic like Lactobacilli, Bifidobacteria and Streptococci populations decreased the Enterobacteria population and altered the microbial enzyme metabolism in the colon of rats.

Inhibition of fat accumulation

Various studies showed that RS had a great potential to modify lipid oxidation. Various studies proposed that eating a RS rich diet substantially increased the mobilization and use of fat stores as a consequence of reduction in insulin secretion.

Reduction of bilestone formation

Digestible starch plays a vital role in the formation of bilestone by the greater secretion of insulin which in turn stimulates the synthesis of cholesterol; therefore resistant starch reduces the incidence of bilestone formation.

Mineral intake

Several studies revealed that RS rich diet substantially increased the apparent absorption of calcium, phosphorous, magnesium, zinc and iron compared with the completely digestible starch.

Application of RS in Food-Products

The resistant starch can be incorporated into products like bread, other bakery goods like cookies, cakes, muffin, extruded cereal products and in encapsulated products.

ADVERSE EFFECTS OF HIGH INTAKE OF RESISTANT STARCH

Resistant starch acts similarly to fibre in the body and it is a part of diet for many. As such, there is generally little risk of side effects when eating resistant starch. However, eating higher levels of resistant starch may cause mild side effects, such as gas and bloating.

CONCLUSION

Dietary fibre consumption has been reduced significantly due to change in life-style. In recent times to increase fibre intake many fibre-enriched products have been developed. Resistant starch has recently been recognized as a dietary starch that escapes digestion in the small intestine and is fermented in the colon producing short chain fatty acids that provides various health benefits including prevention of colon cancer, reduced risk of diabetes, reduction in total cholesterol, etc. The unique properties of resistant starch, that is fine in particle size, high gelatinization temperature, good extrusion properties make the formulation of wide range of food products possible with improved organoleptic qualities as compared with traditional high-fibre products. In future, a detailed knowledge of the characteristics of these starches would facilitate their greater utilization in food industries.

* M.TECH - Food Science and Technology, Indian Institute of Food Processing Technology, Thanjavur, Tamil Nadu- 613005

**SRF, Department of Dairy Engineering, ICAR – National Dairy Research Institute, Bangalore, Karnataka - 560030

***Principal Scientist, Department of Crop Production &Post Harvest Technology, ICAR – National Research Centre for Banana, Tiruchirappalli, Tamil Nadu- 620 102

Press Release

India likes to snack – Namkeen snacks

With a perception from consumers that legume-based snacks are a healthier alternative to other snacks due to a higher nutrient content, snack food manufacturers are looking at the use of legumes as a base ingredient for creative and flavorful snack products.

Namkeen, the home of legume snacks

When it comes to legume snacks, Namkeen leads the way in variety and flavor. Namkeen is a broad term for salty snacks traditionally consumed in South Asian cultures, covering a range of products including whole legumes such as green peas, chickpeas, peanuts, cashews, Moong Dal, Lentils, and dough based extruded products. Depending on regional taste preferences, Namkeen can be coated, highly or lightly seasoned with spices or not seasoned at all, and come individually or blended into mixtures, like Bombay mix or Theeka Meetha, Khatta Meetha, Navarattan, Panchrattan or Chanachur.

Demand for Namkeen outside of traditional markets like India and South Africa has grown significantly. With decades of experience in snack processing, Heat and Control has observed this trend develop across international markets, as snack food manufacturers increase the use of legumes as a base ingredient for their snack products.

Legume Flour Bases

Many legumes are manufactured into flours and are used as the basis for formulations that are used in low-pressure forming systems. One prominent snack application is extrusion. The number of shapes, sizes and ingredients are extremely diverse, but the basic principles involved in producing this product are quite similar. Besan/gram flour (chickpea), soybean and pea flour for example, are mixed with other ingredients to obtain a dough or batter suitable for extruding. Extrusion technology enables numerous products to be made such as Bhujia and Boondi.

BHUJIA - is where the Besan flour dough mix is extruded into long straws which are then broken into small pieces after frying. This product has many variations for final flavors, shapes and presentations and is either packaged and sold separately as Aloo Bhujia or Sev or as a main ingredient in most Namkeen mixtures.

BOONDI - is a spherical shaped product made from Besan flour batter, where traditional cooking methods have been to hand-form the balls through a special sieve arrangement into a large batch frying system. Heat and Control has extrusion systems to automate this process.

Creative recipes for additional flavor

With clever formulations of the legume flour base or including ingredients into the dough, the characteristics and flavor of the final product is enhanced. As a result, it may not be necessary to add topical seasoning or flavoring onto the products after they are fried, as the base product tastes good on its own.

Seasoning is an obvious area where manufacturers can get creative with legume snacks and design endless number of products by adjusting the proportions of the legume, the cooking technique and the flavors added. Seasoning after frying or baking is easily done with various seasoning application equipment either Process Area Seasoning or On-Machine Seasoning systems.

Popular Namkeen Snacks

1. BESAN BHUJIA

Besan flour dough mix is extruded into long straws which are then broken into small pieces after frying. Has many variations for final flavors, shapes and presentations, and commonly mixed in most variety products such as Bombay mix.

2. BOONDI

A spherical shaped product made from Besan flour batter, was traditionally hand-formed using a sieve directly into a large batch fryer. Heat and Control has developed extrusion systems to automate this process.

3. MUNG (MOONG) DAL

Moong Dal is a de-husked mung bean that is hydrated, dewatered, fried, cooled and then packed. It is eaten on its own or mixed with other ingredients.

4. GREEN PEAS

Peas have high protein and carbohydrate content and eaten as a fried snack on its own or consumed as part of a variety such as Chanahur.

5. BATTER COATED PEANUTS

Peanuts that are coated with traditional spice flavors mixed with Besan flour.

6. FRIED CHICKPEAS

Chickpeas are fried and seasoned and in some recipes the chickpea is flattened. Chickpeas have high protein and low fat and high fiber content.

Namkeen Snack Processing Machines

The diversity of snack foods that can be produced using different legumes has long provided a challenge for manufacturers to develop a high-quality product with unique flavoring, while having the capability to develop a frying system to cook these products on the same line. With decades of experience working with the South Asian snack market in Legume and Extrusion processing, our goal was to develop a multi-purpose frying system for food manufacturers to process the raw materials which make up this complex snack product. The flexibility in design is critical, as manufacturers want to be able to use a variety of ingredients on the same equipment line.

In the case of processing whole legumes (green peas), most have a skin and can be prone to thermal shock which results in explosion during frying. This will also increase fines suspended in the oil and reduce output volume. These issues were taken into consideration when a customized snack frying system was developed, resulting in less damage to product during production, reduction in processing time and cost savings through oil use reduction.

Image: HeatWave® Fryer – Heat and Control

The end result was the HeatWave® Snack Fryer, a specialty snack frying system, which efficiently fries nuts, pellets, Namkeen and other snacks using less system oil volume than conventional fryers. This innovative design cooks snacks using curtains of clean filtered oil, which transfers heat more efficiently than submersion techniques. Oil passes over the product and through the conveyor, quickly carrying fines out of the fryer to produce the highest product quality and cleanest operation of any fryer. The fryer is essentially a standard, inside belt return HeatWave Snack Frying system, but with the oil outlet at the discharge of the fryer and fitted with an integrated infeed flume. The infeed options available allow for the handling of extruded noodles, batter coated peanuts, Boondi, and various nuts, peas and lentils.

About Heat and Control

Established in 1950, Heat and Control is a privately-owned company with a global team that has built an extensive knowledge bank and developed a wealth of experience and expertise. Access to production and technical support from a network of engineers, food technicians, field service technicians, skilled tradespeople, and support teams provide food manufacturers with confidence to achieve production goals.

- Ten manufacturing facilities, 11 test centres, more than 30 offices globally
- Testing, design, engineering, manufacturing, installation commissioning, user training, spare parts, and provision of after sales service.

Contact:
www.heatandcontrol.com
info@heatandcontrol.com
LINKEDIN: https://www.linkedin.com/company/heat-and-control
FACEBOOK: https://www.facebook.com/Heat-and-Control-Inc-701882153205836
TWITTER: https://twitter.com/heatncontrol

A New Versatile Clean Label Ingredient for Bakery, Confectionery and Drinks

Emsland Group presents their latest waxy potato development: Emwaxy® Spray 200.

The Emwaxy® Spray 200 fits perfectly with the rapid growing demand for clean label alternative ingredients for the food industry. Emwaxy® Spray 200 is a clean label low DE starch derivative. Emwaxy®.

With the introduction of Emwaxy®, Emsland Group introduces new starch solutions for the food industry. Emwaxy® is produced from special potatoes, containing more than 99% amylopectin and is being cultivated through traditional, non-GMO breeding techniques.

Based on high amylopectin potato starch, Emwaxy® Spray 200 has unique properties. Emwaxy® Spray 200 has excellent solubility and is not prone to retrogradation. Therefore it can be applied in high concentrations whilst staying stable. The high cohesiveness at high concentrations enables to apply Emwaxy® Spray 200 solution as food glue in many food applications. The product has good film forming characteristics and therefore it can be successfully applied as egg wash replacer on baked goods. Body and mouthfeel enhancement or partial sugar replacement are further examples of the possibilities, which Emwaxy® Spray 200 can offer.

CHARACTERISTICS OF EMWAXY® SPRAY 200

- Easy to dissolve
- Clean label
- Stable in solution in high dosage
- Excellent film forming with high transparency and gloss
- Potato starch based – fits in the 'plant-based' trend
- Forms smooth solutions with good body and mouthfeel

For the food industry, the newly developed Emwaxy® range offers a good start to create new innovative appealing products. The unique characteristics of Emwaxy® serves todays trends e.g. easy handling, non-GMO, kosher & halal, gluten and allergen free as well as plant-based and clean label.

Potential applications and advantages	
Application	Advantage
Bakery glaze	Cost effective vegan alternative for egg wash
Cake	Sugar reduction oppor- tunities up to 30 %
Cereal bars	Effective food glue that can replace sugar syrups
Instant drinks (coffee, tea, sport	Prevents lumping and provides excellent body and mouthfee
Chewable confectionery Alternative for gum Arabic and gelatin	

Steady Increase in Plant-Based Fish Alternative Choices

Plant-based alternatives to fish and seafood are the future, not just in terms of nutrition, but also ecologically. One reason is that they appeal to younger consumers like Generation Z. According to Innova Market Insights, at 32 percent worldwide this is the largest population segment. It accordingly will have a major influence on consumer behavior in the coming decades. For this target group, health and well-being are just as important as environmental and climate protection, animal welfare and social factors. Plant-based alternatives to fish and seafood thus not only offer new indulgence experiences for flexitarians, they also meet the demands of the rising generation. Environmental organizations already advise cutting back on consumption of ocean fish and seafood, due to overfishing. Microbiology is another factor. Due to the thermal processes in their manufacture, plant-based alternatives to smoked fish and sushi are microbiologically much safer than traditional fish products.

For this growth area, Planteneers has already developed various product ideas with which manufacturers can make alternatives to breaded fish, fish sticks, filets and more. For example, a plant-based alternative to salmon filet is in the pipeline. These plant-based solutions are based on a diverse range of protein texturates that give products a very fish-like, tender bite. Florian Bark, Product Manager Planteneers, explains: "The right choice of texturate is indispensable in order to get as close as possible to the animal product. Plant protein concentrates are also important in order to match the protein content of the final product to that of the original. In addition, we have a large portfolio of algae-based hydrocolloids that are perfect for making alternatives to fish and seafood."

Among the company's new products are fiildTex for alternatives to tuna pieces. With it, customers can use standard meat and fish production machinery to make alternative tuna that looks and tastes like canned tunafish, and can be used in many ways. Another innovation is fiildFish for alternatives to sushi-style raw fish and smoked products like smoked salmon. These plant-based products impress with typical fish structure and texture. But what makes them special is the flexible recipe – different fish alternatives can be created by adjusting the specific flavor and color. The end products can be readily sliced and are also freeze-thaw stable. This makes them very well suited for convenience products.

Food Irradiation: An Insurance to Food in 21st Century

By P. R. Davara & V. P. Sangani*

Poor post harvest practices including inadequate storage and preservation facilities, as well as adverse climatic conditions, cause heavy losses in India's agricultural and marine produce. With progressive increase in the quantity of food grains and necessity for longer storage periods, these losses will escalate unless disinfestation measures are improved. Chemical disinfestations methods, such as fumigation, require repeated application, as these do not eliminate insect eggs. They may also leave harmful residues in the treated grains. For ensuring availability of good quality food to the people, the post harvesting technology of handling the agriculture produce should go hand in hand with increased agricultural output. Food irradiation, as this process is known, is an important milestone in food preservation methodology since the successful development of canning in the 19th century.

Food irradiation promises to offer and effective means for minimizing these losses, thereby increasing their availability, and stimulating exports. In 21st century, it will be one of the important tools which can make Indian agricultural produce globally competitive. Export development authorities, commodity boards, food industry, farmers, traders, and exporters of agricultural commodities can be benefited from the use of radiation processing technology.

Food irradiation is a process by which food is exposed to a controlled source of ionizing radiation to prolong shelf life and reduce food losses, improve microbiologic safety, and/or reduce the use of chemical fumigants and additives. It can be used to reduce insect infestation of grain, dried spices, and dried or fresh fruits and vegetables; inhibit sprouting in tubers and bulbs; retard postharvest ripening of fruits; inactivate parasites in meats and fish; eliminate spoilage microbes from

fresh fruits and vegetables; extend shelf life in poultry, meats, fish, and shellfish; decontaminate poultry and beef; and sterilize foods and feeds. One great advantage of irradiation is that it can be accomplished after foods are packaged, preventing recontamination during subsequent handling.

Irradiated food is safe and nutritious and produces no unusual toxicity as long as best management practices are followed. Irradiation is a complement to established techniques that can add to food safety, increase shelf life, reduce loss from spoilage, and increase the diversity of foods available to the population. The technology of food irradiation is the most intensely studied of all food processing techniques.

Irradiation can also be used to overcome fruit fly infestation in fresh fruit. The process brings potentially huge benefits for those countries where fruit flies are endemic who wish to export to countries that are free of fruit fly. The United States of America has currently accepted irradiation as a quarantine treatment for the control of 11 major species of fruit flies and mango seed weevil.

FOOD IRRADIATION TECHNIQUE

Irradiation processing of food involves the controlled application of energy from ionizing radiations such as gamma rays, electrons, and X-rays for food preservation. Gamma rays and X-rays are short wavelength radiations of the electromagnetic spectrum. Gamma rays are a part of the electromagnetic spectrum. They can penetrate deep into food materials and bring about desired effects.

Radiation processing of food is carried out inside an irradiation chamber shielded by 1.5 to 1.8 meter thick concrete walls. Food, either pre-packed or in-bulk, placed in suitable containers is sent into the irradiation chamber with the help of an automatic conveyor. When the facility is not in use the radiation source is stored under 6 meter deep water. The water shield does not allow radiation to escape into the irradiation chamber, thus permitting free access to personnel to carry out plant maintenance.

For treating food, the source is brought to the irradiation position above the water level after activation of all safety devices. The goods in aluminium carriers or tote boxes are mechanically positioned around the source rack and are turned round their own axis, so that contents are irradiated on both the sides. Absorbed dose is checked by placing dosimeters at various positions in a tote box or carrier. The quantity of dose is measured in terms of unit, called Gray, abbreviated as Gy. It is the unit of absorbed radiation energy. One gray is equivalent to 1 Joule per kilogram. The old unit of dose is 'rad'. 1Gray is equivalent to 100 rad.

Low dose irradiation completely kills or sterilizes the common grain pests, and even the eggs deposited inside the grains. Moreover, only a single radiation exposure of grains is sufficient for disinfestations. This, therefore, is ideally suited for large-scale operations, thereby offering substantial economic benefits. Irradiation can also serve as an effective process for disinfestation of certain pre-packed cereal products like atta, soji (rava) and premixes.

Low doses of radiation are effective in delaying the natural processes of ripening in fruits. Thus shelf life of mangoes can be extended by about

Low dose applications	Less than 1 kGy	1. Inhibition of sprouting in potato and onion (0.03-0.15 kGy). 2. Delay in fruit ripening (0.25-0.75 kGy). 3. Insect disinfestation in stored grain, pulses and products (0.25-1 kGy). 4. Destruction of parasites in meat and meat products (0.25-1 kGy).
Medium dose applications	1 to 10 kGy	1. Elimination of spoilage microbes in fresh fruits, meat, poultry and seafoods (1.5-3 kGy). 2. Elimination of food pathogens in meat, poultry and seafoods (3-7 kGy). 3. Hygienization of spices and herbs (10 kGy).
High dose applications	Above 10 kGy	1. Sterilization of food for special requirements which are shelf-stable without refrigeration (25-70 kGy). 2. Elimination of viruses. 3. Sterilization of hospital diets for immune compromised patients (25-70 kGy). 4. Food for astronauts in space.

a week and that of bananas up to two weeks. This could improve the scope for internal trade and augment export of these commercially important fruits of India. Furthermore, gamma radiation can eliminate the seed weevil, an insect that lodges deep inside the stone of the mango.

Fumigation of spices with chemicals like methyl bromide, ethylene oxide and propylene oxide, has inherent disadvantages, especially retention of chemical residues. Single treatment of gamma radiation can make spices free of insect infection and microbial contamination without the loss of flavour components. The treatment can also be used for pre-packed ground spices and curry powders.

The existing inadequate preservation facilities for fish cannot cope up with the rapid spoilage of the catch and thereby limit the availability of seafood in the interior regions. By selective destruction of spoilage bacteria, moderate doses (2 kilo Gray) of radiation can extend the acceptability, and, in turn, marketability of iced fish by about two weeks. Besides, this is the only method of removal of pathogens from pre-packed frozen product. The technology can also be used for hygienization and sterilization of non-food items including cut-flowers, pet food, cattle feed, aqua feed, ayurvedic herbs and medicines and packaging materials.

THE SAFETY OF FOOD PROCESSED BY RADIATION HAS BEEN EXAMINED CAREFULLY, BOTH AT THE NATIONAL AND INTERNATIONAL LEVELS. ON THE BASIS OF EXTENSIVE STUDIES WITH LABORATORY ANIMALS CARRIED OUT IN DIFFERENT COUNTRIES INCLUDING INDIA

Over decades of study the FDA and other international organizations such as the International Atomic Energy Agency and the World Health Organization have consistently concluded the following:

- Food does not become radioactive as a result of irradiation.
- The irradiation process is effective in decreasing or eliminating disease-causing microorganisms such as Escherichia coli (E. coli), campylobacter, and salmonella from foods.
- Irradiation reduces spoilage caused by bacteria, insects, and parasites.
- Irradiation inhibits sprouting and delays ripening in some fruits and vegetables.
- Irradiation does not alter in any significant manner the nutritional value of food.
- Alterations in food created by irradiation are like those created by cooking and other processing.
- The irradiation process as regulated by the FDA is safe.

The irradiation process has been approved by the Food and Agriculture Organization (FAO), the World Health Organization (WHO), the International Atomic Energy Agency (IAEA) and the Codex Alimentarius Commission. About 100 countries have approved the process for application in more than 100 food items. India first approved them in 1994. Today, the Directorate of General Health Service, under the Prevention of Food Adulteration Act, has approved more than 20 commodities to be processed using this method.

LABELLING

All irradiated food must be clearly labeled with the international irradiation symbol, the Radura (Fig 1) and the words, "treated by irradiation" or "treated with radiation".

COST OF IRRADIATED FOOD

Irradiation costs may range from Rs. 0.25 to Rs. 0.50 per kilogram for a low dose application such as sprout inhibition of potato and onion, and insect disinfestation in cereals and pulses. It costs from Rs. 1 to Rs. 3 per kilogram for high dose applications

Fig.1. International Radura

such as treatment of spices for microbial decontamination. The costs could be brought down in a multipurpose facility treating a variety of products around the year.

THE SAFETY OF IRRADIATED FOOD

The safety of food processed by radiation has been examined carefully, both at the national and international levels. On the basis of extensive studies with laboratory animals carried out in different countries including India, FAO/IAEA/WHO Joint Expert Committee has recommended that the food items irradiated up to an average dose of 10 kilo Gray be accepted as safe from the health angle and do not present any toxicological hazards. In fact, the doses of irradiation required for the treatment of commodities are far below this stipulated limit. The committee has further recognized radiation as a physical process like thermal processing and not as a food additive.

In comparison to other food processing and preservation methods the nutritional value is least affected by irradiation. Extensive scientific studies have shown that irradiation has very little effect on the main nutrients such as proteins, carbohydrates, fats, and minerals.

Vitamins show varied sensitivity to food processing methods including irradiation. For example, vitamin C and B1 (thiamine) are equally sensitive to irradiation as well as to heat processing. Vitamin A, E, C, K, and B1 in foods are relatively sensitive to radiation, while riboflavin, niacin, and vitamin D are much more stable.

The Joint Expert Committee of the Food and Agriculture Organization (FAO), World Health Organization (WHO), and International Atomic Energy Agency (IAEA), in 1980 concluded that irradiation does not induce special nutritional problems in food. The committee also rejected the possibility of development of chromosomal abnormalities by the consumption of irradiated food.

MERITS OVER CONVENTIONAL METHODS

1. Food irradiation technology has unique merits over conventional methods of preservation such as canning, dehydration, salting, etc. as this process does not lead to loss of flavour, odour, texture, and freshness.
2. Unlike chemical fumigants, irradiation does not leave any harmful toxic residues in food and is more effective.
3. It is efficient and can be used to treat pre-packed commodities. Since gamma rays have high penetrating power, spices can be irradiated after packaging, irrespective of the size of the carton.

* Authors Assistant Professor Dept. of Processing and Food Engineering College Of Agril. Engg. & Technology Junagadh Agricultural University Junagadh - 362001

Colour Sorting in Food Industry: Present and Future

By Deep Shikha*

INTRODUCTION

With growing consumer awareness the demand for quality foods have increased and people are eager to pay more for better quality products. As it is a universal fact that everything natural will show some variation and thus follows a bell curve, the need for sorting good and bad or sub-standard products becomes inevitable. Sorting can be based on different parameters such as shape, size, texture, colour, etc. However, in food industry colour is the major deciding factor for the quality of food products. For instance small size of apple does not necessarily indicate its poor quality but faded colour does.

In ancient times humans used to sort food products by perceiving colours with eyes and sorting it with hands after analyzing it in the brain. With advancement in technologies machines have replaced the manual sorting techniques leading to benefits such as improved food safety, better food quality and increased efficiency. However the basic principle remains the same. In machines there is feed system such as vibrating hopper which is used to feed the product, optical system which is basically the detectors that has replaced the human eye, an ejection system which physically separates unwanted particles from desired ones and has replaced human arm and data processing system which decides whether the food is acceptable or not and thus has replaced human brain.

BASIC PRINCIPLE

The product comes into the hopper; from there it goes into the vibrating feeder. The vibratory feeders spread and level the product to a single-layer flow. Two cameras, which are installed at the two sides of the detection area, scan the incoming product. The data of the cameras are then analyzed in real time by processing system. During data analysis, if the product is found unsuitable, a pulse is generated by the processor, for the duration of a few milliseconds, which blows the grain into the corresponding receiver module.

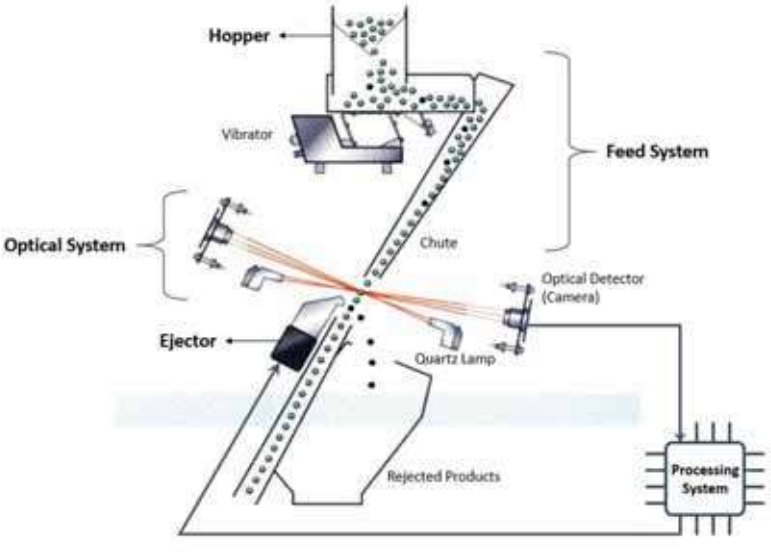


Figure.1.Typical layout for an optical sorting machine [1] (modified)

A typical sorting machine mainly consists of 3 sub-systems: optical system, data processing system and actuator system.

1. OPTICAL SYSTEM

The majority of the food industries use two main color measurement techniques - Colorimetry and Spectrophotometry.

1.1. Spectrophotometry **-** In this method, spectral reflectivity of food product at a particular wavelength is analyzed. Figure.2. Illustrates typical spectral curves obtained from white rice and white rice grains with yellow colour defects. The relative reflectance signal varies from black (zero or no reflectance) to white (100% reflectance). The wavelengths cover the visible spectrum (400 to 700 nm) and extend into the near infrared spectrum (700 to 1100 nm). Optical sorting exploits the region of the spectrum where the reflectance values for all acceptable products are either higher or lower than values for all unacceptable material. If this feature is present, then with the aid of band-pass optical filters, this part of the spectrum can be used as a basis for optical sorting.

Computer controlled reflection spectrophotometers are used to analyze optical properties of surface of the products. Diffuse spherical broadband lighting is used to

HYDERABAD | BANGALORE | AHMEDABAD

BIG DRUM
INDIA Pvt. Ltd.

Sales & Corporate Office
Plot No. 10, IDA Uppal, Ramanthapur Main Road,
Hyderabad 500 039, Telangana, India.
Tel.: +91 40 2720 5293/ 94
info@bigdrumindia.com
www.bigdrumindia.com

Contact us today, for your free sample

monte

uniformly illuminate the product under test. The reflected light is then passed through a computer controlled scanning monochromator, which splits the light into its constituent wavelengths. The detector measures the output and sends it to the processor. Then, the processor analyses the relative reflectance of the different wavelength bands of the measured spectrum. If pattern of reflectance of the spectrum lies above a defined threshold (A) then product will be of desired quality. Similarly, if it lies between A and B it will be of substandard quality.

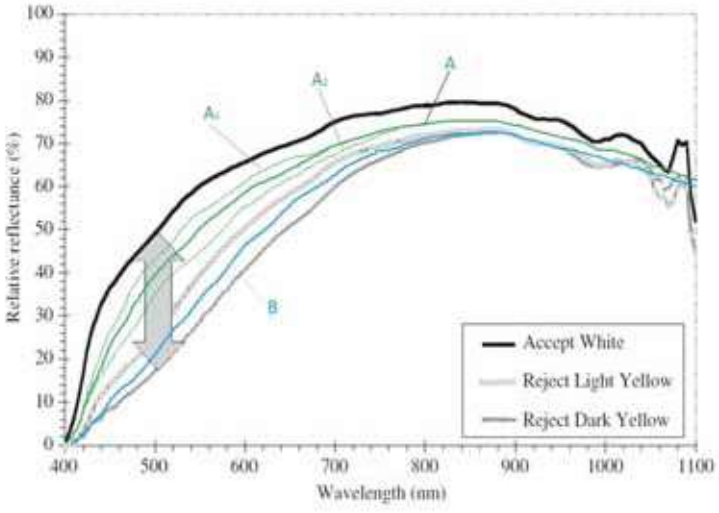


Figure.2. Typical spectral curves obtained from white rice and white rice grains with yellow colour defects [2] (modified)

In case where the intensity levels of materials to be accepted and rejected are clearly separated instead of monochromatic technique, bichromatic technique is used. For instance if dark red and light red apple are acceptable and dark yellow and light yellow apples are not acceptable, it becomes necessary to compare simultaneous measurements at two different wavelength bands. Similarly, further number of different wavelength bands is increased with the introduction of new defects or foreign particles such as glass, stones, insects, etc. If there is a need to detect two distinct types of defect in that case dual monochromatic sorting is used. The dual system sorts monochromatically in each of two separate wavebands.

Some other techniques are also being used for sorting such as Fluorescence technique, Infrared technique, use of optical lasers. Nowadays, defect detection is mostly carried out in the visible and near infrared wavelengths due to the high cost of infrared detector technology. However, other wavelengths, for example X-ray techniques are often employed as a final check for foreign material in packed or processed foods, or to detect hollow potatoes, for instance. Ultra-violet light can be used in some nut sorting applications, especially to detect fungal-infection sites that fluoresce when exposed to UV light [2]. With decrease in cost of lasers, laser technology can also be used widely for texture and sub surface detection.

1.2. Colorimetry - Another major technique used in food industry is Colorimetry. It is a technique based on measuring the three primary colors observed by human capabilities, i.e, red, green and blue (RGB). Food industries are using this type of colorimetric sensors to determine the quality of product using colour detection. However, this technique cannot detect the secondary and tertiary colors individually (because they are combination of RGB) which makes its efficiency limited [3].

2. DATA PROCESSING SYSTEM

It is basically an algorithm working on a microprocessor which decides whether the product meets acceptance criteria or not. This can be a simple algorithm with calibrated threshold or a complex algorithm, based on machine learning technique, with self learning capabilities.

A simple algorithm can be comparison of the measured parameter, for example reflectance spectrum, of the product against a predefined calibrated 'threshold', for example A and B as shown in figure 2. Based on outcome of the comparison the product is accepted or rejected.

On contrary to this, machine learning is advanced technique in which 'threshold' is not pre-calibrated. The machine learns itself which 'threshold' is the best (which could be any value A, A1, A2, etc. as shown in Figure.2). Learning is an iterative process which improves the 'threshold' value automatically with experience.

With increase in speed and efficiency of current microprocessor it is feasible to combine several other parameters such as shape and size along with colour for better and more effective sorting.

3. ACTUATOR SYSTEM

3.1. Feed System - The feed system helps in transporting the product from hopper to optical inspection area in a defined manner and at a defined rate so that all the products sample are captured in a particular orientation. Depending upon the

product type it can be of various types like different types of conveyor belts, gravity chutes, rollers, etc.

3.2. Ejection system - The ejector is basically a robotic arm which acts on the command of processing system to remove unwanted items from the desired product stream. It can be either pneumatic (pressure based), hydraulic (not so common nowadays) or electric (motor based) actuator. With advancements of technology electric actuator are most common as they can be directly controlled by microprocessors. Generally food processing continues for 24 hours a day, all year round so it leads to heating up of electric ejectors. Sometimes due to ejection of heat a need of cooling system arises to increase its durability and uninterrupted working. Meanwhile, advances in detector resolution, valve technology, ejector-duct materials and design, will all help to optimise the ejection process.

CONCLUSION

There are mainly 3 components/ system of colour sorting machine. Various researches and advancements are being done in all these systems to further increase their efficiency and efficacy. However, it is of utmost importance that they all work in complete synchronization with each other. For example, if the speed of feed system is high and that of sensing system is low, then optimum sorting will not happen. The slowest of these 3 components determines the throughput. Similarly, the technical compatibility between the different components should also be ensured. For example, if photo sensors (RGB sensors) are used for colour detection then we need high speed digital signal processor to process the high volume of sensor data. Cost effectiveness is always a deciding factor in selection of different components of sorting machine. The advanced technologies definitely gives better accuracy and high throughput but at higher cost. So, we must consider our requirements like nature of product, speed, accuracy and resolution while selecting the sorting machine.

References

1. Modelling and design of high-speed, long-lifetime and large-force electromagnetic actuators based on magnetic shape memory alloys - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/1-Schematic-diagram-of-an-optical-sorting-machine_fig1_311825865 [accessed 4 Jan, 2021]
2. Bee S.C., Honeywood M.J. (2003) Colour Sorting in the Food Industry. In: Graves M., Batchelor B. (eds) Machine Vision for the Inspection of Natural Products. Springer, London. https://doi.org/10.1007/1-85233-853-9_5
3. Alaya, M. A., Tóth, Z., Géczy, A. "Applied Color Sensor Based Solution for Sorting in Food Industry Processing", Periodica Polytechnica Electrical Engineering and Computer Science, 63(1), pp. 16-22, 2019. https://doi.org/10.3311/PPee.13058

* Author is Food Technologist

How Moisture can Affect The Quality of Packaged Foods?

By Dinesh Gupta*

The consumer pattern of buying and consuming food has evolved quite a bit. The fast-food market has also proliferated in a very short time due to the fast-paced lifestyle, where consumers primarily consider the convenience and easy access to nutritious and appetizing food. The demand for snack food has drastically increased in the Indian market, over the years. This has led the F&B industry to lay increased focus on the quality, processing, and packaging of the end product and ensuring it meets the expected standards of the consumers. Due to the demand for such products, industry players are incorporating sophisticated technologies to maintain the growth fuelled by the changing consumer tastes and lifestyle.

However, given the diversity of ingredients used for a certain processed food item, and following the packaging standards it is like a default process to ensure that there is no harm or loss of key characteristics to the food item because of any external factors. However, there is one external factor that often plays the role of a party spoiler and can be torture for any producer of food and beverage items: The Moisture in the air. To avoid the menace, food processors often use a combination of controls to reduce the moisture content of food in the production and packaging of shelf-stable products to minimise the risk of bacterial contamination and to avoid the food's taste or appearance being altered.

Just imagine, if the food you're buying doesn't satisfy the need than why would consumers buy the specific item. Hence, the F&B industry is laying a lot of focus on the quality, processing, and packaging of the end product and ensuring it meets the expectation standards of the consumers.

Hence, Moisture control is essential in every segment of the food industry in the spheres of storage, processing or packing. For instance in areas near the sea belt, the humidity is higher and it is exasperating when salt from the salt shaker refuses to flow. Now, put the packaging and processing machinery in the same situation, sticky powders can interfere with the operation and obstruct the free and easy movement of the food stuff. Something as simple as an instant juice powder or drink mix becomes a double problem. Not only the powder mix lump refuses to flow smoothly in humid conditions, it also hinders the functioning of the packaging equipment.

Sugary products such as chocolates, hard candies, chewing gums, bubble gums, etc. are hygroscopic. When the humidity is high, these products regain moisture and become sticky and prone to mould formation. The other major problem faced by the confectionery industry is of uneven coating. Uncontrolled humidity/ moisture during the manufacturing and coating process of confectionery (chocolates, candies, sweet snacks) is responsible for change in the structure/dimension of the film core interface, grainy and irregular coating, increase in residual moisture content and improper adhesion i.e. degradation of coating quality in the presence of moisture.

Even snack foods like potato wafers, namkeens, corn chips, noodles etc. absorb moisture from the surrounding air during processing and become soggy. Presence of moisture also results in sweating in the cooling tunnel in the packaging

equipment. To keep snacks crisp and fresh, desiccant dehumidification is extremely important.

During the processing of powder foods such as milk powders, spices (masalas), additives, whey powders, soup concentrates, egg powder, coffee powder etc., the presence of moisture in the air can cause lumping and caking. This affects the free and easy movement of the food and beverage powders in the processing machine and pneumatic conveyors. High humidity in the processing and packaging chambers can result into inconsistent product quality and production, longer drying time, rapid downtime and production loss.

So, moisture can have a major effect on the food industry if not managed properly, and on time. Microorganism growth is one of the main causes of potential food contamination. Moisture results in increased microorganism growth. Microbial growth and dispersal can be controlled if the surroundings and the food processing machinery and equipment inside the food processing plant and food processing facility are kept dry. But keeping a plant dry is not easy as water is an essential part of the product and process of food processing.

Hence, desiccant dehumidifiers are the biggest saviour, and all major food industries are using dehumidification as the primary solution to deal with the menace of moisture. If one adopts to a proper dehumidification process it ensures optimum humidity control as required by the process and are dependable, efficient and versatile. Dehumidification allows smooth powder flow even during periods of high humidity. Desiccant based dehumidifiers lower the moisture content of the surrounding air maintaining RH at a constant level regardless of the ambient conditions during the production, storage and packing to help improve the quality and retain the freshness of the processed food longer.

Desiccant Dehumidifier not only maintains the required humidity level but also ensures cleaner production environment, as the desiccant provided in the dehumidifier prevents microbial growth or fungal growth. The use of our systems dramatically reduce the sanitation cycle time, prevent frost and ice build-up in evaporator coils at cold storage/ freezer areas and spiral freezers. Bry-Air Desiccant Dehumidifiers are designed to comply with the most complex and critical requirements of high humidity and moisture removal/ regain during manufacturing.

Food and Beverage companies world over are deploying the innovative dehumidification technology that require minimal manual intervention, are highly energy efficient, and are extremely helpful in increasing throughput by reducing cost and time. Understanding the need for the dehumidification solution and proper implementation is saving F&B players across the globe a lot of money by minimising the risk of the stock going bad even before it reaches the food table.

Bry-Air Website Link: www.bryair.com

* Author is Director, Bry-Air (Asia)

Wide range of Bry-Air Dehumidifiers for Food Processing Industry

Flow-wrapping machine from Schubert packs with ecological films

A Sustainable Competitive Advantage for Food Manufacturers

The shift towards increasingly individualized packaging and sustainable materials is especially noticeable in the food industry. Companies that want to face these market trends with confidence need a high degree of flexibility in their production. With a Flowpacker from Schubert, manufacturers in the food sector can position themselves strongly to meet these and future requirements. This is because the robot-assisted flow- wrapping machine is so flexible that it can easily keep up with the new packaging trends. It is even possible to switch between conventional and recyclable films or trays on a single line. This is one of the reasons why a long-established manufacturer from France also packs its diverse range of biscuits and pastries with a new Flowpacker.

Today, no food manufacturer can afford to ignore the market's need for rapidly changing, individually tailored packaging solutions that also conserve resources. The latter is a special challenge in the case of packaging into flowpacks. There is a good reason why composite films have conquered the world thanks to their ease of processing and product-protecting properties. However, the shift towards materials that are more recyclable will become increasingly pronounced and is likely to be irreversible in the long term. The answer to these developments is flexibility. Companies that can change their packaging processes quickly and as needed gain a competitive edge in the marketplace, especially when it comes to environmentally conscious consumers and future trends. With the Flowpacker flow- wrapping machine from Schubert, manufacturers of almost any product can capitalize on a packaging machine that combines effective packaging solutions with extremely variable processes – thanks to its modular design and the use of highly developed robot technology.

Both plastic trays, and trays or boards made of cardboard can be processed in the bakery's flow-wrapping machine.

A SEAMLESS AND HIGHLY FLEXIBLE PACKAGING PROCESS IN A SINGLE LINE

This is based on a machine concept that integrates the entire packaging process seamlessly, efficiently and in an exceptionally flexible manner into one TLM line. Firstly, in the Flowpacker, the products are fed to the flow-wrapping unit by pick & place robots which can be adapted to the customer's desired output range and types of products. Secondly, the combination of state-of- the-art sealing technologies and the unique flying cross-sealing unit makes it possible to gently and reliably process both conventional composite films in cold- and heat-sealing processes, as well as mono films and paper-based films. And thirdly, the formats in the Flowpacker can be changed very easily and quickly thanks to the format parts which are customized by Schubert. The integrated concept therefore offers companies in the food industry outstanding flexibility on several levels – namely unrestricted choice of product, packaging material and sealing technology.







Coating & Conveying Solutions **designed for your business**

Ideal applications:

- Snack foods
- Prepared foods
- French fries
- Fresh produce
- Pet food
- Nuts & Trail Mix
- Crackers
- Confectionery

Across industries and applications, we design specialised solutions

Bringing together leading brands in coating and conveying equipment for food and other industries. Our solutions set the standard for yield, efficiency, and safety while producing the highest quality and tasting product. Whatever your product needs, we can meet it with precision and passion.

HEAT AND CONTROL | FastBack | Spray Dynamics

info@heatandcontrol.com | heatandcontrol.com | +91 44 4093 1100

A long-established bakery in Alsace packs its biscuits and pastries with recyclable packaging materials using Schubert's flow-wrapping machine.

LONG-ESTABLISHED COMPANY BENEFITS FROM THE FLOWPACKER'S FLEXIBILITY

The medium-sized, heritage bakery from the French Alsace also counts on this flexibility. A wide range of fine pastries and biscuits are produced at the company's facilities, including many products in organic quality, wafers and biscuits with and without chocolate, in layers or fully coated – and all in a wide variety of sizes. Packaging ranges from conventional to recyclable films, from plastic trays to cardboard trays and U-boards. The different sizes and consistencies of the products, as well as the quick change from one packaging to another, are no problem for the flow-wrapping machine. Easy-to- change format parts based on the plug & play principle facilitate easy handling for the machine operators. The individual gripping and suction tools on the pick & place robots can be changed in just a few steps.

The two-part forming shoulders developed by Schubert can also be replaced quickly and without requiring subsequent adjustment. The packaging machine manufacturer uses forming shoulders in the Flowpacker without sharp edges for all film variants. This is because during packaging, the film is pulled over the forming shoulders at top speed and formed into a tube, which places great stress on the film and components. Paper-based films are especially susceptible to tearing or wrinkling, and also wear down the material of the forming shoulders permanently. Therefore, to achieve an ideal result, the format parts are individually adapted to a packaging material by hardened and coated surfaces.

Easily exchangeable format parts, such as the forming shoulder here, make format changes in the Flowpacker quick and easy.

SEALING TIMES ARE ACCURATE TO THE MILLISECOND

To keep all options open when choosing films, a flow-wrapping machine's sealing system is also of particular importance for food manufacturers. This is because ecological films require exceptionally gentle sealing technologies due to the sensitive nature of the material. Thanks to its state-of-the-art sealing systems, the Flowpacker processes laminated films as well as the new sustainable variants – right through to paper-based films. The TLM machine can switch between different types of film without requiring much effort. This is due in part to the flying cross-sealing unit: It is the only cross-sealing system on the market which allows complete control over the entire duration of the sealing process. The sealing time can be selected to the millisecond and always remains constant due to the design of the sealing robot. The unit compensates for fluctuating production speeds by moving with or against each flowpack on the conveyor as required. This means that mono films and paper-based films can be sealed perfectly and without damage in the packaging machine.

Schubert also uses specially developed heating elements as its latest sealing system for longitudinal sealing. The five-by-five-millimeter ceramic elements can be controlled individually, heat up very quickly and, above all, cool down again in the shortest possible time. This means that

Thanks to specially developed forming shoulders, the Flowpacker from Schubert can process not only mono films but also paper-based films.

conveyor belts are superfluous. Instead, F4 robots place the biscuits flexibly and gently into the trays or directly into the chain. Breakage, damage and rejects are therefore minimized. Moreover,

the Schubert image processing system inspects the goods in each Flowpacker to ensure that they are in perfect condition. Only products that meet the specified quality criteria are picked up and packed by the pick & place robots. At the bakery, an incident- light scanner is used for this purpose. Depending on the requirements, however, 3D image processing can also be used

With the state-of-the-art sealing technologies, both conventional and sustainable flow-wrapping films can be used in the same line.

the heat supply at the sealing seam can be precisely controlled at every point – in terms of temperature and time. Both are decisive for a consistently high and process-reliable sealing quality. Furthermore, every Flowpacker with heat-sealing technology and a flying cross-sealing unit can process both classic composite films and cold-seal films. This is because the sealing systems can be converted to cold- sealing in a very short time. Older cold- sealing films can also be processed well in the Flowpacker, as the glue joints in the longitudinal sealing unit can be easily preheated if necessary due to the available heating elements.

HIGH PROCESSING QUALITY AND EXCELLENT MACHINE EFFICIENCY

The exceptional flexibility in terms of product specifications and packaging material is one thing about the Schubert flow-wrapping machine, and the high processing quality and machine efficiency are another: Thanks to the robot-assisted processes, especially sensitive products such as Alsatian pastries, are packaged extremely gently. Long in the flow-wrapping machine, and for example, record and assess the product height.

With the flow-wrapping machine, manufacturers in the food industry in particular can benefit from highly flexible and reliable packaging processes: The wide range of options in the choice of packaging, the products to be packaged and the options on recyclable materials make the Flowpacker a future- proof packaging machine which can accommodate the fast-moving food industry in every respect.

Spray Technology and its Applications

By Yashashree Bhagat*, Meemansha Sharma**, Ayon Tarafdar ***

Spray-drying is converting slurry or liquid feed into dried particulate form by atomizing the feed into a drying chamber where moisture is evaporated through hot air. The history of spray drying is traceable to a US patent issued in 1872 in the name of its inventor Samuel Percy. The first major application of spray technology was during World War II. During these times there was a major problem in the transportation of bulky milk with low shelf life. Subsequently, the dairy industry employed spray drying technology to produce milk powder for easy distribution. Since then, many advancements have been made to achieve high quality, free-flowing powdered products from a various materials. First nozzle atomizers were introduced, later followed with rotary atomizers. Spray technologies can produce powders with uniform particle size distribution and, is the preferred drying method in many industries such as foods and pharmaceuticals, especially for thermally-sensitive materials for instance, catalysts. If the feed is oxygen-sensitive (such as ethanol) then nitrogen is used instead of hot air.

Spray technologies have a set protocol under which they are operated. For instance, spray drying takes place in five steps: concentration (increase solid content), atomization (particle breakdown to increase surface area), droplet-air contact (counter current interaction of atomized liquid with hot air), and droplet drying (>95% moisture evaporated) and separation (Cyclones, bag filters, and electrostatic precipitators are used). The particles descend to the bottom of the chamber for primary separation, and a small portion of the particles remain trapped with the air and must be retrieved in separation equipment such as cyclone. A carrier material (such as maltodextrin, gum arabic, alginates, carrageenan, waxes, protein isolates, and cellulose derivative) is usually supplied during drying to protect heat sensitive elements.

APPLICATIONS

Spray technology is an essential part of food and beverage manufacturing operations. It is used for everything from cleaning tanks to glazing cakes, and from sanitizing bottles to portioning vitamins. The experience in food processes and the wide range of products for the sector give us the opportunity to improve the quality of the plants, increase operational efficiency and reduce waste. Within the meat processing industry, spray technology applications include carcass washing, screen cleaning, boot cleaning, spray chilling, and sanitizing evisceration tables, while dairy processors use spray technology for apportioning preservatives to cheeses and powder formation. Beverage processors use spray technology to sanitize bottles, clean tanks with caustic solutions and so forth. Further spray technology has been found to be effective in encapsulation. Encapsulation is a process to embed core active agents within a carrier material to improve delivery of bioactive molecules enhancing their stability while decreasing their sensitivity. This technology is widely used for nutraceutical compounds with low stability and heat sensitive substances.

The particles produced range from a few nm to a few millimeters. Encapsulation technology is now well developed and accepted within the pharmaceutical, chemical, cosmetic, foods and printing industries. In food products, fats and oils, aroma compounds and oleoresins, vitamins, minerals, colorants, and enzymes have been encapsulated. Spray chilling is another important application which is used to produce lipid-coated active materials. The core substance could be lipid-soluble, dry particles, or aqueous emulsions. Spray-chilling involves a setup similar to fluidized bed spray granulation, keeping the particles at a low temperature, but

the key difference being the melting point of lipids. Unlike spray-drying, there occurs no evaporation in spray chilling. Spray chilling has a temperature range of 34–42°C, whereas it is higher for spray cooling. Spray freeze-drying (SFD) is another method which combines the spray drying and freeze drying and has found major application in probiotic encapsulation and drying volatile compounds to retain their functional properties due to low temperature processing. It is applied in packaging, to spray antimicrobials into vacuum packages before sealing. The antimicrobials are evenly distributed around the product when vacuum-sealed, effectively sterilizing it.

Spray technologies are very economical, scalable and have lower operational costs. The major challenge facing the spray industry today is the development of more efficient nozzles. The use of ultrasonic nozzles is constrained to some applications such as microencapsulation. Ultrasound in spray drying is still not in practice to its full potential majorly due to lack of suitable large-scale reactor, low throughput values and cost of operation of ultrasound. Use of ultrasound in spray drying has been found to be much effective in microencapsulation, drying probiotics to maintain the cell viability, improving the texture of food products, and reducing the microbial contamination as well. There are several areas where the use of ultrasound in spray drying needs to be amended to meet the desired objective.

References

Kumar, D., Mishra, A., Tarafdar, A., Kumar, Y., Verma, K., Aluko, R., Trajkovska, B., & Badgujar, P. C. (2021). In vitro bioaccessibility and characterisation of spent hen meat hydrolysate powder prepared by spray and freeze-drying techniques. Process Biochemistry, 105, 128-136.

* National Institute of Food Technology Entrepreneurship and Management, Sonipat, Haryana 131 028, India

**Division of Pharmacology and Toxicology, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly 243 122, Uttar Pradesh, India

***Livestock Production and Management Section, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly 243 122, Uttar Pradesh, India

The Right Approach Can Lead to Meaty Profits From Plant-Based Products

Nils Beyer, Food Application Technologist at GEA Food Solutions discusses the growing trend towards plant- based eating habits and how the food processing sector can take advantage of technology to meet the demand for a wider variety of products.

Meat replacement products are growing in popularity with consumers, whether for ethical, environmental or nutritional reasons, and retailers are quick to jump on the bandwagon by offering an increasing range of plant- based alternatives across all their stores. But is this trend just a flash in the pan involving a minority of consumers, or is it something bigger than that and, if so, how can food processors best profit from this revolution in eating habits?

Extensive consumer research carried out in four European countries last year found that more than one third of those asked were either reducing their meat intake or planning to reduce their meat consumption.* Rather than only counting those who already classify themselves as vegetarian or vegan, if we look at the numbers of people reducing their meat intake, the move towards this lifestyle is much more significant and widespread than was previously thought. The challenge for manufacturers is to create the perfect protein substitute for meat in taste and texture, which was also high on the wanted list according to the research.

Taste is becoming everything in the eyes of the discerning consumer so when considering a food concept, it's important that equipment and ingredients work well together. Consistency of products is also vital as the upstream process of preparing the mix for meat replacement products has the biggest impact upon the success of operations further down the line to provide wholesome, delicious and exciting food.

A strong need to expand meat alternative choices beyond the typical veggie burgers we're all familiar with has also been identified. Food processors are having to demonstrate more and more culinary creativity and, while there is no silver bullet, the latest multi-faceted high-speed equipment can provide this competitive edge with the flexibility and power to design exciting vegetarian options and meat- replacement products that will satisfy a much wider audience.

It's vital to strike the right balance between natural appearance, color, flavor and texture on the one hand, and optimal binding characteristics of the ingredients mix on the other. Water and fat binding are very important, as well as the sustainability aspect of how products are designed. Choosing the right equipment can help bring to the market the new and innovative ranges that not only look like the real thing but taste just as good.

GEA recommends to manufacturers proven solutions that offer complete process control by preparing all the components, whether making plant-based meat substitute burgers, mimic chicken coated nuggets, veggie

fish sticks or vegan sausages. The choice of equipment for developing meat alternative products will depend on the application, the volume and on what the customer is trying to achieve.

The latest high-tech solutions can be programmed to cover all the stages in the process in a fast, reliable and controlled way such as rehydration under vacuum of texturized vegetable proteins (TVP), mixing of oil and methylcellulose binder, high- speed cutting for optimal emulsification, cutting and cooling of the fat complement such as coconut butter and the final mixing of all ingredients, including spices and flavorings, ready for forming.

To get the best results mixing and cutting, a range of equipment needs to be available that can handle all manner of ingredients that can be added to this process depending on the recipe, such as purified pea-protein, soy, extruded sunflower, extruded peas, wheat protein and gluten with the end result the same – thoroughly mixed, smooth patties that will have the mouth feel and juiciness of real meat.

Next to mixing of ingredients, equipment that has a built-in vacuum feature will help intensify fresh and appetizing colors while contributing to exceptional fat binding and the higher density of the mix, leading to improved formability, with minimum waste during production.

When it comes to vegetarian and meat replacement products, preparation of the mix is just part of the story. Having the right equipment is a good start, but having a thorough knowledge about the ingredients being used, and how those ingredients are likely to behave throughout the process will allow much greater control of the final outcome. For example, with products that are intended to mimic meat, water binding and retention are essential and these properties can be influenced by different factors at different stages during the process. Rehydrating proteins such as TVP under vacuum as opposed to other methods is not only quicker, it also allows greater water retention, thus increasing yields and avoiding the use of additives to achieve this.

GEA works in collaboration with ingredient suppliers and product development companies testing out and developing new concepts at the GEA technology center in Bakel, the Netherlands. Pooling together expertise with companies such as Griffith Foods, in process know-how, ingredients, and technology, exciting new meat-free product concepts are being developed and tested in industrial conditions, including plant-based tacos, ribs, sausages, fish alternatives, pulled Mexican 'chicken' and flavored 'chickenless' donuts with pesto-spinach, BBQ beetroot and carrot-curry coating.

Naturally, before any decisions are made, food manufacturers need reassurance that any equipment purchased will prove to be a profitable investment. Feasibility studies, process improvements and R&D tests all need to continue, even during the current Covid-19 crisis.

GEA has a wide range of equipment to meet the needs of food producers. The company's engineers and food technologists work closely with customers to ensure that their whole production lines are productive, sustainable, creative, reliable, and efficient with the lowest possible total cost of ownership and total security of outcome.

Unconventional Labelling Solution for Pizzas and the Like

Automatic labelling, high-quality appearance, and large area for information but still with an unobstructed view of the product - the full wrap labelling solution from MULTIVAC for pizzas and other flat food products fits the bill in every way. This solution is also significantly more cost-effective than traditional box packs. And it meets the increasing demands of the market as regards sustainability.

Generally fresh or frozen pizzas, tortillas, pitta breads, quiches, tart bases and other flat products are packed in hinged trays, thermoformed packs, standard trays or simply in film. They are often packed using a pre-printed film with top and bottom labels or a cardboard sleeve. In the case of pizzas in particular, it is usual to pack them in a complete box.

"THINKING OUTSIDE THE BOX"

Full wrap labelling from MULTIVAC redefines the packaging and labelling of such products. The L 310 full wrap conveyor belt labeller is the ideal solution. This highly flexible model with its driven, extra-narrow transport conveyors makes the C labelling and D labelling of packs possible at speeds up to 120 packs per minute. The label width is up to a maximum of 500 mm. The labeller can also be equipped with an integrated printer, as well as a zero downtime function and label/ print monitoring for maximum output, efficiency and process reliability at even the highest throughput.

HIGH LEVEL OF FLEXIBILITY IN TERMS OF MATERIALS

MULTIVAC offers a wide range of suitable label materials and adhesives, so that the packs can be labelled perfectly on the machine. In addition to PP and PET labels, the range also includes sustainable materials made of paper or from renewable sources. "By matching the label material to the packaging material, we can ensure that the constituent parts of the pack can be separated to meet the recycling requirements. Adhesives, which can be dissolved or washed off, enable the individual packaging components to be easily separated, so that they can then be directed to the particular recycling stream," explains Michael Reffke, Product Manager at MULTIVAC Marking & Inspection.

Another benefit: Thanks to the use of particularly light label material, the concept also contributes to improving the CO2 balance, since the transport weight of the packs is

reduced along the entire supply chain to the consumer. "If full wrap labels are used instead of cardboard sleeves, the weight of the banderole can be halved," adds Michael Reffke. "A full wrap label instead of a standard-size pizza box saves over 65 g of pack weight. Also not to be ignored for the producer are the savings in terms of license charges for the collection and disposal or recycling of the retail packs."

NEW DIMENSION OF ADDED VALUE

When compared with previous packaging concepts for pizzas and similar products, full wrap labelling does not just win in terms of output and sustainability. When it comes to appeal at the point of sale and the usable area for promotion, this new and unconventional concept for such products outscores top and bottom labelling by far. It is also in no way inferior to cardboard sleeves, as well as being significantly more efficient than a complete box. It also offers consumers the benefit, that they can have a close look at the product before buying it.

Even where the lowest-cost material is used, this packaging concept is still highly impressive at the point of sale with its high-quality look and feel, since the print design, shape and type of material can be individually adapted to the product and brand.

Tummy Yums Cares About Your Health

Tummy Yums rose out of adversaries. When the Pandemic hit Abhishek Tripathi , Founder Tummy Yums, felt the need to start something on his own, though it was fraught with risk he went ahead. He set-up his a company with the help of friends and families in 2020. The company deals in healthy snacks and is growing the company with his past experience in the food and beverage industry.

1 BEFORE WE DIVE INTO TUMMY YUMS PLEASE TELL US ABOUT YOUR BACKGROUND?

I began my journey like every average high school student to find a stable career option and so I landed into pharmacy medicine. But unlike every other individual I wasn't ready to settle for the ordinary and having realized early on that I was meant to enter the entrepreneurial world I dropped out of my course and pursued my graduation from Mithibai College followed by Masters in Business. Remembering the very first job where I earned Rs10k in 2006 I had kept my change of career choice a secret from my parents until this point. Later, the monotony of the regular 9-5 working period was jinxing my innovative side which again wasn't to my liking I said continuing to narrate my story to Startup story. I then was attracted towards the world of the internet and started working for an IT company and was awarded by NASSCOM. However, fate wasn't in my favour at the time and I met with an accident while I was in the middle of starting my own company. But that did not stop me from getting back up and pursuing my dreams, like I say 'Nothing should be allowed to distract you, focus is important' .

One of my previous clients was highly impressed by me and offered me a place as a consultant at FMC. This was my step into the food industry. Elaborating more about my work I told Startup Story that I was working with a huge quality clientele for private labeling including Wal-Mart, Spenser's, Haldiram's etc. My work in the food industry served as the basis of experience for me to set up my own brand later.

Once the pandemic hit the world, my company also felt the blow and had to go through a layoff. Even though I was kept on board I took this opportunity to start my own business with a small funding from my friend as a part investor I set up a factory and launched Tummy Yums in 2020.

2 YOUR BRAND NAME IS CATCHY. WHAT WAS THE MOTIVATION BEHIND FOUNDING THIS BRAND?

Being a foodie myself and having a son who enjoys snacks just as much, his son would usually say 'yummy in my tummy', which led to him naming his brand Tummy Yums all the same adding a personal touch to it.

3 THERE ARE OTHER COMPANIES WHO ARE USING MAKHANA TO PRODUCE SNACKS. HOW ARE YOU DIFFERENT FROM THEM OR IS THE MARKET SO BIG THAT THERE IS A SPACE FOR MORE PLAYERS?

Every brand has their own market share depend on quality & product positioning we as Tummy yums have PET CAN packaging using food grade material well packed and hygiene also makhana as product vary from size to size we prefer bigger size 15 mm minimum quality parameter raw material we directly procure from Bihar. As far as taste is concern seasoning and edible oil place an important role we prefer high standard and quality product which we procure directly from trusted source.

The Makhana market will grow at a CAGR of almost 7% during the forecast period of 2019-2023. The global Makhana market size will grow by USD 72.5 million during 2019-2023.

4 WHAT ARE THE OTHER PRODUCTS DO YOU MANUFACTURE? HOW MANY SKUS DO YOU HAVE?

We have wide range of product from under Tummy Yums brand we are also into healthy chips segment we have 40 SKU's as follows various categories Ragi Chips, Oats chips Chia Chips, Jowar Puff, Quinoa Puff, Vacuumed fried Sweet potato chips many more. We don't manufacture each and every product we do also prefer contract manufacturing with our specification.

5 COULD YOU THROW SOME LIGHT ON THE SIZE OF THE HEALTHY SNACKS MARKET IN INDIA?

Healthy snacking has become an enduring habit of snack lovers in the country. Driven by this smart snacking culture coupled with the recent Covid-19 push, a market which has been estimated to cross INR 1 billion will only touch greater heights, A survey conducted by IPSOS has revealed that while 72% of participants were aware of the nutritional needs of the body, 91% of Indians would like to explore healthier alternatives while looking to 'snack up'. Prompted by a fast-paced lifestyle always pressed for time, people are consciously making healthy snacking an integral part of their regimen. In a recent world-wide poll conducted online on snacking habits and preferences of people that also included Indians, 63% of respondents affirmed that health was a top priority. snack makers and brands are increasingly switching to making products from established and widely-acknowledged healthier ingredients which are typically used for preparation of our regular meals. These healthier alternatives range from staples such as rice, wheat and pulses to gram flour, millets, oats, ragi, quinoa, barley etc. Our multigrain chips has been developed by blend of such ingredients.

6 HOW ARE YOUR TARGET AUDIENCE? WHICH ARE THE SELLING CHANNELS DO YOU USE?

We have got niche TG especially people who are health conscious believe in healthy lifestyle majority we are targeting T1 T2 cities, and selling our product thru Omni-channels. We are present in supermarket as well online platform too. As rising demand of social media facebook & Instagram is the best platform to create the brand awareness of your product.

7 FROM WHERE DO YOU SOURCE RAW MATERIALSS?

We have set of vendors in India every state is known for some grain or fruits as makhana we mainly source from Bihar.

8 COULD YOU ENLIGHTEN US ABOUT THE TECHNOLOGY THAT YOU USE?

The future belong to D2C customer for the better margin and company growth perspective we have developed our in house e-commerce platform on open source platform which is taking care of all from inventory till accepting payment, supply chain is the biggest challenge for the last mile delivery, to make it easy we have integrated third party logistics channel Delhivery and shiprocket with our platform. Soon we will launch our app for android users.

9 WHAT ARE THE MEASURES DO YOU FOLLOW TO MAINTAIN COVID APPROPRIATE BEHAVIOUR AND FOOD SAFETY NORMS?

We are ISO Certified 22000:2018 (FSMS) food safety management system. HAPPC certified company personally I have also done my certification which was conducted by Fostac, FSSAI Covid-19 Guidelines, at our facility we strictly follow all safety norms. In India, majority of people still prefer unpacked food but the ongoing coronavirus pandemic has changed this preference and slowly and steadily we have seen a shift towards packaged food in tier 3 cities too. The packaged food reaches the consumer in protected packs and with minimum handling. Packaged food also offers ease of identification, and reduces the risk of adulteration and wastage due to spillage. Even packaged foods meet all the food standards and are fortified, we at Tummy Yums consciously using PET Can which is not only safety also more attractive and easy to carry.

10 YOUR ADVICE TO START-UPS IN HORECA AND SNACKS MARKET?

My advice to the food start-up & key mantra of success is to focus more on consumer listen to your customer frequently take the feedback of your product quality taste, packaging & pricing more customer centric approach as ultimately consumer is the king.

Mindful Eating: Perspectives from Ayurveda

By Kaushik Shankar*

In 2016, I had raised the idea of a "satvik" symbol for processed foods, much like our green/brown dot symbols for vegetarian/non-vegetarian foods. Key questions revolve around market potential, benefits to the consumer and the industry, and the nature of such a label (who will certify to what standards).

Health and wellness is a trend that has been dovetailed into food formulations over the past decade in the west. This has taken the form of calorie reduction, fortification with minerals/vitamins, addition of nutraceutical ingredients like fibers, antioxidants and omega-3. In India, this trend picked up even as the processed food industry began to start making inroads.

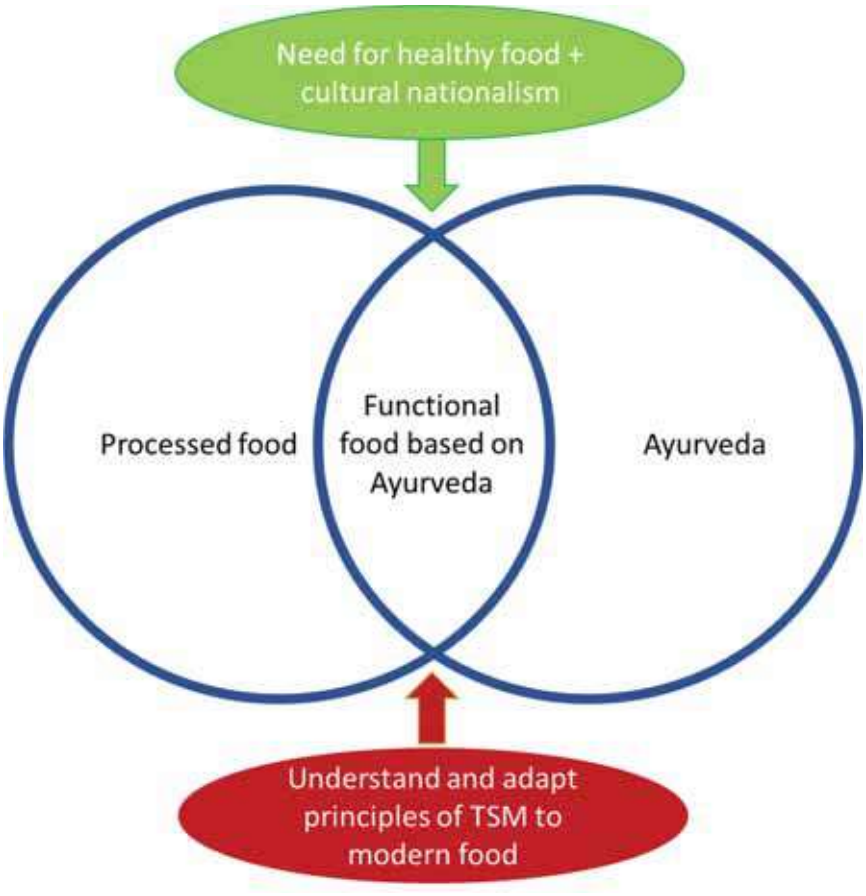
Many traditional societies have developed the idea of food influencing characteristics/mood/physical well being of the human body based on esoteric concepts of energy flows. In India, this is codified in the traditional systems of medicine – Ayurveda, siddha, and regional systems. Of these, Ayurveda has a pan-India presence and appeal.

Ayurveda, as a upaveda of the Atharva veda was codified in the charaka Samhita with three branches, of which the nara Ayurveda deals with human wellbeing. The 27th chapter of the charaka Samhita (annapana vidhi adhyaya) deals with the process of partaking food along with cooking methodologies. While undeniable that this teaching has been an integral part of life over millennia in Bharat, current processing methods and formats must be heavily experimented with to align with this principle. This is the first challenge.

Reformulating for the purpose of creating a healthy food on the principles of Ayurveda is not a simple matter of adding beneficial ingredients. Ayurveda classifies foods based on composition, source, forms, and effect. There are modern equivalencies to

Classification	Ayurvedic terms	Proposed modern equivalent
Composition	Ease of digestion – Laghu (quickly digestible) and Guru (slowly digestible)	Digestibility, satiety, glycemic index
Source	Shuka (grains), Shami (pulses), mamsa (meat), shaka (vegetables), phala (fruit), Haritha (greens), madya (fermented), jala (water), dugdha (dairy), ikshu (sweet), kritanna (cooked), ahara yogi (adjuvants, condiments, spices, seasonings)	In parantheses associated with the ayurvedic terms
Form	Ashita (eatable), peeta (drinkable), leedha (lickable) and khadita (masticable)	Food and beverage further classified into snacks and confectionery
Effect	Pathyatama (wholesome) and apathyatama (unwholesome)	Healthy, specific beneficial positioning like gut, heart etc.

AYURVEDA ALSO TAKES A HOLISTIC VIEW OF FOOD INTAKE. HENCE THE PROPERTIES OF FOOD ALONG WITH THE QUANTITY, TIMING, SEQUENCE, REGULARITY OF INTAKE AND ENVIRONMENT IN WHICH FOOD IS TO BE PARTAKEN IS ALSO CODIFIED. ANOTHER FEATURE IS PERSONALIZATION BASED ON THE PRAKRITI (NATURE OF THE PERSON).



Within the ayurvedic texts, further definitions of each of these terms are available along with specific food items and processes that could fall under these definitions. It is obvious that there is a large synergy between the terms that the modern food industry is used to and what Ayurveda suggests. Grey areas like pathyatam/apathyatama exist even in the modern processed food world. For example, in study to understand clean label, multiple terms have been used by the food industry to come under this umbrella label.

Ayurveda also takes a holistic view of food intake. Hence the properties of food along with the quantity, timing, sequence, regularity of intake and environment in which food is to be partaken is also codified. Another feature is personalization based on the prakriti (nature of the person). This can be akin to personalized nutrition that is becoming popular in the west and a key research area for processed food companies. The difference again is the problems of the consumer that is taken up for personalisation. For example, calorie intake based on metabolism (for example, physical activity) and disorders (for example, diabetes) is not the same as vata/pitta/kapha that Ayurveda defines are the nature of the consumer. These differences need to be aligned.

While many other areas of interest exist, one of the factors that is not under the direct control of the food industry is legislation. In the west, legislative challenges to labelling meat/dairy/egg analogues containing these terms are being debated. In India, a couple of dichotomies have already been observed by Giract. A popular ayurvedic chain has some food products with license from FSSAI (therefore classified as food) and some products with Ayush license (therefore an ayurvedic proprietary medicine). Another product is "chyavanaprashad", presumably since the formulation has been modified from the original to make it sugar free, and therefore ineligible to be called "chyavanaprash". Many of Patanjali products contain a green dot, which is not necessary for ayurvedic proprietary medicines (falls under FSSAI). While these are minor differences that were noticed by the author, when the trend picks up and products begin to flood the market, even small errors of judgement on part of the industry can have a magnified effect on consumer sentiment and acceptance of these products.

* Author is Project Manager, GIRACT

Growth Opportunity for Soy-Free, Hypoallergenic Formula in Asia

By Tan Heng Hong*

Concerned parents across the Asia Pacific region are turning to infant formula made with cleaner ingredient sources to minimise the risk of allergies and other health issues. They are opting for minimally processed, plant-based options to avoid potential allergens and other harmful substances in infant formula.

At the moment, specialised nutrition for babies with allergies to cow's milk comprises mainly of hydrolysed and amino acid-based formula as well as soy-based and rice-based formulas. However, according to a report by Healthy Eating Advisory Service in Australia, up to 40% of children who are allergic to cow's milk are also allergic to soy drink. The soy-free, plant-based formula can be an option for parents with toddlers with cow's milk allergy. It can also target parents who want to give their toddlers cleaner sources of nutrients from plants.

Going 100% vegan offers consumers a way to avoid animal milk protein that might be contaminated with antibiotics, hormones or even pesticide residues. Parents do have perceptions of plant-based foods as healthier. According to Mintel research, in Germany, three in 10 parents of children under the age of 16 see plant-based milk as healthier than dairy milk vs two in 10 of all adults. Whereas, over two-thirds of parents in the UK are worried that some baby/toddler food and drink products might contain harmful substances such as arsenic, pesticides.

Hence, brands that have turned to plant-based ingredients are also avoiding known allergens such as soy from their ingredient list.

ASIA IS A KEY MARKET FOR SPECIALISED HYPOALLERGENIC INFANT NUTRITION

With its rising middle class, Asia is becoming an important infant formula market for babies with cow's milk allergies.

Parents are increasingly aware of childhood allergies and are even carrying out allergy tests on their babies to ensure that the right type

of infant formula is given. Seven in 10 Chinese parents aged 20-39 have run an allergy test on their baby, highlights Mintel research. Whereas one in four Chinese parents agree that ascertaining a formula's suitability for their baby's physical condition is the most important feature when choosing infant milk formula.

At the same time, infant nutrition companies are actively offering concerned parents solutions and education. In China, Nestle Health Science China formed the "Anti-Allergy Alliance" with the Chinese Maternal and Child Health Association in 2020 to promote food allergy prevention and management in infants and young children.

THERE EXIST A WHITE SPACE OPPORTUNITY FOR SOY-FREE AND PLANT-BASED INFANT FORMULA TO FULFIL THE NEEDS OF PARENTS LOOKING FOR CLEANER SOURCES OF INFANT FORMULA FOR THEIR BABIES AND TODDLERS WITH COW'S MILK ALLERGIES. BRANDS CAN ALSO LOOK AT ASIA FOR POTENTIAL GROWTH AS AWARENESS ABOUT COW'S MILK ALLERGIES IS ON THE RISE.

OPPORTUNITIES FOR PLANT-BASED, SOY-FREE ALTERNATIVES IN ASIA

Major infant formula companies have made their presence felt in Asia with specialised nutrition for babies with cow's milk allergies. Opportunities do exist for plant-based, soy-free options. This is in line with Mintel's Food and Drink Trend 'Power to the Plants' which highlights how there is an increase in consumer interest in the plant-based diet, especially in Asia.

In 2020, Israel-based Else Nutrition officially started selling Else Plant-Based Complete Toddler Nutrition in the US for toddlers aged one year and above. The debut of Else Plant-Based Complete Toddler Nutrition on Amazon in August 2020 has renewed the spotlight on the use of 100% plant-based, non-dairy, non-soy options for toddlers with cow's milk allergy.

Else Nutrition also has plans to launch its plant-based infant formula in India and China. For China, Else Nutrition aims to enter the market in the coming two to three years through cross-border eCommerce, which facilitates the sale or purchase of products through online shops across national borders.

In Malaysia, Nutriscience Global has captured a niche market through its Dale & Cecil brand which has plant-based, soy-free milk called Miwako A+ for children aged 1 and above. The company has started exporting to Indonesia.

THE OPPORTUNITY

There exist a white space opportunity for soy-free and plant-based infant formula to fulfil the needs of parents looking for cleaner sources of infant formula for their babies and toddlers with cow's milk allergies. Brands can also look at Asia for potential growth as awareness about cow's milk allergies is on the rise.

* Author is APAC Food and Drink Analyst, Mintel

food MARKETING & TECHNOLOGY इंडिया

Vol. 12 • Issue 6 • June 2021

IMPRESSUM FMT

Publishing Company

L.B. Associates (Pvt) Ltd
B-4/148C,
Safdarjung Enclave
New Delhi - 110029
Website: www.lbassociates.com

Publisher
Linda Brady Hawke

Marketing & Events
Binoy Sahee
info@lbassociates.com

Neenu Choudhary
+91-8744069171
contact@lbassociates.com
info@fmtmagazine.in

Editor
Kanchi Batra
kbatra@lbassociates.com
fmteditorial@lbassociates.com

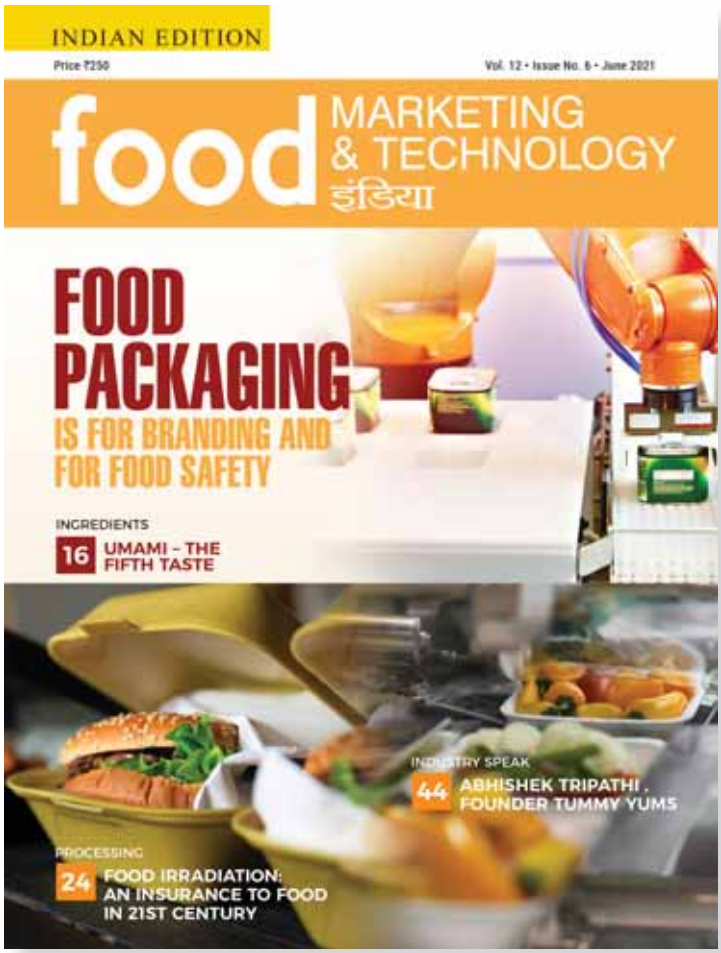
Legal Consultant
Roopa Somasundaran

Layout & Design
Atul Kumar

Subscription
info@lbassociates.com
+91-7827892179

Parent Company
Dr. Harnisch Publications
P.O. Box 90328 Nuremberg, Germany
Email: food@harnisch.com
Website: www.harnisch.com/fmt

NOTE: Key numbers at the end of articles can be used as references for reader requests



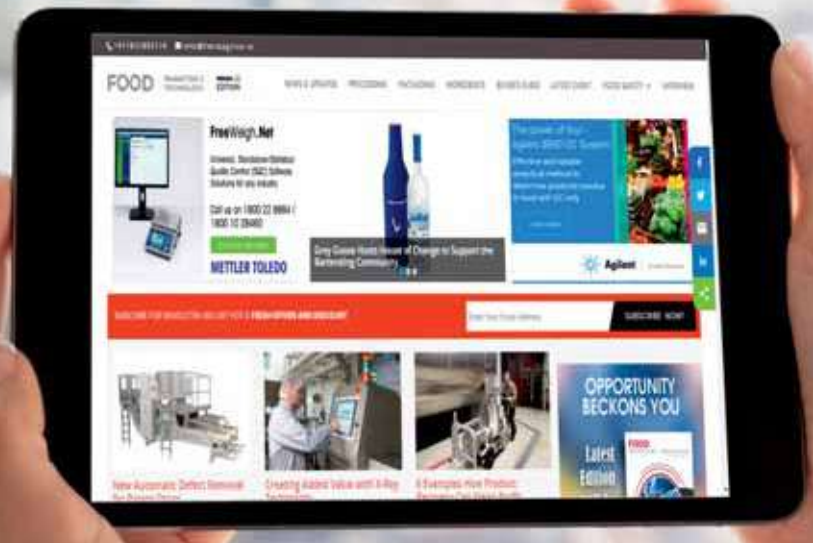
National Events Calender

3RD FOOD TRADE ASIA
11-13 August .....New Delhi

food MARKETING & TECHNOLOGY इंडिया

We Cover Food Industry Like No One Else

New and Fresh Look



Call: +91-7505972946

For Advertisement contact contact@lbassociates.com, info@fmtmagazine.in

For Editorial contact fmteditorial@lbassociates.com

www.fmtmagazine.in

FIBER *UP* YOUR WORLD!

VITACEL® Dietary Fibers
VIVAPUR® Functional Systems

www.jrsfood.net

Made in Germany

Varied Applications

Bakery	Dressings & Sauces
Snacks	Beverages
Meat	Anticaking Agents
Gluten-free	Nutraceuticals
Dairy	Frozen Formed Products

- Fiber Enrichment
- Calorie Reduction
- Enhanced Sensorial Properties
- Label Friendly

Follow the Fiber People!

RETTENMAIER INDIA PVT LTD

Fibers designed by Nature

RETTENMAIER INDIA PVT. LTD.
816, Lodha Supremus-II, Road No. 22,
Wagle Estate, Thane (W) - Mumbai 400 604
Maharashtra - India

Contact:
meeta.raheja@jrsindia.com
rasika.nachane@jrsindia.com
Telephone- 022- 4024 3817-21
www.jrs.de

RNI No. UPENG/2010/38219