FUNCTIONAL STARCHES FOR IMPROVING FOOD PRODUCTS:

WEBINAR ORGANIZED BY PROTEIN FOODS AND NUTRITION DEVELOPMENT ASSOCIATION OF INDIA (PFNDAI) IN COLLABORATION WITH ROQUETTE: A REPORT

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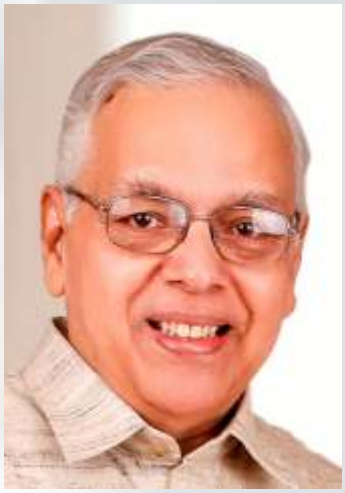
PFNDAI in collaboration with Roquette organized a webinar on the topic "Functional Starches for improving Food Products" on 7thJuly 2022.

The speakers for the webinar were Dr. Jagdish Pai, Executive Director PFNDAI, Ms. Charmie Patel, Application Scientist, Roquette, Mr. Rohit Salgaonkar, Application Development Team Leader, Roquette. The Panellists were Mr. Clifford Pinto, Head of marketing department (Food GBU) South Asia, Roquette, Mr. Mayank Kumar, Deputy General Manager- R&D Innovation centre, Mother Dairy Fruit & Vegetable Private Limited, Mr. Manoj Pareek Global Head of R&D, Hindustan Unilever Limited, Mr. Amol Waghmare, Senior Manager R&D, General Mills and Ms. Nidhi Gupta, Scientific Assistant, PFNDAI. There were more than 100 attendees in the event. Ms. Dolly Soni, Executive-Marketing and Digital introduced the speakers.

1. The first presentation was given by Dr. Jagadish Pai on "Introduction to Starches and their Functional Properties."



Prof Pai spoke about various sources of starches in food products, including grains, pulses and root vegetables. He presented on the structure of starch, types of starches based on digestibility (Rapidly Digestible Starch, Slowly Digestible Starch and Resistant Starch). He mentioned about the slow digestibility of Amylose and the low Glycemic Index associated with it. Amylopectin (70-80%) on the other hand digests rapidly

which could be utilised by athletes requiring instant energy. Resistant Starch is undigestible by our enzymes and they act more like dietary fibre. Whole grains, potatoes and green bananas have good amounts of Resistant Starch in them. Slow Digesting Starch (SDS) is better for sustained energy and for long distance runners. Both RS and SDS are good for diabetics and give low GI to foods. RS also works as prebiotics and helps probiotics grow, it improves insulin sensitivity, lowers LDL and helps HDL cholesterol levels.

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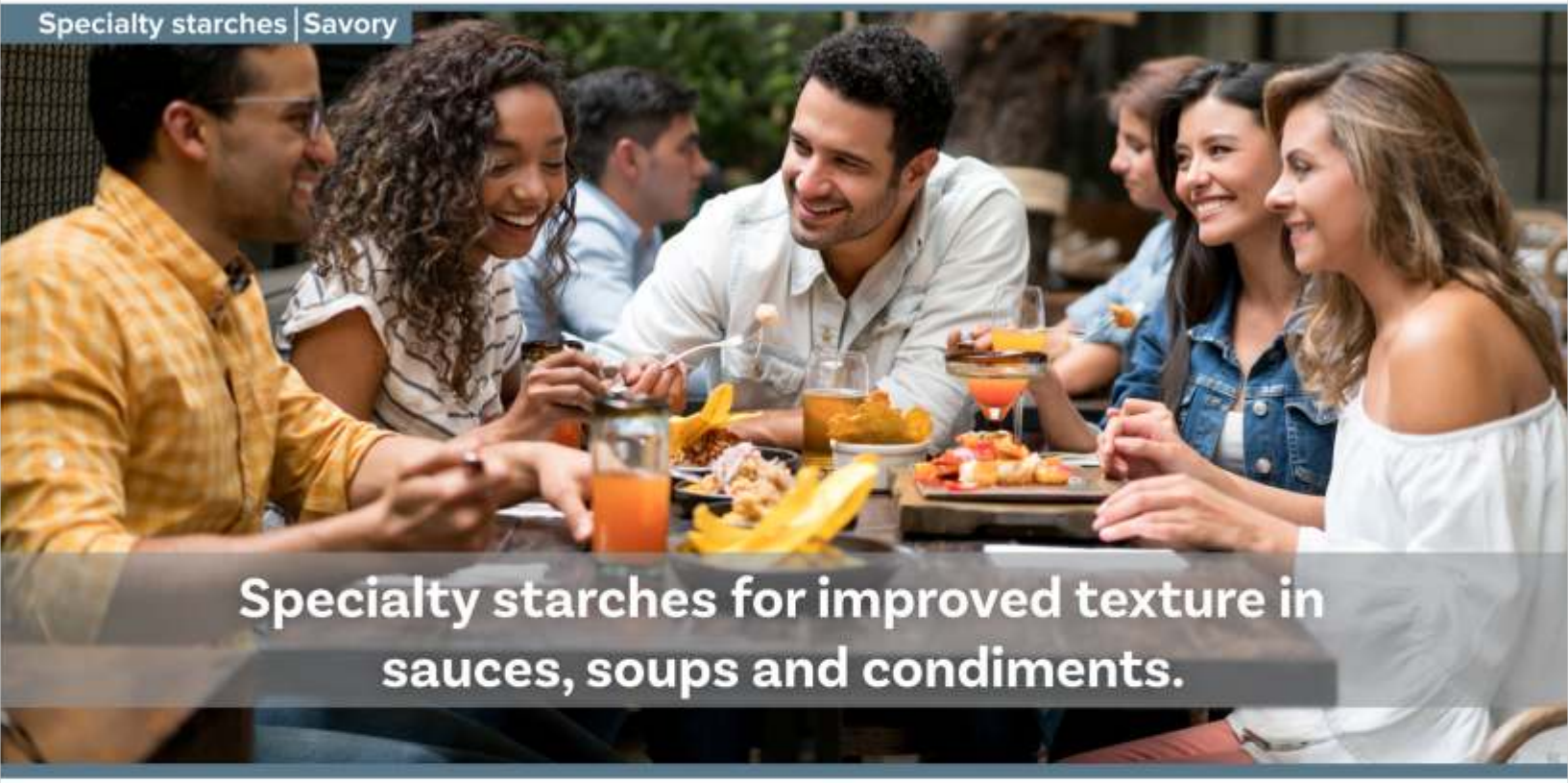


Dips


Gravies


Soups


Ready meals


Batters and coatings


Marinations

Key benefits:

- Increased viscosity and mouthfeel
- Resistant to High shear, high temperature, and low pH
- Prolonged crispiness
- Low oil uptake
- Re-heatability and freeze-thaw stability
- Binding properties
- Clean label

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Starch sources containing highAmylose content were discussed including High Amylose Corn, Corn, Cassava, Wheat, Sweet Potato, Arrowroot, Sago and Potato. Different types of RS (RS1, RS2, RS3 and RS4) were discussed with their sources of occurrence. Dr. Pai gave an introduction to the various functional properties of modified starches in foods like specific viscosity, thin boiling, viscosity resistance acid, freeze thaw stability, gel texture, clarity, flow properties, mouthfeel, adhesiveness, crystallinity, long shelf life stability, cold water swelling, film forming properties.

The need for modified starch in place of native starch arises due to the limited functionality and application of native starches. Starches can be modified by esterification, etherification, hydrolysis and oxidation to achieve desired properties. These modifications make starch suitable for various baked products, confectioneries etc. Modified starches including physical, enzymatic and chemical modifications have properties suitable for gelling, emulsification etc. Physically modified starches are not very stable and hence chemical modifications like esterification, etherification, oxidation and cross linking play an important role in achieving the desired properties of modified starch which can then be used in various applications like canned foods, baked goods, frozen foods, salad dressings, baby foods etc.

2. The second presentation was given by Ms. Charmie Patel, Application Scientist, Roquette. Ms. Charmie's presentation was focussed on the role of starches in improving product characteristics in Dairy, Beverages and Confectioneries.

Native Starches are modified to improve functional characteristics as once native starch is heated they tend to degrade. She mentioned about stabilized starches, which are used as thickeners in foods and undergo thermal treatment e.g. in soups, sauces, instant noodles etc. Stabilized starches are used where cooking temperatures are low, in freeze/thaw applications and for improving the shelf life.

Among the dairy category,the role of starches was discussed. Milk undergoes multiple high temperature, high shear processes, where there is extreme pressure and latent heat formation to the product. Multiple critical aspects need to be considered while formulating the product. For preparing yoghurt of improved flavour release, it has to maintain the right viscosity to expect the right set product which the consumer is expecting. To identify right ingredient mix is important, hence many yogurts containing fruit fillings in a sandwich format or with lots of layering are containing starches.

Acid-resistance of the product needs to be rightly estimated and based on this the correct ingredient needs to be identified. In other products like beverages, the low acidity, mouthfeeland dispersibility of the product, type of starch needs to be identified. In savoury products, mayonnaise, ketchups and sauces shear mixing plays a role. Different groups of modified starches (thin boiling), have different applications. Converted starches or thin boiling starches are designed in a way that do not build viscosities at higher temperatures and pressures. Their application remains in gummies and confectionery. They are also having retrogradation over a period of time.

Thin boiling starches are specially designed do not set and remain liquified so that it can be deposited into moulds. It enables to obtain a specific texture and finds a huge application in vegan cheese and serves as an important substitute for milk proteins. OSS (Sodium Octenyl Succinyl Starches; Emulsifying starches) are cold soluble (mayonnaise) and in a lot of flavour encapsulation applications. Different grades of OSS starches are available based on their solubility index and their ability to hold oil portion and hence could be used easily for all the spray drying applications.

Pregelatinized Starches (Instantized starches) are used for instant dairy desserts, instant creams, instant soup and are designed in a manner when there are no lumps while being used in small packet applications in the industry. An overview of drum drying of pregelatinized starches was represented where pregelatinized starches could either be native starches where they are instantized for cooking or they are modified for different applications. Modified starches E numbers would change upon different modifications of the starch. Application of starches (Cold Soluble/Instant viscosifier), important to develop processing parameter and identifying the matrix of that formulation. Instant ready to use fondant, instant shakes and premixes. Modified starches when used in kulfis, ice creams helps in controlling melting rate, clean shiny gloss in the fruit preparations. Clean label starches are used at specific applications and is a versatile cook up starch, it is best used for drinking yogurt formats.

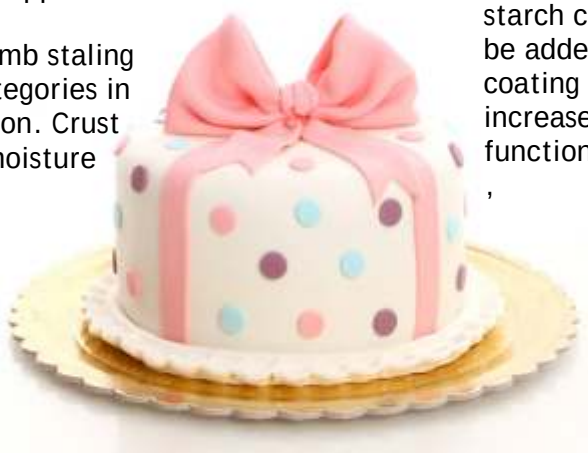
3. Mr. Rohit Salgaonkar

presented on some new segments in bakery segment.

Overmixing of batter leading to overdevelopment of gluten and loss of CO2 leading to tunnel formation. Other problem is sedimentation of the inclusions. Inclusions are added in cake batters which stay in suspension, upon baking sedimentation occurs leading to non uniformity in the final product. When temperature rises during baking it leads to melting of the fat crystals along with sugars which decreases the viscosity of the solution and hence the sedimentation. It is important to maintain viscosity until starch gelatinization and protein coagulation happens.

Crust staling and crumb staling are the two main categories in physical retrogradation. Crust goes stale because moisture from the crumb has transferred, when crumb goes stale it is because the starch has crystallised because of the retrogradation of the amylose molecule, hence for better shelf life addition of amylopectin with starch is recommended. Pregelatinized starches can replace part of the flour decreases the tunnel formation, also pregel starch will help maintain the viscosity and keep inclusions in suspension throughout the process. Pregel starches are a god choice for gluten formation, moisture retention of cakes and serves as a texturing and stabilizing agent. After 30 days, cakes with waxy starches were 30% softer than control.

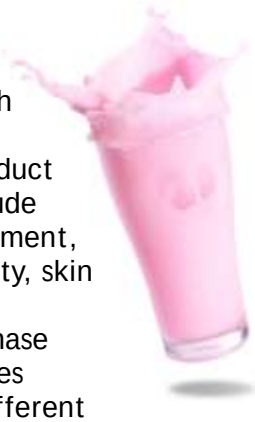
Modified starches serve effective in controlling the moisture within the product. In breakfast cereals and bars, there are 4 major challenges which could be categorized as low bowl life, sogginess, binding and breakages (during transportation). Due to quick moisture uptake by these cereals when mixed with warm milk, it results in low bowl life of these products. Also these cereals are loaded with high sugar to increase its bowl life. Pregelatinized native maize starch can be added to coating to increase its functionality ,



will improve its storage stability and will help improve the bowl life of the product. Amylose forms a coating on top of the cereals which results in delayed sogginess/ improved bowl life of the product. This starch can be used as a bonder in baked bars as well giving it a crunchier texture.

In sandwich creams, certain amounts of sugars and fat in the solution were replaced using a certain amount of pregelatinized potato based starch. It adds stability to the product, maintains thick and creamy sensory qualities, offers excellent dispersibility and helps in sugar and fat reduction. In the snacking category, extruded snacks are tricky to formulate, starches helps in maintaining good lubrication capacity, controls expansion in products like puffed cheeseballs with the correct amount of use. High amylose starches control expansion and reduce breakages, increases porosity, improves binding and machinability, improves crispiness. When we extrude with the right combination of the starches, we will have crunchier and harder texture.

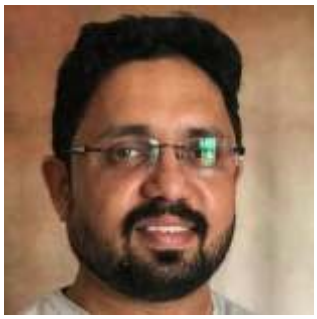
In the Savoury segment, challenges, which need to be addressed in product formulation include viscosity management, high water activity, skin formation, lump formation and phase separation. Sauces aremade with different processes (hot and cold). Cold processes are usually used to manufacture salad dressings and mayonnaise. All of these concepts would need a thickening agent to provide viscosity but it is important to identify the process before identifying the thickener. Shelf stability and stability of the finished product need to be looked upon to identify the right modification and thickener. Modified pregelatinized and cookup waxy maize starch are used due to their high amylopectin content and good shine to the product. In batter and coating, starches play an important role to control batter pickup. Slow digestible starches have become popular in people focussing on weight management and looking for sustained energy release.



Finally, a panel discussion was held on the various applications of modified starches. The panel discussion was moderated by Ms. Dolly Soni.

Mr. Mayank Kumar addressed the question on "Type of starches used in dairy products and their functional role in dairy products." He mentioned about the use of starch as fat replacer, texture improver, high nutritional claim, stability for better heat and shear resistance.

Mr. Clifford Pinto addressed the panel question on "what are modified starches" , by defining them as modification of starches from grains like maize, wheat, potato, peas have been treated by heat, acid or enzyme to improve their stability and keep the structure and texture of food as desired by the consumer. There are different types of modified starches depending upon physical, chemical or enzymatic modification. He mentioned that almost 50% of products in the market with a texture claim have had an incorporation of modified starches in them like readymade pizza, sauces, soups.



Mr. Amol Waghmare addressed the panel question on "Which modified starches are preferred in baked products and their functional roles in the same." He highlighted the role of modified starches in cakes, pastry, doughnuts, puffs etc. Choice of starch in these bakery products depends on the end product desired like moist cake, dense, cream cakes etc. In general native, pregelatinized starches are usually used in bakery. In desserts, where chocolate sauce and whipped cream are used starches having emulsifying capacity are used. Crosslinked Starches have a critical role to play in the frozen dough and retain moisture as frozen dough tend to lose moisture during storage.

Ms. Nidhi Gupta addressed the panel question on "Soup premixes commonly utilising starches, and their functional role". She highlighted on the use of potato starches commonly used in soup premix which are in cross linked form, in particular distarch phosphates provide better granule swelling without disruption in the soup premix.

Ms. Charmie Patel addressed the panel question "Can starch dissolve in water if heat is applied. If yes, why?" She first made it clear that there is a possibility for starch to be dissolved in cold water if the starch has been modified. Pregelatinized, instantized starches are created for this type of application. She mentioned that heat application would result in dispersion of starch in water as the granules swell due to water uptake, hence it cannot be termed as dissolution.

Mr. Rohit Salgaonkar addressed the panel question on "how to choose right starch and which parameters need to be considered." Process conditions, storage conditions and target shelf life determine the choice of starch. A vigorous process of say 1000C, holding time of say 30 mins and pH 3.8 and storage is at frozen condition, a highly cross-linked starch and stabilized controls freeze thaw stability of the product and will not result in loss of viscosity of the product at the same time.

The webinar concluded with a vote of thanks by Ms. Dolly Soni.