Novel Technologies for Food Processing and Shelf Life Extension

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Lecture – 58
Food Powders & Premixes

Hello friends in this class we will study about Food Powders and Premixes. What are different types of powders, how the premixes are prepared, how they are important in fact, they several types of food powders and premixes are available in the market whether they are used directly for various purposes or even these powders are used as an ingredient in different food formulation and in different food preparations.

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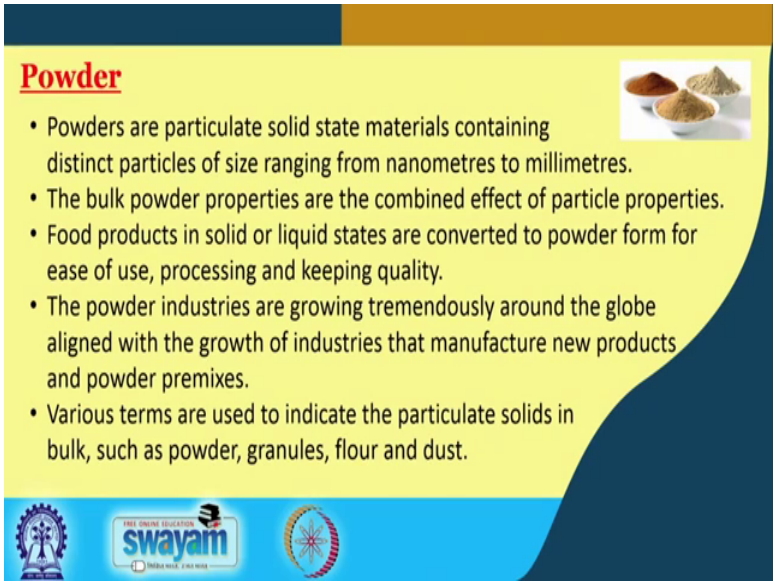

So, let us study. So, first thing; what is a powder? That they are particulates solid estate materials containing distinct particles of sizes ranging from nanometers to millimetres. The bulk powder properties are the combined effects of particle properties, food products in solid or liquid states are converted to powder form for the ease of use, for the ease of processing or for the benefit of keeping quality or restore ability. The powder industries are growing tremendously around the globe aligned with the growth of the industries that manufacture new products alright.

And powders or premixes as I told you there is food powders become the ingredient or raw material for preparation of several products in industry. So, they are used, even

various terms are used to indicate the particulate solids in bulk such as powder, granules, flour and dust.

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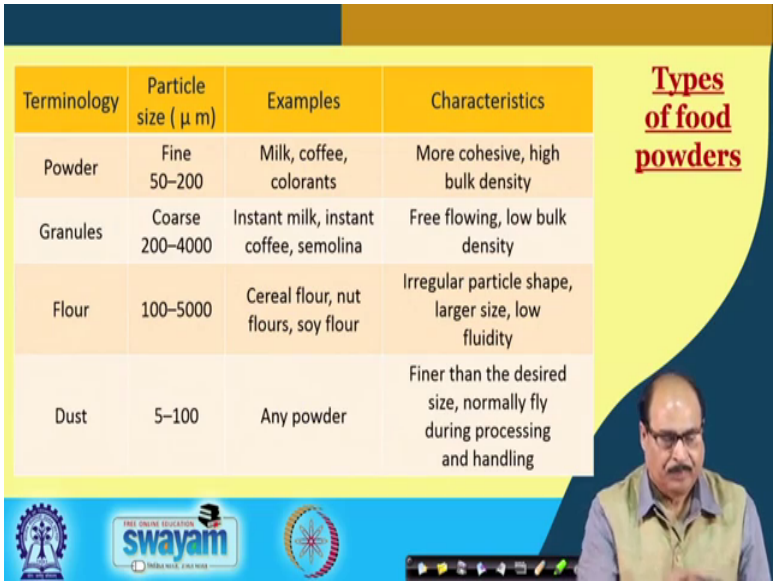

So, in this table I have given what are the terminologies that is particle size examples and the characteristics that they have like for example, powder their particle size generally ranges between 50 to 200 micro meter, they are fine particles. Examples of this may become milk powder, coffee powder or other colorants powders etcetera and they are more cohesive and comparatively have high bulk density.

The granules are little bit coarser in size, they have the particle size in the range of 200 to 4000 micrometers, examples of granules are of the instant milk, instant coffee, semolina etcetera. And they should have or they have a free flow nature and low bulk density. The flours their particle size ranges from 100 micrometer to 5000 micrometers and examples of this category are powders include cereal flours, nut flours, soya flours etcetera and they have irregular shape larger size and low fluidity.

The dust they may content particle size somewhere in between 5 to 100 micron and it may include any powder that verifies of the powder of the dust, the finer than the desired size, normally fly during processing and handling.

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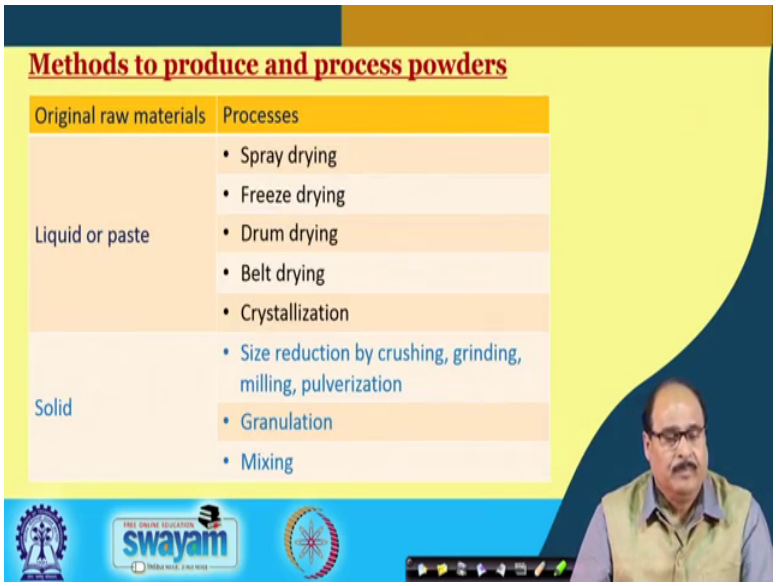

So, the various methods are used to prepare different types of prepare and process powders, depending upon the raw material and depending upon the characteristics desired in the powder different unit operations are used for the liquid and paste. Like raw materials they can be converted into suitable quality powder by using processes like spray drying, freeze drying, drum drying, belt drying, crystallization and so on.

And obviously, each of these processes they require a special parameter, a special unit operation, a special preparatory, steps etcetera. The solid raw materials they can be converted into particles or powders or desired functionality desired characteristics, by having appropriate size reduction process, such as crushing, grinding, milling, polymerization etcetera or granulation and mixing also may be used to prepare or to get the powder of desired characteristics and desired sizes.

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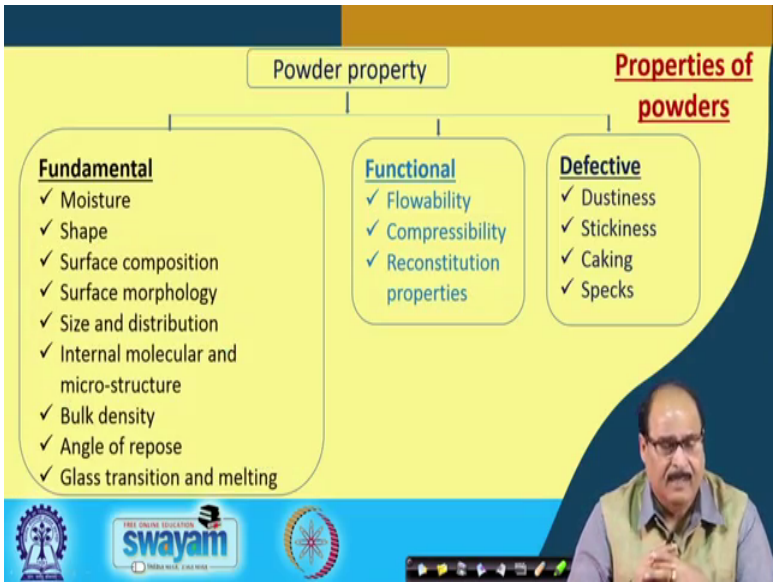

So, in general the properties of the powders they can be grouped that is desirable properties or undesirable properties like desirable properties; there is one is the fundamental properties of the powders, is the moisture, content, shape, surface composition, surface morphology size and distribution of the particles, internal molecular and microstructure, bulk density, angle of repose and glass transition and melting characteristics. So, these becomes the fundamental characteristics of the powder and analyzing there is to analyze the powder for a specific operation in a specific food products many times these characteristics play major role in determining the usability of the powder.

Similarly, the functional property like flowability, compressibility, reconstitution properties etcetera. Again play important role in deciding the usefulness of a particular food powder in a particular food product for a specific purpose. Same now at same time the powders there they are excited they may be some defect sector, if they are not stored properly, if they are not handled properly even depending upon the materials.

So, that is like if during from solid material if the powder are made during grinding and pressing you have to find, particles are made or crushed. So, they may become dust so it may become very fine dust and which may fly. So, handling of these fine dust etcetera are may be a difficult thing, even if their material are used hydroscopic material are there. So, during this grinding or during this spray drying etcetera process, the material

may absorb moisture or even during a storage. They may absorb moisture and they may stick together they may form cake is a specks etcetera; means they are free flow nature, maybe they are handling another characteristic may be adversely affected.

So, even they are mixed in with the other ingredients maybe adversely affected. So, these are the some of the defect to property. So, during handling any storage care should be taken during manufacture, that it is this desirable properties are maintained in the powder.

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Then, but there are certain issues there are certain challenges in the preparation of food powders; because most food powders they are not directly consumed, they are usually mixed with water or other liquids or even they are mixed with solids to produce either wet or dry formulations, like premixes etcetera. And these formulations they can be further processed to produce either ready to eat, ready to cook, ready to do ready to serve products etcetera.

So, the prevention or contamination with micro organism or with other undesirable chemical components is a huge issue in the food powder manufacture that is even in environmental contamination and maintaining the desirable composition and characteristics of the powder, is an important issue and it is challenged.

Other issues while delivering the food powders include the ability to handle and transport ingredient powders, dust problems, dust fire and explosion hazards, allergy problems, creation of desirable powder particle properties. And the ability to dissolve these powders when required, their instantization their soluble behavior another functional property to maintain these are very important issues and challenges.

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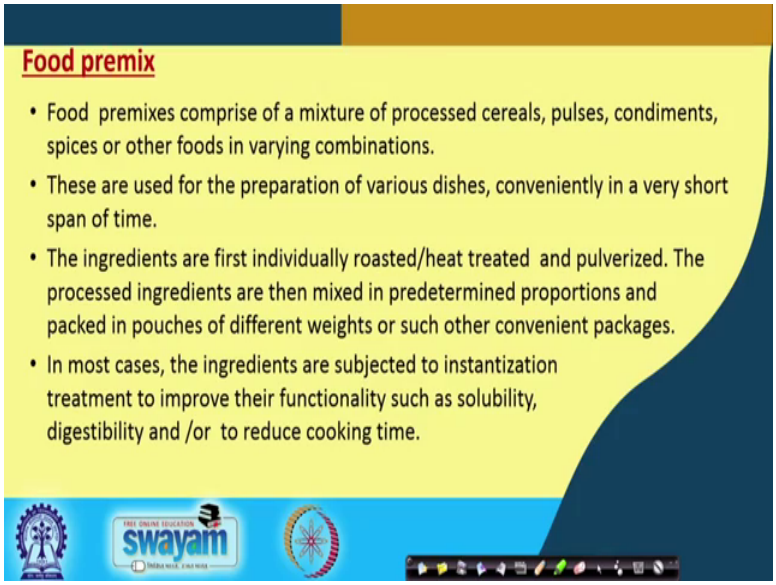

So, next is the food premix food premixes, comprise of a mixture of processed cereals, pulses, condiments, spices or other foods in varying composition, even different food powders; they can be mixed in a proper proportion to get a desired premix of a particular food of desired characteristic; preparation of various like premixes are used for the preparation of various diseases conveniently in a very short span of time. The ingredients are first individually maybe roasted or heat treated or given some sort of suitable process and then treatment and then they are polymerized.

The processed ingredients are then mixed in predetermined proportions as per the formulation and are packed in pouches of different weights and sizes or in various convenient pouches in convenient form or convenient sizes. In most cases the ingredients are subjected to instantization treatment that is these powders for mixing or even during mixing, after mixing they are subjected to instantization treatment. So, as to improve the functionality, capability, wettabilityy or even to reduce the cooking time to improve the digestibility of the material are so such properties etcetera.

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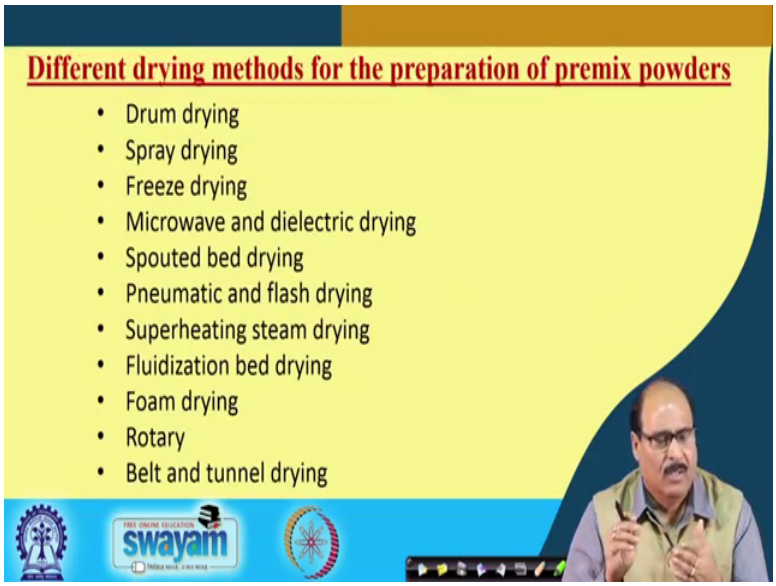

So different methods, methods which are used for drying or preparation of premixes powders may include like drum drying, spray drying, freeze drying, microwave and dialectic drying, spouted bed drying, pneumatic bed drying. So, depending upon the raw materials, which are used whether they are formed etcetera the different mixes etcetera. One can choose our sensitivity of the material component etcetera one can choose a suitable type of drying; like it may be a homemade drying, or belt and tunnel drying or pneumatic and flash drying etcetera.

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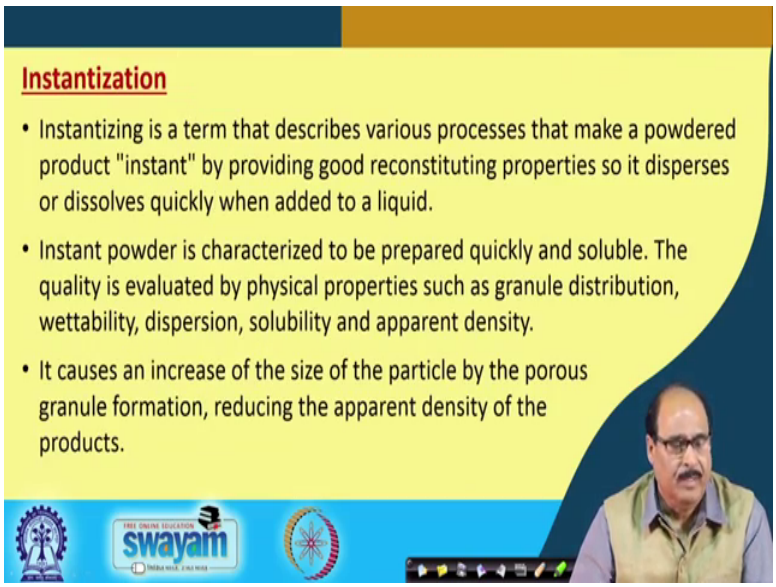

Instantization let us because it is a important process in the preparation of food powders as well as in the premixes. Like instantizing as I told you is a short is a term that describes various processes, that make a powdered product instant, we have in the market instant tea, instant coffee, instant premixes etcetera.

Instant what? Instant rice, instant noodles like the solubility of the material in the water are reconstitution property is improved, functional properties are improved, they are easily digestible instant material; and also the cooking time accordingly is reduced maybe there water absorption characteristics may be improved. So, instant powder is characterized to be prepared quickly and is more soluble. The quality of the instant materials are evaluated by their physical properties such as granule distribution, wettability, dispersion, solubility and apparent density. It causes an increase of the size of the particle by porous granule formation, or it results in reducing the apparent density of the products.

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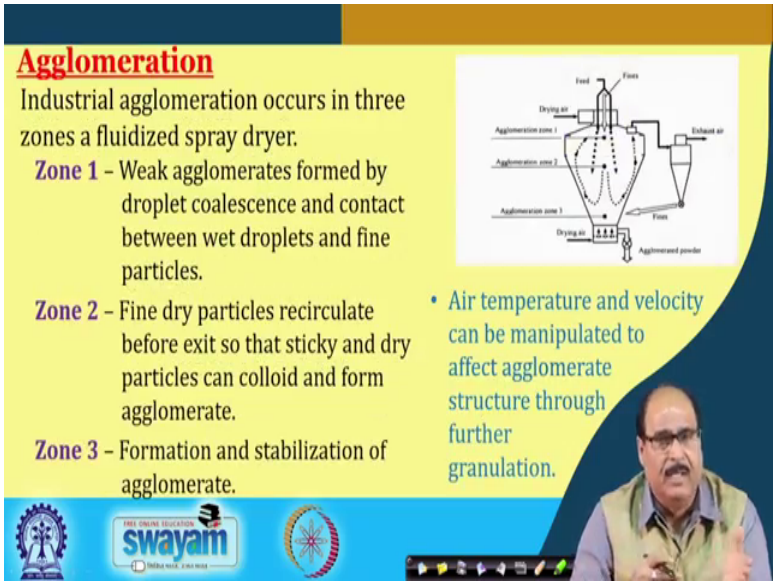

So, instantization may like one example is the agglomeration, may be one process which may result in to the instantization of the material. And in their agglomeration like in the for making granules of the instant coffee granules or then milk powder or granules etcetera. The agglomeration process during spray drying, takes place and it that is a may occur in three stages as you can see here in the zone 1 and zone 2 and zone 3, in the spray dryer number. So, in the zone 1 weak agglomerates are formed by droplet

coalescence and contact between wet droplets and fine particles. Then in zone 2 find right particles recirculate before exit so that, the sticky and dry particles can collide and form agglomerates. And finally in the zone 3 their formation and stabilization of the agglomerate take place.

So, air temperature and velocity of the particle inside the drying chamber are the important steps, important parameters and they can be manipulated to affect agglomerate a structure through are the further granulation.

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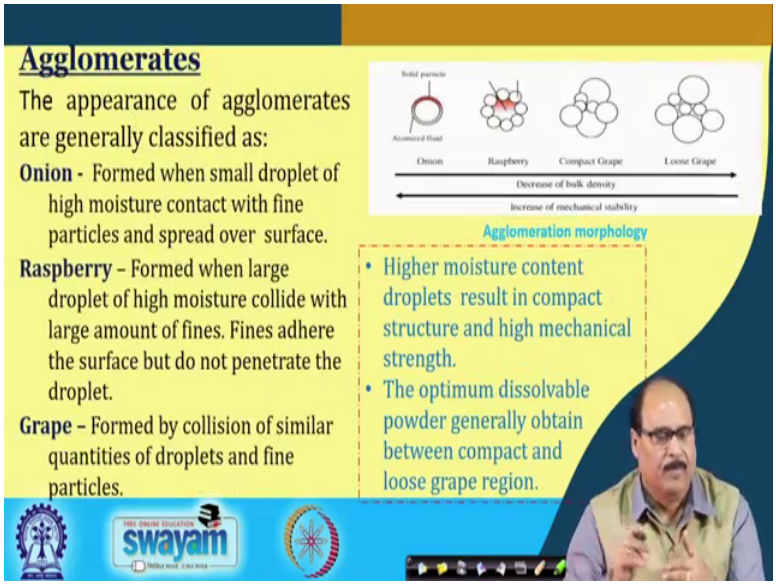

The different agglomerate structures may be onions, raspberry or compact grape or lose grapes and so on. And this as I told you by having the proper process inside the drying chamber by having proper conditions of temperature, particle velocity or etcetera will can get it at the structure appearance; like onion is formed when small droplets of high moisture content with fine particles; and spread over surface that is when a small droplets of high moisture contact with fine particles and spread over the surface.

Raspberry structure is far bigger when large droplets of high moisture, collide with large amount of fines; these fines were hard to the surface as you can see here, the fines add up to the surface, but they do not penetrate the droplet. Grape formed by the collision of similar quantities of droplets and fine particles.

So, higher moisture content droplets result in compact structure and high mechanical strength. The optimum dissolvable powder generally obtained between compact and the lose grapes that is that, these have the structure particles obtained between the compact and lose grape they give the better solubility etcetera.

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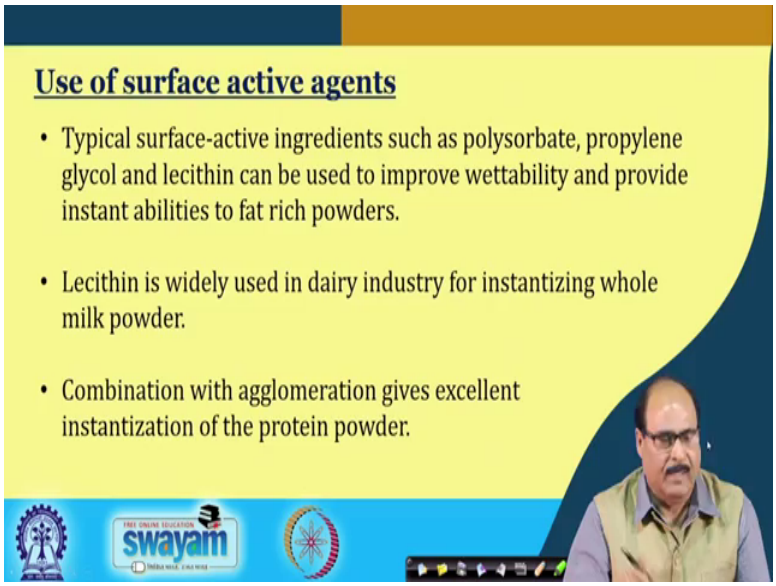

So, in addition to that there are some other means by improving or by getting the instantization of the materials; like use of surface active agents the typical surface active ingredients such as, polysorbates, propylene glycol, lecithin etcetera; can be used to improve wettability and to provide instant abilities to fat rich powders. Lecithin is widely used in dairy industry for instantizing, whole milk powders this surface active agents in combination with agglomeration give excellent instantization of the protein powder.

Apart from this, there are some other various top processes such as microwave treatment, eradiation, high pressure or heat treatments etcetera may also be applied. The material may be exposed to this or a proper parameters etcetera.

So, such like eradiation and heat treatment etcetera they may cause the larger polymers to break down, they make break the polysaccharide linkages etcetera with polymers into smaller polymer. And this the material which have a smaller polymer proportion more that is become more soluble or they get instantize moisture absorption etcetera is improved. So there are various methods. Now, depending upon the material

characteristics, depending upon the requirements and facilities available; when we use which type of which process to be used for the instantization purpose.

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So, various types of food premixes are available in the market, like gravy mixes, ethnic food premix, instant milk shakes, instant soup premixes, instant drinks, instant tea premix, instant chutneys, tea premixes, coffee premixes, instant cake mixes etcetera. So, various starting from that its containing from various raw material like fruits, vegetables, cereals, grains, dairy etcetera.

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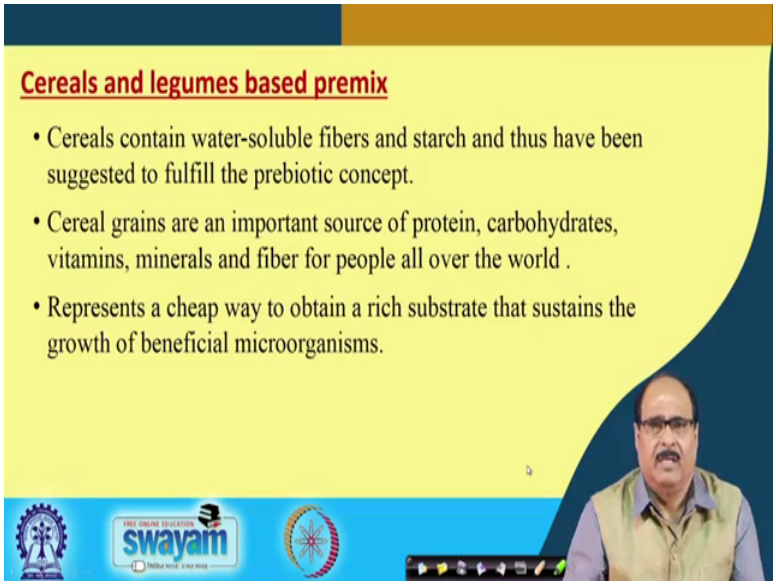

So, I will just in the next slide give you a few common type of products particularly those of Indian origins etcetera. Like what is the cereal and legume based premixes? That is cereal contain water soluble fibers and starch and thus have been suggested to fulfill the prebiotic concepts some of the cereal oligosaccharides etcetera they have a prebiotic effect.

So, they may be a suitable subtext for even probiotics. So, cereal grains are an important source of protein, carbohydrates, vitamins, minerals and fibers for the people all over the world. So, they represent a cheap way to obtain rich substrate that sustains the growth of beneficial microorganisms etcetera. So, they can be manipulated and accordingly the large number of cereal based premixes etcetera even are available in the market.

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We at IIT Kharagpur had also worked, and the development of the cereal based drink powder and powder premix. Like here in this process we take the grains like Bengal gram, maize and ragi. And they are of course, after giving the obvious creative processes primary process treatments like the (Refer Time: 19:29) ingredients (Refer Time: 19:31) etcetera.

They are roasted and this roasted grains are converted using (Refer Time: 19:39) mill or another suitable mill at (Refer Time: 19:41) mill they are converted to grinded into particles or powders of desired sizes alright. And they are finally, sieved passed through

sieves of 250 micron size the purpose of this is to have a four mixture premix that is these flours are in they are used in the proper proportion.

So, the flour mixed of desired size and uniform particle size distribution. Then finally, there these formulation this is colloidal mill, this with water mill and converted into form of paste. Then freeze dried, this freeze dried flex and the flex are ground into this is a beverage powder. And this by that is roasting grinding colloidal milling and freeze drying this results into the instantization at improved solubility as well as functionality; and you get the grain based premix.

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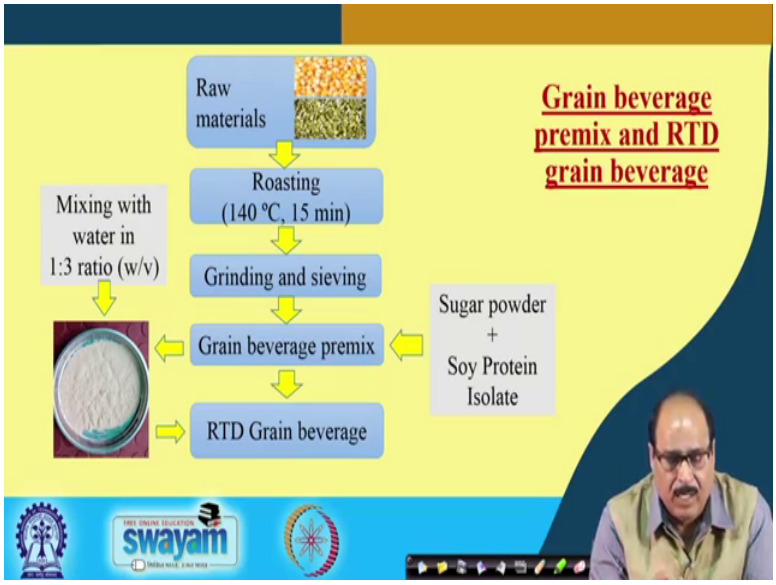

Similarly, the another some other raw material maze and some etcetera are used are even this green gram, that is maze and germinated green gram is used, they are roasted alright. Grinding and sieving finally, get in this powder in sugar powder and soya protein isolate in the reserved proportion is added. And grade grain beverage premixes is prepared, and this green beverage in the green beverage premix; obviously, in order to get ready to drink green beverage it is mixed with water portable water drinking water in 1 is to 3 ratio weight by volume, and we get ready to drink grain beverages.

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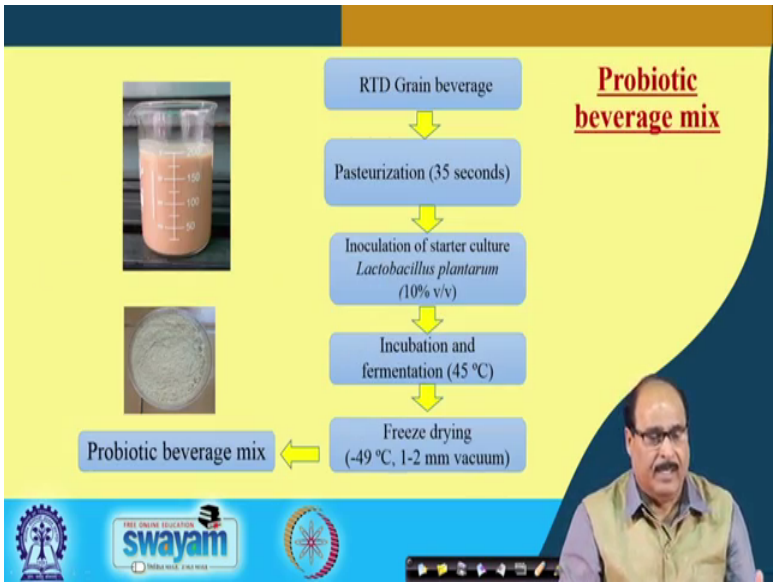

And as I told earlier that is these beverage that is materials they have a good prebiotics, so they become a good substrate for the so we have worked on, that is this grain beverage premix which was paid.

In fact, it is the surface pasteurized whether this beverage were prepared beverage was pasteurized and then this the probiotic bacteria, like lactobacillus plantarum 10 percent by volume of this RTD beverage who are inoculated. And finally, incubated at 45 degrees Celsius for the fermentation for the bacteria to grow; and finally, the material is freezed inside. So, if we get a probiotic beverage probics and we have studied details about the stability or survival of the probiotic bacteria in the beverage premix etcetera.

And gives a even a reconstitution and after the reconstitution of this beverage, that is the reconstituted. Probiotic beverage mix has a good or may be more than 10 to the power 6 or 10 to the power 7 see a few per ml of the per gram ok.

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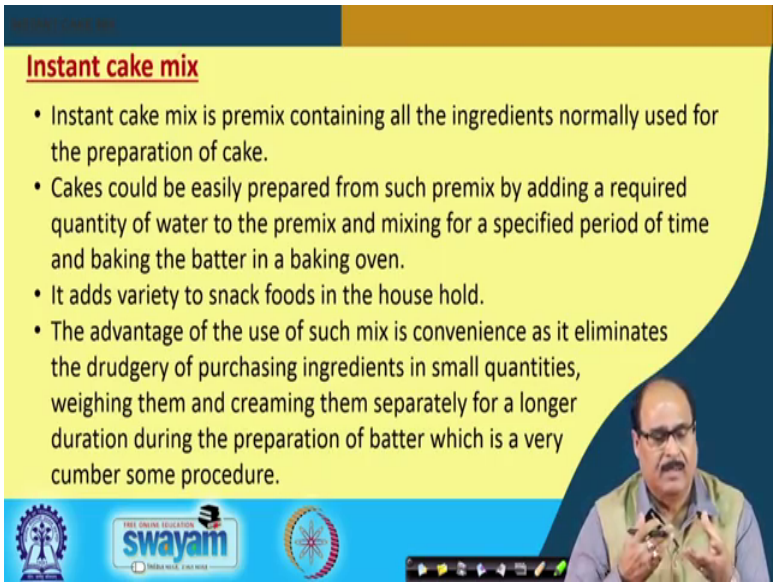

So it is a good approach, then in the market instant cake mixes are available for this that is the cake premix, cake premix containing all the ingredients which are normally used for of the preparation of cake they are so. In the premix they take all the ingredients, they are in the required proportion and by suitable way they are blended and mixed.

So only thing is that, that is these premix are purchased and in the home on the cake are to be prepared, because added with the required quantity of hot water or lukewarm water batter is made and batter it put into the oven for baking. So, it reduces the time and the required for purchasing different ingredients and weighing them and having in; so it is a more convenient form.

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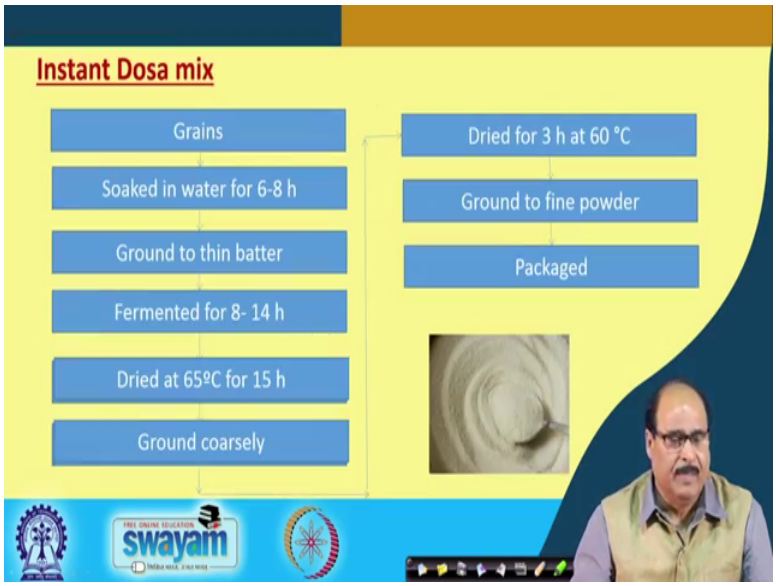

So, instant cake mix similarly instant dosa mix, that is they are available commercially in the markets processes have been standardized; that the grains normally which are used for making dosa in homes they are taken, the grains are soaked in water for 6 to 8 hours, ground to thin batter and then these batters are allowed to ferment.

The it to 14 hours after which they are dried at 65 degrees Celsius for about 12 to 15 hours and ground coarsely. And after grinding they are further dried in order to reduce to facilitate further reducing the size of the particle. So, after drying for 3 hours at 60 degree Celsius, they are grinding to fine water and packaged.

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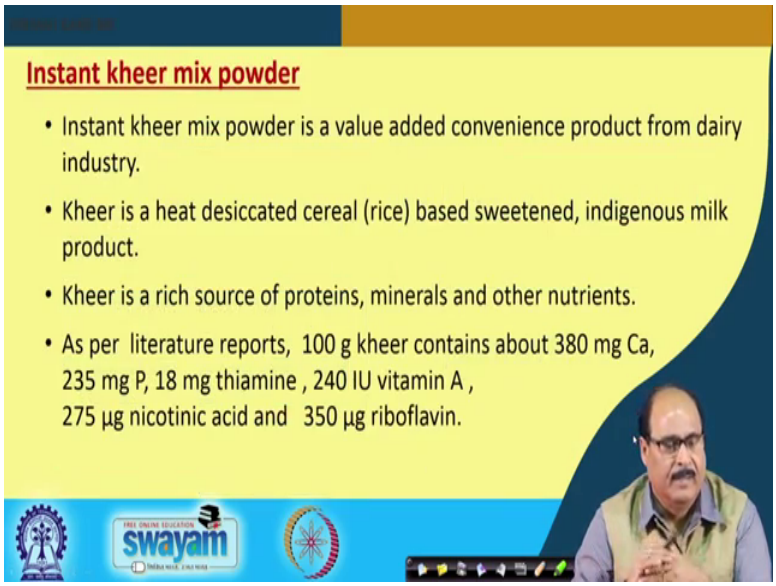

Similarly instant kheer mix, is a another product which is now available some of the dairy industries etcetera. They are working on this product is available in the market were instant kheer mix powder is a value added convenience product from dairy industry. And kheer is a very very popular product in India which is heat desiccated cereal normally rice is used, that is a serial based sweetened indigenous milk product. And kheer is a rich source of proteins, minerals and other nutrients it contains a good amount of calcium, phosphorus, thiamine, vitamin a, nicotine and riboflavin etcetera.

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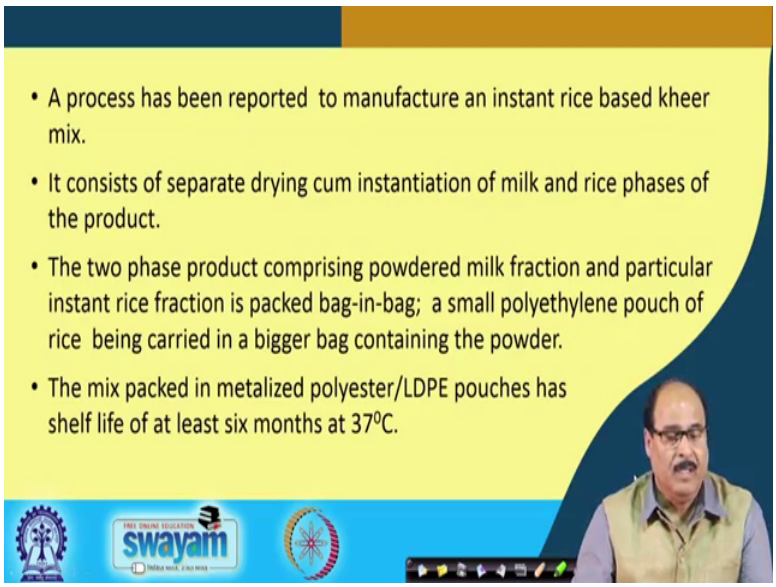

So, a process has been reported in the literature to manufacture an instant rice based kheer mix. It consists of separate drying come instantization of milk; and rice phases are the product. Then dried and instantized milk powder and rice phases these are packed into bag in bag or a small polythene pouch of the rice been carried in a bigger bag containing the powder. So, the mixed pack is metallized mix it packed in metalized polyster or LDPE pouches has shelf life of may be 6 months at 37 degrees Celsius.

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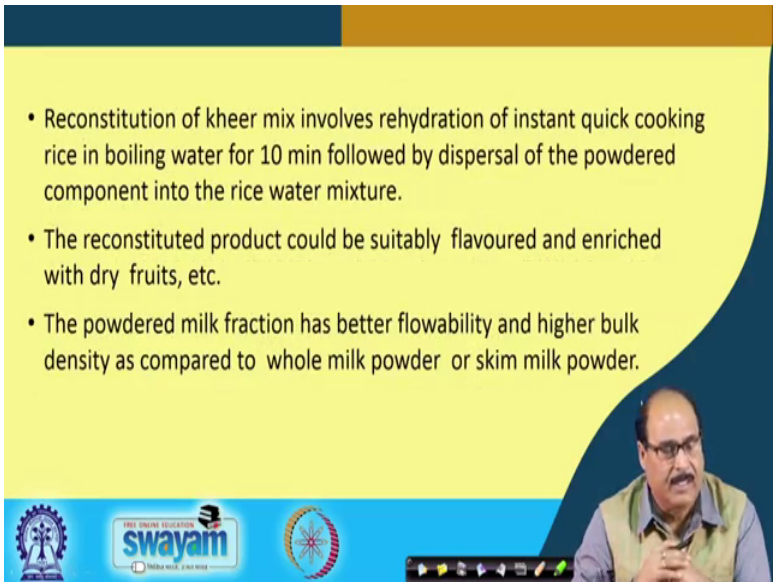

So, they reconstitution of kheer mix involves hydration of instant quick cooking rice in boiling water for 10 minute followed by dispersal of the powdered component into the rice water mixture. The reconstituted product could be suitably flavored and enriched with dry fruits etcetera. The powdered milk fraction has better flowability and higher bulk density as compared to whole milk powder or skim milk powder.

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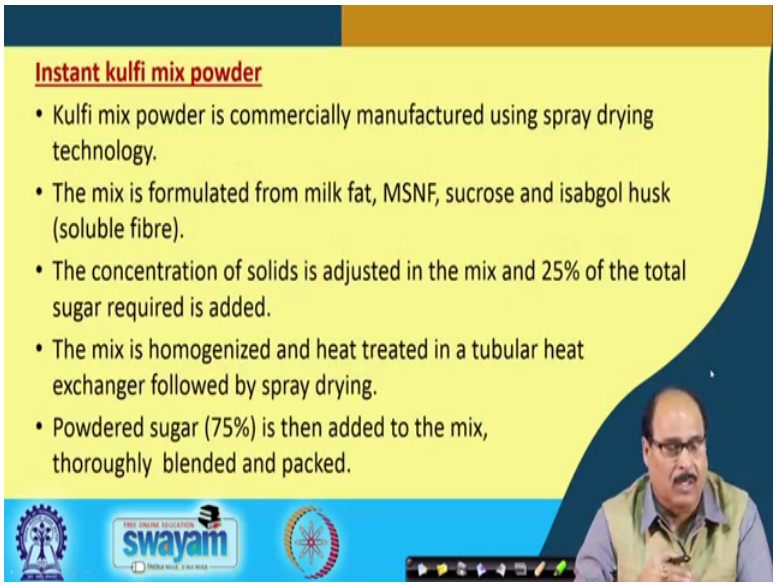

Instant kulfi mix is another popular product available in Indian market ok. The mix is formulated from the milk, milk solid fat, sucrose and isabgol husk or such other material which provide insoluble fiber into the mix and these mix is a manufactured using spray drying technology. The concentration of solids is adjusted and in the mix and about 25 percent of the total sugar is required in the formulation is added.

And the mix is homogenized and heat treated in a regular heat exchanger followed by a spray drying is dried in the spray. And after that this dried mix a dried powder is added with the remaining powder sugar there is 75 percent of sugar is added to the mix thoroughly blended you for getting a uniform mixture of a for blend of sugar powder and kulfi, its powder and the packet.

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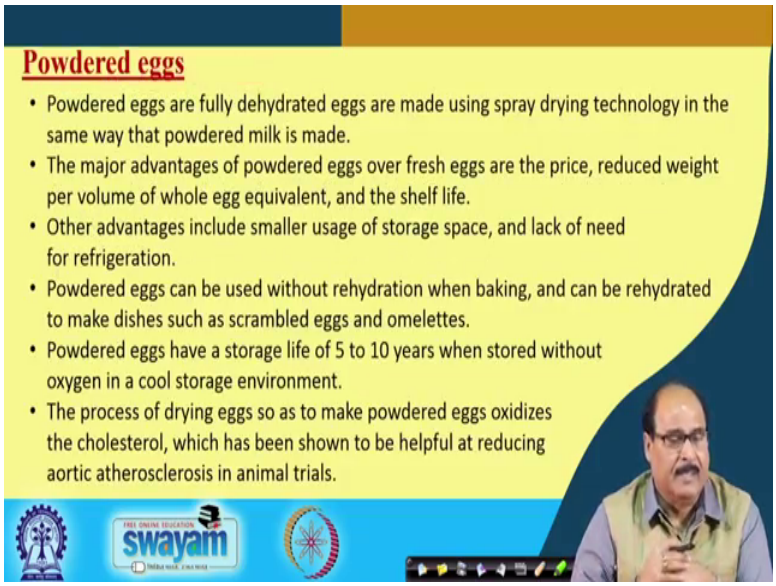

Similarly, powdered eggs they are prepared. In fact, that they are the completely dehydrated egg made by using a spray drying technology. And they are made in the similar manner, in which the milk powder is made only the thing is that egg can be a wide they are made into thin slurry and this slurry is atomized in the spray drier, and powder is prepared.

The process of drying egg; so as to make powder exists that is it oxidizes the cholesterol, which has been shown to be helpful by reducing erotic atherosclerosis in animal trials etcetera. Powdered egg have storage life up even about the reported to be a stable for about 5 to 10 years when is stored without oxygen in the cool environment.

So, this powder conversion of egg into powder is a very good method effective method, it also the powder require less storage energy, less space, easy to handle, easy to use. These can be conveniently use as a protein powder if the food formulation in product as a different ingredient.

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There are even several instant soup mixes available in the market, it is a the these different types of soups powder are designed for fast as simple preparation; even some soups are homemade and some are mass produced are an industrial scale and they are treated in various ways to preserve them. A wide variety of types, style and flavor of a instant soups exist in international market, including those in India. Commercial instant soaps are manufactured in several types, they are usually dehydrated they may be canned they may be freeze dried.

And the process may be that the similar like different materials in the powdered form of the liquid formed, they are blend that with the spices salts etcetera. And then the powdered one may be mixed properly, uniformly or the liquid one they may be freeze dried or they may be dried by other conventional method or advanced method of drying to get the desired characteristics.

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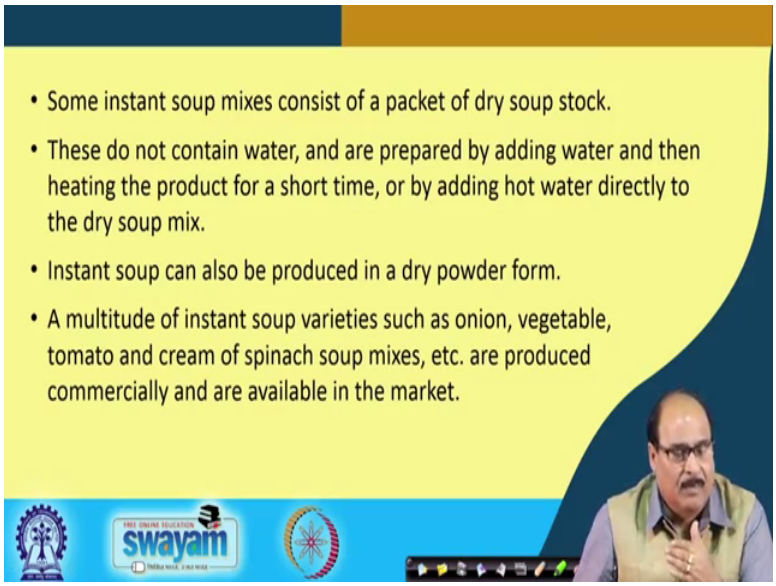

Some instant soup mixes consist of a packet of dry soup stock, these do not contain water and are prepared by adding water, and then heating the product for a short time or just these dry soupy stock. They can be converted into soup by just adding the lukewarm water or hot water into the mix.

Instant soup can also be produced in a dry powder form. In fact, many such products are available in the market. A multitude of instant soup varieties like having flavor of different type like onion soup, vegetable soup, tomato soup, cream of spinach soup, mixes etcetera are available in the market. They are produced commercially alright by several companies. So, with this I thank you very much for your patience listening to this lecture.

Thank you.