Title: ULTRATHIN METAL COATED REFERRED HEREIN AS METALIZED EDIBLE FILM AND HYGIENIC PROCESS FOR PREPARATION THEREOF

Abstract: Disclosed herein is an ultra thin metalized edible film; wherein thickness of the metal coating lies in the range of about 0.01 micron to about 0.08 micron and that of edible film ranges from about 0.4 micron to about 6 microns. The invention also relates to a process for making the same comprising deposition of precious ultra thin metal film on an edible film that will not only support metalized film but will also prevent cracking of the ultra thin metal film and could be used for packing of the edibles thereby prolonging shelf life by protecting the food products from bacterial and germs attack and also enhancing aesthetics of the food products.
"ULTRATHIN METAL COATED REFERRED HEREIN AS METALIZED EDIBLE FILM AND HYGIENIC PROCESS FOR PREPARATION THEREOF"

FIELD OF TECHNOLOGY

The increased consumer demand for high quality, extended shelf life, ready to eat foods has initiated the development of several innovative techniques to keep their natural and fresh appearance as long as possible and at the same time render them safe decorative and attractive look. Packaging has been an important element in these preservation concepts for providing the appropriate (mechanical and functional) protection to the commodity. Since synthetic packaging materials contribute to the environmental pollution, edible coatings and packaging have been proposed to replace or complement conventional packaging. Biodegradable & edible films and coatings are made from naturally occurring polymers and functional ingredients, and are formed on the surface of various food products. Edible films and coating have long been known to protect perishable food products from deterioration and reduce any quality losses. They can act as effective carrier for antioxidant, flavor, color, nutritional or anti-microbial additives. These films have an acceptable sensory characteristics, appropriate barrier properties (C0₂, O₂, water, oil), microbial, biochemical and physicochemical stability. However, they should be safe, and produced by simple technology having low cost implications.

Disclosed herein is an ultra thin metalized edible film represented by figure 1; wherein thickness of the metal coating is in the range of about 0.01 micron to about 0.08 micron whereas the thickness of edible substrate film ranges from about 0.4 micron to about 6 microns. The invention also relates to a process for novel composition for a substantially thin substrate edible film and novel process for making the said ultrathin metal coated edible film comprising deposition of precious ultra thin metal film on an edible film (with a substrate) that will not only support metalized film but will also prevent cracking of the ultra thin metal film. Besides enhancing the aesthetics of food products they could also be used for packing of the various
edible products thereby prolonging shelf life by protecting the food products from bacterial and germ attacks.

Disclosed herein is a ultra thin metalized edible film represented by figure I and a process thereof characterized by vaporization of edible metal by the technique as represented by the figures II and III over the substantially thin substrate edible film replacing traditionally used metallic foil thereby reducing the quantity of metal used in traditional methods for making precious metal leaf (e.g., gold or silver) and hence providing an economical and health friendly solution with enhanced productivity.

The said process allows for the manufacturing of small to large product formats, with selectable surface finishing (matt/semi-gloss/gloss/mixed matt gloss/embossing/etc.). Moreover the same product of the subject invention can be used to manufacture edible flakes/shreds comprising metal.

BACKGROUND OF THE INVENTION

Packaging is important in post-harvest preservation of fruits and vegetables and also for sweets and confectionaries to extend shelf life of processed foods. Packaging systems are intended to protect the food from its surroundings acting as physical/mechanical, chemical and microbiological barrier to maintain quality, safety, and to prolong the packaged food's shelf-life. Food quality and its average shelf-life gets decreased when the foodstuff interacts with its environment gaining or losing moisture and aroma, or taking oxygen leading to oxidative rancidity. Additionally, microbial contamination results in food spoilage, or even food poisoning. In multi component foods the quality and shelf life are reduced when moisture, aroma or lipids migrate from one food component to another.

A variety of techniques have been developed to maintain the quality and microbiological safety of foods. Fresh oranges and lemons were wax coated in China in the 12th and 13th centuries, to reduce water loss. The first packaging materials based on cellulose were developed in 1856,
and in 1907 phenol-formaldehyde (bakelite) resins were synthesized. This was the starting point of a series of developments and innovations giving birth to a great diversity of packaging materials which nowadays are employed.

The use of conventional food packaging materials such as synthetic polymers is usually effective in terms of barrier property. Approximately 40,000,000 tons of plastic packaging is used every year worldwide, and most of this is put to one time use and then discarded (Sri nivasa and Tharanathan, 2007) which creates the huge waste and a threat to the environment. This has motivated researchers to look for edible films and coatings to be used as food packaging material as a one possible solution to save environment.

Nowadays, edible films and coatings are applied on many products to control moisture transfer, gas exchange or oxidation processes. The major advantage of using edible films and coatings is that several active ingredients can be incorporated into the polymer matrix and consumed with the food, thus enhancing safety or even nutritional and sensory attributes without threatening the environment. Edible films and coatings are defined as continuous matrices, prepared from proteins, polysaccharides, and lipids or mixture thereof. Suitable polysaccharides include cellulose derivatives, alginites, pectin, starches, chitosan and the likes.

Edible coatings and films made from a number of commodities have been developed that offer a variety of advantages to fresh and further processed foods and poultry such as edibility, biocompatibility, aesthetic appearance, and barrier properties. Edible films are considered as packaging as well as a food component, they fulfill a number of requirements, such as, good sensory qualities; high barrier and mechanical efficiencies; biochemical, physicochemical, and microbial stability, non-toxic, simple, non-polluting, and low cost. Edible films can serve as carriers for a wide range of food additives, including various antimicrobials that can extend product shelf life and reduce the risk of pathogen growth on food surfaces.
The development of new technologies to improve the delivery properties of edible films and coatings is a major issue in research activity. At the moment, most studies on food applications have been conducted at a laboratory scale. However, further research is the need on a commercial scale with the purpose of providing more realistic information that can be used to commercialize food products coated with edible films or coatings. In spite of these limitations, the food industry is looking for edible films and coatings that could be used for a broad spectrum of food products and add value to said food products, while increasing their shelf-life and aesthetics.

The edible film and coating industry has grown many folds and is now a multi-million dollar industry from less than $1 million in 1999 to more than $350 million according to James Rossman of Rossman Consulting. Pharmaceutical and consumer products have been responsible for the tremendous growth. This growth has produced an enormous amount of scientific articles, patents, and research projects undertaken by members of the food industry, academia, and research institutions.

Edible Films and Coatings for food applications bring together this vast wealth of scientific knowledge in a systematically organized volume. It examines the science, application, function, and market for edible films and coatings.

Gold and Silver leaf has been used for centuries, not only for decoration of fine art objects but also for the decoration and protection of food products like cakes, sweets, chocolates, fruit, marzipan, champagne cocktails, etc. Edible leaf is manufactured with extreme care and controls and adheres to the FDA guidelines of edibility. Edible leaf has no taste or smell but enhances appearance/applicability considerably along with prolonging shelf life. Precious metal in suitable quantity has a medicinal property and if taken in excess of medically permitted level then it has adverse effects on human health. The ultrathin metal coating of the instant invention addresses this issue.
Silver has an oligodynamic effect and are toxic for bacteria, algae, virus and fungi in vitro. The oligodynamic effect is typical for heavy metals, such as lead and mercury, but, among the elements that have this effect, silver is the least toxic for humans. The antibacterial action of silver is dependent on the silver ion. The effectiveness of silver compounds as an antiseptic is based on the ability of the biologically active silver ion (Ag+) to irreversibly damage key enzyme systems in the cell membranes of pathogens. Acting as a catalyst, it reportedly disables the enzyme that one-celled bacteria, viruses and fungi need for their oxygen metabolism. They suffocate without corresponding harm occurring to human enzymes or parts of the human body chemistry. The result is the destruction of disease-causing organisms in the body and in the food. If silver is taken in dosages higher than medically permitted then it carry the risk of serious side effects such as argyria which results in disfiguration of skin and interactions with prescription medications.

For this reason silver foil is used as an edible film for Indian sweets, confectionaries, coating on cardamom and other herbs used as mouth fresheners. This protects the food products from germs attack prolonging the shelf life and also enhancing product aesthetics (Lansdown AB (2006). "Silver in health care: antimicrobial effects and safety in use". Current Problems in Dermatology 33: 17-34. Doi:10.1159/000093928. ISBN 3-8055-8121-1. PMID 16766878). However, it is important to note that the amount of the metal to be consumed has to be within the limit of its acceptability for the human consumption; therefore, thickness of the metallic film plays a vital role while giving its coating over the edible film.

All of the products have safety certification, Halal and Kosher. Edible Gold and Silver are classified as Natural Food Additives. Gold is classified as E175 and Silver as E174 in CODEX.

These over the top, edible precious metal finishes recreates the magic of this ancient Renaissance tradition. Edible gold & silver leaf can be used to garnish handmade chocolates, cakes and candies. While typically used to decorate desserts, edible gold leaf is also an attractive addition to cocktails or delicate canapés. The edible gold or silver itself has no taste
and no texture, melting upon consumption. Whatever is intended use; a touch of edible gold leaf will convey elegance and sure to dazzle guests.

The use of silver foil in food in India dates back to thousands of years, it is claimed; in fact, India converts 13 British tons of pure silver into edible foil every year. Silver leaf is a lustrous metal and is facing resurgence in popularity as an edible food additive and for decoration. Silver can be used to garnish a number of dishes, giving them a contemporary or even a futuristic appearance. It is also widely used for traditional decoration, particularly for Indian dishes, where it is known as Varak or Varkh, intended to be consumed in festival celebrations and other grand occasions. (Gold Gourmet Edible Silver Leaf Booklet - 25 Leaves Ref: 2319/S25).

Conventionally edible Silver or gold leaf or foil is made from pure metal by beating until it's finer than a leaf of a tissue paper. The edible leaf has been manufactured specifically for the food industry and adheres to strict safety standards as it is to be consumed in limits. However these traditional methods which are based on the malleable and ductile nature of the metal and are associated with drawbacks as in this case thickness of the sheet remains non uniform and excessive hammering makes them brittle which causes it to lose its mechanical strength and hence resulting in cracks. Quantity of the precious metal used for making the said film is high and process involved is very laborious. There is no control over the thickness of the film which eventually decides about the quantity used for packaging food and will be consumed by humans. Moreover, owing to brittle nature of the said metals and the traditional process therefore, the metal foil is thick and the metal quantity may not be within the medically recommended limits.

silver accumulates in the body. Chronic intake of silver products can result in an accumulation of silver particles in the skin. These particles in the skin darken with exposure to sunlight, resulting in a blue or gray discoloration of the skin known as argyria.

However, the instant invention addresses this issue as the process for the formation of metal coating/film results in ultrathin metal film having thickness of about 0.01 micron to 0.08 micron and the issue related to the brittle nature of the metal is addressed by the process used therefore and the support to the metal film by the substantially thin substrate edible film. The quantity of the metal used therein in the said novel ultrathin metalized edible film disclosed herein is within the medically permitted limits.

The subject matter described herein above describes edible metal application as thin film over the confectionary items or the sweets, but no where it mentions that the metal film can be used as a coating, wrap or packaging. This is mainly due to its handling problem such as curling and cracking because of their delicate nature.

In view of above inventors of the present invention felt necessity to develop ultrathin precious metal film supported by a substantially thin substrate edible film that will prevent cracking of the ultra thin metal film and can be used for covering as well as for packing of the edibles to increase their shelf life besides enhancing their aesthetic look. Thickness of the metal film can be adjusted up to level which shall be permitted by regulatory bodies and will not impact human health adversely. Disclosed herein is an ultrathin metalized novel edible film comprising a removable carrier substance which can be removed during final packaging. Ultra thin coating of a edible metal in a health friendly quantity not only reduces the edible metal quantity consumption over the traditional methods but also does not threat any danger to human health like argyria or any other metal associated disease.

US4710228 discloses edible film coating composition of low moisture permeability and their methods of preparation. The composition comprises cross linked, refined shellac and an edible
member. The molten mixture is dissolved in a food grade solvent, applied to a substrate and dried. The coating is useful as a moisture barrier in composite food articles having phases in contact which differ substantially in water activity.

US4915971 discloses an edible film for retarding water transfer among components of multi component food product. The film includes a base film having a hydrophilic polymer layer and the base film lipid layer. The base lipid layer has a hydrophobic surface presented away from the hydrophilic polymer layer. An additional lipid layer is laminated to the hydrophobic surface of the base film lipid layer. The invention further includes a method of making the edible film and a food product incorporating it.

US5401518 discloses an emulsion which provides an edible moisture barrier coating for foods. The emulsion is coated onto a food product and cold-set using refrigeration, where the coating serves as a moisture barrier.

US6165521 discloses a method of making an edible film with a thickness up to print paper size and a method of utilizing such edible films with various food products.

US4493872 discloses an improved process for the adhesion of metal over the plastic films comprising the metalized technique resulting into a product that is used for as a packaging material.

US5631066 (hereinafter referred as '066) discloses a metalized packaging film comprising a biodegradable poly(hydroxy acid) film having a thickness of 25-125 micrometers (microns) having adhered to one side thereof with a metal coating characterized by a process comprising sputtering a metal, such as aluminum, gold, silver, copper, platinum, nickel, titanium or tantalum onto a biodegradable poly(hydroxy acid). The metalized film disclosed therein in '066 is biodegradable metalized film used for packaging and lamination and is not edible, therefore, can't be used for food products.
US7252878 discloses a high oxygen barrier, multilayer flexible packaging structure having a vacuum metalized, biaxially oriented polypropylene (met-BOPP) or metalized polyester (met-PET) film substrate; a high barrier ethylene vinyl alcohol layer coextruded or laminated directly on the metal-containing layer wherein said metal-containing layer has an optical density of about 1.5 to 5.0; and optionally an adjacent layer of anhydride modified polyolefin and anhydride modified adhesive resin on the ethylene vinyl alcohol layer.

US5827615 discloses a metalized film substrate having a core layer and a metal receiving skin layer of ethylene vinyl alcohol. The ethylene vinyl alcohol surface is metalized with aluminum. A low temperature sealable layer is coated to the aluminum surface. For the adhesion of ethylene vinyl alcohol, the core layer may either be blend with a maleic anhydride modified polyolefin or have an adhesion-promoting tie layer.

US 6616958 B1 discloses an edible film, method of making and using same for decorating foodstuffs, in particular baked goods, wherein anyone can easily, inexpensively and artistically decorate foodstuffs.

The traditional methods for making the metal films popularly known as metal leaf comprises the following steps and are associated with certain drawbacks as understood from below:

i) Manual or electric hammering of the metal piece having desired size and weight resulting into thin films having the thickness of about 3 microns and requires more metal as input.

ii) These films are bundled manually to form a booklet during which many of them go waste due to curling and cracking because of their delicate nature.

iii) In case when the shredding is required these sheets are required to subject to the vibratory sieve to achieve the desired size.
The present invention has been successful in eliminating these problems by providing metal film having uniform thickness in the range of about 0.01 micron to about 0.08 micron achieved by (deposition by vaporization technique under vacuum) thereby consuming less metal but with increased productivity in comparison to that of up to 3 microns obtained by traditional methods. Based on the thickness of the metal film, the quantity of the edible metal in the said ultrathin metalized edible film of instant patent application is about 40 to about 250 times as compared to the edible metal film obtained by the traditional process.

The present invention has also eliminated the problem of curling and cracking of the metal film by using substrate edible film as support which is further mounted on the carrier base film while preparing the said ultrathin edible film. Moreover, the thickness of the substrate edible film ranges from about 0.4 to about 6 microns.

None of the prior art references cited herein above disclose ultrathin metalised edible film represented by the figure 1 and which is used as coating, wrapping or packaging material for the edible products which not only gives the prolonging shelf life but also enhances the aesthetic look of the product. This is further characterized by reduced thickness for both metal as well as edible film that is further mounted on a peelable & removable carrier thus providing ready to eat food products to the consumer.

Disclosed herein is an edible film which is ultra thin coated with a edible metal mounted on a peelable or removable carrier base film which therein is coated with a releasing material that acts as a helping aid to peel it off before final packaging leaving behind the food product left with edible metalized film that can be put directly into the mouth. The process under the subject invention is capable of producing ultra thin metallic edible film having metal thickness in the range of about 0.01 micron to about 0.08 micron and an edible film in the range of about 0.4 to about 6 micron. This implies a better control on the product, since the effective thickness of the edible metal layer can be defined, and measured within the manufacturing process over that of traditional method thereby reducing the consumption of the edible metal to a
remarkable extent making the process more economical without any wastage of edible metal. Compared to 3 microns thickness of the edible metal films obtained by the traditional methods, the quantity of the edible metal used therein in the ultrathin metalized edible film disclosed herein in the present invention is about 40 to 250 times less.

Novelty and the inventive features of the subject invention reside in the fact that the product comprises of substantially thin substrate edible film coated by ultra thin edible metal film which is not achievable by the traditional method. Moreover, the edible film is mounted on peelable or removable carrier base film (coated with a release agent) is used throughout the manufacturing process as a mere mechanical support during the manufacturing process of the said substantially thin edible film, and during the metalization process, to avoid damages to the product itself, which is too thin and delicate to be self-supporting. After these process steps, the product (edible film and metal coating) is separated from the carrier film in peel-off equipment.

The special features of the process are characterized by the ultra thickness of the substrate edible film ranging from about 0.4 to about 6 microns and ultra thickness of edible metal layer ranging from about 0.01 micron to about 0.08 micron which is strongly reduced over the traditional method. The said novel ultrathin metalized edible film disclosed herein is composed of an edible/highly soluble polymeric substrate (hereinabove and herein below referred as substantially thin substrate edible film) having ultrathin coating of an edible metal (which gives the metal-like appearance to the product). Another feature of the instant invention is the novel composition for the said substantially thin substrate edible film with good mechanical and elastic properties. Another feature of the process of the subject invention is that the product can be shredded just by transferring the edible sheets into the shredder by bypassing the horizontal cutters where long strips of edible film (Metal coated/ metalized) are crushed to a desired mesh size which are then finally collected in a container.
Synergistic and surprising effect of the present invention can be seen in terms of i) reduced consumption of the edible metal thereby producing higher output with less input of the very expensive edible metal, ii) Better aesthetic look along with better protection for the food products iii) peelable or removable carrier base film from the metalized edible film leaving it to be ready to eat food product and reusing peeled off carrier base films, iv) the edible metalized film of the subject invention is used as a coating, wrapping or as a packaging material.

OBJECT OF THE INVENTION:

The first aspect of the invention is to provide a novel ultra thin metalized edible film that can be used for the packaging of the food products which not only gives the protection to food stuffs but also enhances the aesthetic look.

Second aspect of the invention is to reduce the quantity of the edible metal by producing it having the thickness in the range of about 0.01micron to about 0.08 micron against 3-5 microns (it is the comparison between metal thickness only) produced by the traditional method, thereby increasing the productivity.

Third aspect of the invention is to provide an economical process for the preparation of metalized ultrathin edible films since the product comprises thickness of metalized layer in the range of about 0.01 to about 0.08 micron thick while that of substrate edible layer is about 0.4 micron to about 6 micron.

Forth aspect of the invention is to improve the mechanical strength hence avoiding the cracking of the metal film by using the substantially thin substrate edible film as a support.

Fifth aspect of the invention is to mount substantially thin substrate edible film over a peelable or removable carrier film/sheet which facilitates the rolling of the edible film.
Sixth aspect of the invention is to furnish the ultrathin metalized edible film that will supply the edible metal in such an amount that is safe and will not harm the human on its consumption as the thickness of the metal film can be adjusted during the process.

Seventh aspect of the invention is to provide a novel composition to make the substrate edible film of the subject invention comprising pullulan, Tapioca starch, soy protein, chitosan, Zien, amylopectin starch, glycerol, sodium alginate, sodium oleate, xylitol, citric acid, agar, pectin and sorbitol.

Eighth aspect of the invention is to obtain the salable product either in the form of sheets or the shredded form.

Ninth aspect of the invention is to provide a process for the preparation of ultra thin metalized edible film comprising steps:

a) a novel composition comprising mixing pullulan, Tapioca starch, soy protein, chitosan, Zien, amylopectin starch, glycerol, sodium alginate, sodium oleate, xylitol, citric acid, agar, pectin and sorbitol;

b) making of substantially thin edible film of the substrate by applying novel composition of step a) over the carrier base film coated with releasing material;

c) drying the raw material mixture in a dryer to get a roll of edible coated film (ECF);

d) feeding edible coated film roll obtained in step c) in a metal coating machine where desired quantity of edible metal is deposited on the surface of ECF to get a metal coated roll done in a vacuum coater;

e) subjecting metal coated roll obtained in step d) into the peeling off machine to separate carrier base film from metalized edible film;

f) subjecting the product obtained in step e) for shredding into desired small pieces in shredding machine or cut into desired pieces in cutting machine to get different sizes;

g) Packaging of final product.
The plant used for the said process as mentioned herein above resulting into the product of figure I is represented by the figure IV.

ADVANTAGES OF THE PRESENT INVENTION:

1. Present invention provides an ultra thin edible metal film over a substrate edible film; wherein the thickness of the edible metal film achieved is in the range of about 0.01 micron to about 0.08 micron while retaining the mechanical properties of the product which is related to the fact that the said ultrathin metalized edible film is a laminated film. The said ultrathin edible film comprises of edible/highly soluble polymeric substrate coated with ultrathin edible metal thin film. The thickness of the said edible film comprising substantially thin substrate film coated with ultrathin edible film and represented by figure-I varies from about 0.4 micron to 6 microns.

2. Present process for the preparation of metal films reduces the quantity of the edible metal over the traditional method as it comprises metal deposition by vaporization by the technique as represented by figure II and III rather than obtaining by hammering as done in the traditional methods.

3. The thickness of the metal film can be achieved in such a way so that the edible metal will not exceed the medically permissible limit of the metal when consumed.

4. Use of a peelable or removable carrier film or sheet as a mounting for the substrate edible film facilitates the production of substantially thin edible film as it not only provides a solid support to retain its mechanical property but also help in rolling of the edible films.

5. Use of a releasing material helps in peeling off of the carrier film before it is used for final packaging of the food products thus leaving behind food product to put directly into mouth. Moreover this peeled off carrier base film can be reused.

6. Metalized technique helps providing an ultra thin coating of the edible metal with enhanced adhesion onto the surface of substrate edible film. Metalized technique disclosed herein comprises making of the film by directing a stream of metal vapor onto the surface of substrate edible film by vacuum deposition technique as represented by the figures II and III that gives the uniform thickness and also uses less metal over the traditional method.
7. Hygienic advantages of present manufacturing process are that it doesn't require any contact between operators and product, so that any possible contamination can be strongly reduced to negligible or none. Moreover, the whole manufacturing plant can be installed in a clean room with full control over possible contamination deriving from air. The plant has been designed and manufactured complying with food-safety regulatory requirements.

8. The said metalized edible film of the invention can be used for the packaging of the food products that will not only protect the food stuff from germs attack but also enhances the aesthetic look of the product.

9. The said ultrathin metalized edible film of the present invention can also be converted into shredded product by bypassing the horizontal cutters and transferring the metalized edible sheet into the shredder.

**SUMMARY OF THE INVENTION:**

The present invention disclosed herein relates to an ultra thin edible film and process for the production of the same characterized by vaporization of edible metal over the substantially thin substrate edible film which can replace metallic foil thereby reducing the quantity of the edible metal over the traditional methods of making precious metal leaf (eg. gold or silver) providing an economical and health friendly edible film with enhanced productivity.

The subject invention provides an ultra thin substrate edible film metalized with edible ultrathin metal film supported on a carrier base film coated with a releasing material that acts as a helping aid to peel off the carrier base film or sheet before final packaging leaving behind the food product left with edible metalized film that can be put directly into the mouth and the composition and process thereof.

The said process allows for the manufacturing of small to large product formats, with selectable surface finishing selected from matt, semi-gloss, gloss, mixed matt and gloss, embossing and the like. The same product is used to manufacture edible flakes/shreds with silver/gold appearance.
The process of the subject invention comprises:

a) a novel composition comprising mixing pululan, Tapioca Starch, soy protein, chitosan, Zien, amylomize starch, glycerol, sodium alginate, sodium oleate, xylitol, citric acid, agar, pectin and sorbitol;

b) making of substantially thin edible film of the substrate by applying novel composition of step a) over the carrier film precoated with releasing material in the edible film coater;

c) drying the carrier film supported substrate obtained in step b) to get roll of edible coated film (ECF);

d) feeding edible coated film roll obtained in step c) in a metal coating machine where desired quantity of edible metal is deposited on the surface of ECF to get metal coated roll; the said edible metal coating is done in a vacuum coater;

e) subjecting metal coated roll obtained in step d) into a peeling off machine to separate carrier base film from metalized edible film;

f) subjecting the product obtained in step e) for shredding into desired small pieces in shredding machine or cut into desired pieces in cutting machine to get different sizes;

g) Packaging of final product.

The plant that is used for the process described herein above is depicted in the figure IV.

DETAILED DESCRIPTION OF THE INVENTION:

The present invention provides an ultrathin metalized edible film, composition and method of making the same and utilizing such edible film for packaging of various food products. The products and processes thereof the present invention rely on the interaction among various steps of the production of the films in order to provide films that substantially reduce the quantity of the edible metal that is used for providing an ultrathin film coating over a substrate edible film. Desirably, there is a high level of uniformity in the thickness of the edible metallic films over the substrate edible films prepared by the present invention. Monitoring and control
of the thickness of the precious metallic film also contributes to the economics of the production process.

Other film-forming methods used in conjunction with the methods of the present invention, includes the making of an ultrathin edible film supported on a carrier base film (coated with a release agent) is used throughout the manufacturing process as a mere mechanical support for the manufacturing of the substantially thin substrate edible film and during the metallization process, to avoid damages to the product itself, which is too thin and delicate to be self-supporting and also facilitates the rolling of the edible films. After these process steps, the product (substrate edible film+metal coating) is separated from the carrier base film in peel-off equipment that gets facilitated due to the presence of the releasing material.

Although the films of the present invention preferably are described herein according to certain parameters, it will be understood that these may be altered in various ways without substantially affecting the resulting end product.

In a general embodiment there is provided a process for making an ultra thin edible film having a substantially uniform distribution of components, comprising the steps:

a) the film product of the present invention is produced by using a novel combination of a properly selected components and mixing the said set of components selected from the group comprising pullulan, Tapioca Starch, soy protein, chitosan, Zien, amylomize starch, glycerol, sodium alginate, sodium oleate, xylitol, citric acid, agar, pectin and sorbitol and mixture thereof;

b) making of substantially thin substrate edible film of the substrate by applying the said novel composition of step a) over the carrier base film pre-coated with releasing material in the edible film coater;

c) Drying the carrier film supported substrate obtained in step b) to get a roll of edible coated film (ECF);
d) feeding edible coated film roll in a metal coating machine where desired quantity of edible metal is deposited on the surface of ECF to get edible metal coated roll; the said edible metal coating is done in a vacuum coater;
e) Subjecting metal coated roll obtained in d) into a peeling off machine to separate carrier base film from metalized edible film;
f) subjecting the product obtained in step e) for shredding into desired small pieces in shredding machine or cut into desired pieces in cutting machine to get different sizes;
g) Packaging of final product.

The components used for the preparation of composition of edible film as described in the step a) herein above may be varied as per the requirements and therefore, change in the composition by changing the ingredients remains under the scope of the invention. Mixing of the various ingredients can be done by any of the techniques known in the art. Various types of mixing systems are contemplated herein, including, but not limited to static mixers, dynamic mixers, and small and large volume in-line mixers and the like. The compositions may optionally be combined and mixed continuously in any desired mixer. Mixers may allow for continuous flow of components or the components may be intermittent, or there may be a combination, wherein particular components are continuously fed into the mixer, while others may be fed intermittently.

In general the substrate edible film comprises a highly soluble/edible polymer, which in turn can be (for example, but not exhaustively): pullulan, Tapioca Starch, cellulose derivatives, corn starch, tapioca starch, arabic gum, pectine, potatoes starch and the like. More generally, any naturally derived polysaccharide is a good candidate to manufacture the said substrate edible films: the choice depends on the mechanical properties of the film itself, from its solubility, taste which has to be assessed case by case.

The carrier base film or sheet used in the invention is selected from the group comprising thermo plastic polymer, paper and non toxic substances those can be peeled off from the
edible film. The thermoplastic polymer is selected from the group comprising polyethylene terephthalate abbreviated as PET, PP, polystyrene, EVA and the like.

Drying of raw material mixture is done in a dryer to get a roll of edible coated film (ECF). A controlled drying process is used to dry the film, and may additionally reduce the variability of the composition in the film. Controlled drying methods are useful in eliminating the formation of bubbles in the film during drying, thereby reducing the likelihood of variability of content in the film.

Product formats is selected from the group comprising rolls, sheets starting from 50 mm x 50 mm to 600 mm x 1000 mm (which is not possible with traditional methods), shreds.

Product finishing is selected from the group comprising gloss, matt, semi-gloss, watermarked, punched, laser engraved and shapes and the like.

In a specific embodiment of the invention there is provided a process for making an ultra thin edible film having a substantially uniform distribution of components, comprising the steps of:

a) the edible film of the present invention is produced by a novel composition comprising pullulan, Tapioca starch, soy protein, chitosan, Zien, amylomize starch, glycerol, sodium alginate, sodium oleate, xylitol, citric acid, agar, pectin and sorbitol;

b) making of substantially thin film of the substrate by applying novel composition of step a) over the thermoplastic polymer film (PET) to act as carrier having coated releasing material done over the edible film coater;

c) Drying the raw material mixture in a dryer to get a roll of edible coated film (ECF);
d) feeding edible coated film roll obtained in step c) in a metal coating machine where desired quantity of silver is deposited on the surface of ECF to get silver coated roll done in the vacuum coater;

e) Subjecting silver coated roll into peeling off machine to separate carrier base film of PET from silver film;

f) subjecting silver coated product for shredding into desired small pieces in shredding machine or cut into desired pieces in cutting machine to get different sizes;

g) Packaging of final product.

DETAILS OF THE FIGURES

Figure I represents product of the invention; wherein thickness of the metal film ranges from about 0.01 to about 0.08 microns (white background) whereas thickness of edible film ranges from about 0.4 to about 6 microns (grey background) and carrier base film (blue background).

Figure II and III represents the vaporization technique used for the metallization resulting into ultrathin metal film.

Figure IV represents plant that is used for the entire process.

The invention can be best understood from the example given herein below:

Step 1): In the first process pullulan, Tapioca starch, zein, agar are mixed with other raw materials viz sugar, citric acid, glycerol, sodium alginate, sodium oleate to form a homogenous powder using a mixer. Water is added to the mixture in the same mixer in a defined ratio to form a thick starch paste which is uniform, consistent and homogenous in nature with no lumps at all. Once the paste is made, it is transferred to the edible film coating equipment to coat this mix/paste on a carrier substrate. The paste is spread on the substrate uniformly with the help of a roll to roll coater. In this machine carriercoated roll passes through a series of rollers to apply the paste and evenly spread it out at a desired thickness. Once the application part is done, the coated roll passes through a drying tunnel where the coated mix is dried and thus a completely uniform and consistent edible film is formed.
Step 2): Once the coated rolls are received from the step 1, they are mounted on vacuum coater with help of hoist. Once mounted, the substrate is guided through the set of rollers to provide the direction of movement. Once the machine is turned on, the vacuum pump activates and starts achieving the vacuum required to do the metal coating. Simultaneously the SILVER METAL pieces are fed into the designated places on the machine which ultimately are taken to a vaporization phase. Once the vacuum is achieved, silver starts flowing in the vacuum chamber in form of a mist but in a guided fashion so that it mainly goes to the area which needs to be coated. Once the silver is coated it goes through drying chamber to achieve a completely DRY silver coated edible film with a Base substrate.

Step 3): Once the metalized rolls are received from step 2, they are put onto a slitting and splicing machine where the substrate base is peeled off using a gripper and simultaneously the roll is being slit into the desired width. The substrate which is being peeled off keeps on winding on a roll to form a roll that can be used later. The peeled off edible film (silver coated) is then cut using horizontal cutters to form sheets of desired sizes which come of the machine in stacks of specified numbers which are further packed using other packaging machines. However, if shreds are required instead of sheets, the material bypasses the horizontal cutters and gets transferred to a shredder where long strips of edible film (silver coated) are crushed to a desired mesh size which is then finally collected in a drum for sale.
We claim:

1. An ultrathin edible film comprising a substantially thin substrate edible film with an ultrathin metal coating.

2. The ultrathin edible film according to claim 1 wherein thickness of substrate edible film is about 0.4 to about 6 microns.

3. The ultrathin edible film according to claim 1 wherein thickness of metal coating is about 0.01 to about 0.08 micron.

4. The edible film according to claim 1 wherein metal coating used is of gold or silver.

5. A process for the preparation of ultrathin edible film comprising:
   a) making a composition comprising mixing a set of selected ingredients;
   b) Applying the said composition of step a) on the carrier base film coated with a releasing agent; the said composition applied on the carrier film forms a substantially thin substrate edible film;
   c) drying the said substantially thin substrate edible film formed in step b) in a dryer to get a roll of substantially thin substrate edible film referred as ECF;
   d) feeding the said substrate edible coated film roll obtained in step c) in a metal coating machine wherein desired quantity of metal is deposited on the surface of ECF to get metal coated roll;
   e) Subjecting metal coated roll into a peeling off machine to separate coated carrier base film from ultrathin metalized edible film.

6. The process according to claim 5 wherein composition of step (a) is prepared comprising mixing a set of ingredients selected from the group comprising pullulan, Tapioca starch, soy protein, chitosan, Zien, amylose starch, glycerol, sodium alginate, sodium oleate, xylitol, citric acid, agar, pectin, sorbitol and mixture thereof.

7. The process according to claim 5 wherein the pre-coated carrier film is selected from the group comprising thermoplastic films or paper film.

8. The process according to claim 5 wherein metal used for coating in step d is selected from gold or silver.
9. The process according to claim 5 wherein the thickness of the substantially thin substrate edible film in ECF obtained in step b is about 0.4 micron to about 6 microns.

10. The process according to claim 5 wherein thickness of the metal coating obtained in step d is about 0.01 micron to about 0.08 micron.

11. The process according to claim 5 wherein for step c; any dryer disclosed in the art for the said purpose is used.

12. The process according to claim 5 wherein for step d vacuum coating machine is used for the said purpose.

13. A composition for the preparation of substantially thin substrate edible film comprising a set of ingredients selected from the group comprising pullulan, Tapioca starch, soy protein, chitosan, Zien, amyloamize starch, glycerol, sodium alginate, sodium oleate, xylitol, citric acid, agar, pectin, sorbitol and mixture thereof.

14. The composition according to claim 13 wherein the said composition forms a strong substantially thin edible film having thickness about 0.4 microns to about 6 microns.

15. The composition according to claim 13 wherein the substantially thin substrate edible film of claim 2 is coated with an ultrathin metal coating to obtain a strong ultrathin metalized edible film; wherein metal film is having thickness about 0.01 microns to about 0.08 microns.
FIG. 3

FIG. 4
**INTERNATIONAL SEARCH REPORT**

**International application No**  
PCT/IB2014/063061

A. CLASSIFICATION OF SUBJECT MATTER

INV. A23L1/00

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols.)

A23L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.  

See patent family annex.

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Date of the actual completion of the international search: 28 November 2014

Date of mailing of the international search report: 16/12/2014

Name and mailing address of the ISA/  
European Patent Office, P.B. 5818 Patentlaan 2  
NL-2280 HV Rijswijk  
Tel. (+31-70) 340-2040,  
Fax: (+31-70) 340-3016

Authorized officer: Lepretre, Frangois
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