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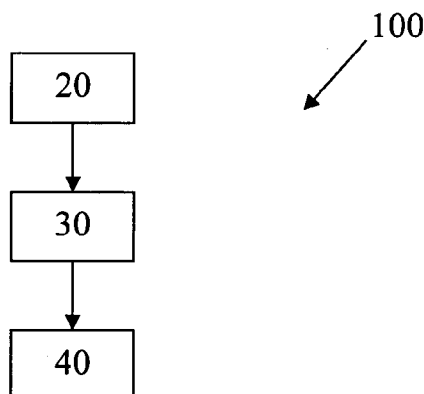
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(54) Title: COMPOSITION AND METHOD FOR PRODUCING COMPOSITION

FIG. 1



(57) Abstract: The present invention relates generally to a composition comprising an isolated ground fibrous preparation of an extract of Brassica, Apium and/or Ipomoea genera. The invention also relates to a method of producing a composition including the steps of soaking isolated Brassica, Apium and/or Ipomoea genera plant material, separating a solid phase from the soaked plant material, and grinding the separated solid phase to thereby produce the composition.

COMPOSITION AND METHOD FOR PRODUCING COMPOSITION

FIELD OF THE INVENTION

The present invention relates generally to a composition and a method for producing a composition. In particular, but not exclusively, the present invention relates to a composition comprising an isolated ground fibrous preparation of an extract of Brassica, Apium and/or Ipomoea genera and a method of producing that composition. The composition is useful in the preparation of a food product and/or in the preparation of a medicinal product.

BACKGROUND OF THE INVENTION

The pandemic of obesity poses a global health and medical threat to the latter day populace. Pharmacological efforts to induce body weight loss include reducing lipid absorption by the human gastrointestinal (GI) tract through pancreatic lipase inhibitory compounds such as orlistat and catechins, at the enzyme level (Dunican, 2007; Koo, 2007). The underlying basis for observed weight reduction is the shifting of the body's energy flux into a deficit state, by reducing the energy inflow (measured as calorie units, in energy macromolecules such as fats, proteins and carbohydrates) versus the body's energy outflow (calorie burning through ATP depletion by body's basal metabolic processes and work done by muscle tissues).

Energy inflow and/or outflow can also be simultaneously reduced through less food intake and/or calorie burning by the use of pharmacological agents such as sibutramine, rimonabant and medium chain triglycerides (MCT) (Bray,

2007; Krotkiewski, 2001).

However, 1.6 billion overweight people and 400 million obese people, with different medical, lifestyle and healthcare needs, require different energy-shifting weight control therapeutics, either as small molecule drugs, peptide drugs, dietary supplements or functional foods. The latter not only encompass medical foods, dietary foods, but also behaviorietary foods. Behaviorietary foods refers to edible materials such as, food and drinks taken for pleasure, recreation and other lifestyle purposes beyond bodily needs (Ong, 2007).

Lignins, hemicellulose and cellulose are major water-insoluble fiber constituents.

Lignins form part of the xylem. Xylem and phloem are vascular bundles of higher plants that conduct water, soil and photosynthetic nutrients. Lignins are covalently linked to hemicellulose and thereby crosslinks different plant polysaccharides, conferring mechanical strength to the cell wall. Collectively, lignins, cellulose and hemicellulose are termed as water-insoluble plant fibers. These water-insoluble plant fibers confer mechanical strength to vascular plants; the former trio group together with resins and are commonly termed as wood, in trees and other woody plants. Most importantly, wood is indigestible by mammalian and human gastrointestinal digestive enzymes. However, wood is mostly unpalatable to humans. Moreover, non-fiber components of wood, sourced from different families of angiosperms, can be acutely or chronically toxic to the human body.

Of recent pharmacological significance, lignins found in water-insoluble

fibrous tissues, have been reported to confer therapeutic benefits, when liberated by the microbial flora residing in the human and mammalian gastrointestinal tract, notably in the colon. For instance, lignins are precursors of mammalian lignans *in vivo*, and contribute to the prevention of breast cancer and cardiovascular disorders (Begum et al, 2004).

Additionally, the other components of water-insoluble dietary plant fibres are suberin and cutin. Suberin is a plant polymer containing aromatics and polyesters, forming part of the plant periderms. Periderms are the outer tissue layers of woody roots and stems. Cutin is a polymer formed from hydroxy and epoxy fatty acids that forms the surface hydrophobic barrier of leaf cuticles (Li et al, 2007).

Published medical studies suggest that lignins, suberin and cutin provide chemopreventive effects against colorectal cancer, the relative risk of suffering from the latter being inversely correlated to the oral intake of water-insoluble plant fibers (Harris and Ferguson, 1993; Kritchevsky, 1997).

Brassica genus (BG) belongs to the mustard family (Brassicaceae) and is native in the wild in western Europe, the Mediterranean and temperate regions of Asia. In addition to the cultivated species, which are grown worldwide, many of the wild species grow as weeds, especially in North America, South America and Australia.

BG is commonly known as cruciferous vegetables, eaten by humans for dietary or culinary reasons. For instance - broccoli, brussel sprouts, cabbage, cauliflower, chye sim, kale and mustard. Cruciferous vegetables, such as

broccoli, cabbage and kale, are also rich sources of sulfur-containing compounds called glucosinolates. Isothiocyanates are biologically active hydrolysis (breakdown) products of glucosinolates, with anti-neoplastic (anti-cancer) activities. Cooked cabbages can still deliver isothiocyanates, albeit to a lesser
5 degree than raw cabbages. Isothiocyanate release from raw BG vegetables is catalysed by the plant's native myrosinase, from the glucosinolate sinigrin, in the upper intestinal tract, while isothiocyanate release from cooked BG vegetables, occurs in the lower intestinal tract through hydrolysis by colonic microflora (Rouauzd, 2004).

SUMMARY OF THE INVENTION

The present invention is broadly directed to providing a composition that comprises an isolated ground fibrous preparation of an extract of Brassica, Apium and/or Ipomoea genera and a method for making the composition. Advantageously, the composition may have a low calorie content and/or
15 chemopreventative effect.

In a first aspect, the invention resides in a composition comprising an isolated ground fibrous preparation of an extract of Brassica, Apium and/or Ipomoea genera.

In a second aspect, the invention resides in a food product comprising an
20 isolated ground fibrous preparation of an extract of Brassica, Apium and/or Ipomoea genera.

The food product may comprise half or less than half an energy yield of a conventional edible chip.

The food product may comprise half or less than half an energy yield of a conventional edible cookie.

In a third aspect the invention resides in a method of producing a composition including the steps of:

5 soaking isolated Brassica, Apium and/or Ipomoea genera plant material;

 separating a solid phase from the soaked plant material; and

 grinding the separated solid phase to thereby produce the composition.

10 The method of the third aspect may further include the step of washing the isolated Brassica, Apium and/or Ipomoea genera plant material.

 The method of the third aspect may further include the step of adding one or more food additive to the ground separated solid phase.

 The method of the third aspect may further include the step of heating the
15 ground separated solid phase.

 The method of the third aspect may further include the step of purifying the ground separated solid phase.

 In a fourth aspect the invention resides in a food product produced according to the third aspect.

20 In a fifth aspect the invention resides in a composition comprising an extract of Brassica, Apium and/or Ipomoea genera prepared by water purification thereof and grinding in a wet state, recovered as solid phase for the formation of a low and/or non-energy yielding food.

The composition of the first and fifth aspects may be heated and or cooked.

The composition of the first and fifth aspects may further comprise one or more food additive.

5 The one or more food additive may be a water-soluble fiber.

The water-soluble fiber may be acacia gum and or konjac gum.

The one or more food additive may be erythritol.

The one or more food additive may be erythritol, curry spice and salt.

10 The one or more food additive may be acacia gum, konjac gum, erythritol,
an intense sweetener, cocoa powder and vanillin.

The extract of the first and fifth aspects may be of a Brassica genus.

The composition of the first and fifth aspects may further comprise a carrier, diluent and/or excipient.

15 The composition of the first and fifth aspect may comprise at least one
insoluble fibrous compound.

The composition of the first and fifth aspect may comprise at least one cellulosic structure.

The composition of the first and fifth aspect may comprise at least one lignin structure.

20 The composition of the first and fifth aspect may comprise at least one
suberin structure.

The composition of the first and fifth aspect may comprise at least one cutin structure.

The composition of the first and fifth aspect may comprise at least one cellulosic structure and at least one soluble fiber.

The composition of the first and fifth aspect may comprise at least one food-grade additive.

5 In a sixth aspect the invention resides in a method of modulating an excess body mass index condition in a subject, said method comprising administering to said subject the composition of the first and/or fifth aspect to thereby modulate the excess body mass index.

10 In a seventh aspect the invention resides in a method of modulating a cancer risk in a subject, said method comprising administering to said subject the composition of the first and/or fifth aspect to thereby lower the cancer risk in the subject.

The administration may be *ad libitum*.

The composition may be administered to a human.

15 The excess body mass index may be due to hyperphagia.

The excess body mass index may be due to hypercalorification.

The excess body mass index may be due to behavior.

The excess body mass index may be due to behavioriet.

The excess body mass index may be due to diet.

20 In an eight aspect the invention resides in an article of manufacture or kit comprising the composition according to claim 1 and written material that may provide instructions and/or urge the use of the composition to modulate, a body mass index condition, a body weight-related condition or chemoprevention

mediated by the behavior, behavioriet and/or diet.

In a ninth aspect the invention resides in a method of purifying edible, water-insoluble fibrous isolates from Brassica, Apium and/or Ipomoea genera plants. The steps may comprise purging water-soluble sugars and starches from
5 the tissues of the Brassica, Apium and/or Ipomoea genera plants with a heated aqueous system, separating the liquid from the solid phase, recovering the solid phase in a hydrated state, wet-grinding the solid phase, applying vented dry heat to this solid phase and exposing the solid phase to heat such as, microwave energy, to obtain the dried fibrous isolate. As tissues of the Brassica, Apium
10 and/or Ipomoea genera plants, all tissues can be used; the aerial parts are preferred, and leaves and stems are most preferred.

In a tenth aspect the invention resides in a composition comprising of low and/or non-energy yielding, water-insoluble hydrated solid phase forming a matrix with the water-soluble gum fibers, in the presence of added water,
15 applying vented dry heat to this heterogenous matrix, to obtain a porous composite fibrous mass.

In an eleventh aspect the invention resides in an article of manufacture that comprises a composite material of the invention, that has low and/or non-energy yielding, water-insoluble hydrated solid phase in a matrix of water-soluble
20 gum fibers and trapped water, together with flavouring agents, condiments and low and/or non-energy yielding sweeteners (especially with a polyol or glycoside compound).

In a twelfth aspect the invention resides in use of Brassica, Apium and/or

Ipomoea genus plant material, or a botanical or horticultural equivalent thereof, which is capable of providing an edible, water-insoluble, fibrous isolate, after subsection of the aerial plant tissues to the method described herein.

In a thirteenth aspect the invention resides in a purified, biosynthetic or
5 chemical synthetic molecule form of Brassica, Apium and/or Ipomoea genera plant material, or a botanical or horticultural equivalent thereof, or an extract thereof which molecule is capable of forming a composite material with water-soluble gum fibers of microbial, botanical, biosynthetic or wholly synthetic origins.

In a fourteenth aspect the invention resides in use of Brassica, Apium
10 and/or Ipomoea genera plant material or botanical or horticultural equivalent thereof or an isolate thereof or an extract thereof or a chemical or functional equivalent of the purified water-insoluble fibrous isolate or biosynthetic form or chemical synthetic form of one or more components of the water-insoluble fibrous isolate in the manufacture of a therapeutic or medicament for the treatment of an
15 overweight or obese condition.

In any of the above aspects the genus may be a Brassica genus.

The Brassica genus may be Brassica oleracea.

Suitable Brassica genus include a cruciferous vegetable such as a broccoli, a brussel sprout, a cabbage, a cauliflower, a chye sim, a kale, a mustard
20 and/or any combination thereof.

In this specification, the terms "comprises", "comprising" or similar terms are intended to mean a non-exclusive inclusion, such that a method, system or

apparatus that comprises a list of elements does not include those elements solely, but may well include other elements not listed.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a flowchart illustrating one embodiment of the method of the invention.

FIG. 2 is a flowchart illustrating a second embodiment of the method of the invention.

FIG. 3 is a flowchart illustrating a third embodiment of the method of the invention.

FIG. 4 is a flowchart illustrating a fourth embodiment of the method of the invention.

FIGS. 5A and 5B are illustrations showing the effects of the processing method: (A) Purification and isolation of homogenous BG fibrous isolate (microscopic structure x40 magnification); (B) Purification and isolation of homogenous BG fibrous isolate (macro view x1). 100g fresh BG aerial parts were rinsed with water at ambient temperature to remove soil and other particle contaminants. Note the numerous tight cellular micro-structures (FIG. 5Ai). The cleansed BG tissues (solid phase) were then placed in 5000ml of 100°C water (liquid phase). The solid phase was separated from the liquid phase after 30min. Changes in the micro-structures of the BG tissues post-treatment, with lysis of cellular contents, to form larger vacuoles are evident (FIG. 5Aii).

FIG. 6 shows the formation of behaviorietary chips with vented dry-heating. The final characteristics of the BG fibrous isolate alone, after undergoing

the treatment processes and final baking formulation.

FIGS. 7A and 7B are illustrations showing the effects of the combination between the BG fibrous isolate and water-soluble fibers acacia gum and konjac gum: (A) The composition at 40X magnification. (B) Macroscopic view of the composition.

FIG. 8 shows the formation of behaviorietary cookies with vented dry-heating. The final characteristics of the BG fibrous isolate in combination with soluble fibers and final baking formulation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In accordance with the present invention, the inventors have discovered a novel isolated ground fibrous preparation of an extract of Brassica, Apium and/or Ipomoea genus that has a low energy yield. Advantageously, the composition can be combined with a common vegetable gum to form an edible food product such as, a chip, a cookie and a biscuit.

The inventors have provided a novel and inventive product and method which may overcome or reduce the economic and health costs of obesity and related disease and disorders. Additionally the inventors have provided a novel and inventive product which may have a chemopreventive effect.

The food product of the invention may have a texture and consistency the same as or similar to conventional food products such as, a chip a cookie and a biscuit. Advantageously, the identification of these fibrous isolates as edible, non-caloric substitutes for baking flours and other food bulking agents, permits the rational design of therapeutic protocols and compositions useful in the production

of edible behaviorietary foods, for human consumption; with collateral chemopreventive (anti-cancer) benefits.

In the context of the present invention, a composition "consisting essentially of" recited ingredients will produce edible behaviorietary foods with textures and consistencies that are palatable to humans and yet, yields no or a low physiological sources of food energy, vitamins and minerals in the gastrointestinal tract (GIT), compared to the foods obtained using baking flours or bulking food agents or wood or cellulose alone as the base compound. As a preferred instance of behaviorietary food with extremely low biological-usable energy, vitamins and minerals, but with palatable consistency and texture, a 1g cooked food using baking flours and the like, or wood, will have four (4) Calories, or approximately zero (0) Calories respectively. Wood while yielding approximately zero (0) Calories biologically in the human gastrointestinal tract, will not be palatable in terms of consistency and texture, or food safety. Insoluble fibers are also potential sources of lifelong anti-cancer chemopreventive foods, but eating a lot of vegetables daily, for an entire lifetime may not be palatable for many people. In contrast, behaviorietary food with extremely low biological-usable energy, vitamins and minerals, but with palatable consistency and texture, is obtained, when the composition of the invention and suitable flavourings or condiments, are applied together to produce the final cooked behaviorietary food. At the same time, the water-insoluble fibrous isolates also provide a daily, lifelong, source of anti-cancer lignins and other chemopreventive compounds.

In one embodiment the present invention is predicated in part on the

production of a purified fibrous isolate with food product-like properties such as, cookie-like and chips-like behaviorietary properties, in a formulation comprising parts of a plant and water-soluble gums or equivalents thereof.

Suitable plants include Brassica, Apium and/or Ipomoea genera. In one
5 embodiment the plant or plants are one or more member of the Brassica genus.

Any plant material and/or tissue may be used. The aerial parts are preferred, and leaves and stems are most preferred.

"Aerial parts" as used herein means those parts of a plant that are above the ground and/or exposed to air during normal plant growth and normal plant
10 life. Aerial parts include the stem and leaves.

In this specification *"raw"* means isolated and not treated or processed in any way.

It is to be understood that purify, refined, treated and separated are relative terms and any step that increases purity by any amount is considered a
15 purification, refinement, treatment and/or separation.

The plant material may be washed for example, to remove soil and/or other surface contaminant.

The washed plant material may then be soaked in a solvent. Suitable solvents include water and other aqueous solvents. The soaking is performed to
20 extract unwanted compounds from the aerial parts into the solvent.

A soaking method is one of the several methods of extracting and removing unwanted compounds, such as sugars and starches, from the plant material. In this method, the intact aerial part of the plant is soaked with an

aqueous system and left for a period of time to allow the active compounds to dissolve into the aqueous system. To enhance the diffusion of the active compounds into the solution, the mixture can be mechanically agitated and/or heated to a pre-determined temperature. The mechanical agitation methods include but are not limited to the following: shaking, vortexing, swirling, stirring and ultrasonication.

In one embodiment one (1) kg of plant material is soaked in five (5) litres of 100% water at 100°C for 30 minutes. A person of skill in the art is readily able to select an appropriate plant material : solvent ratio as well as appropriate temperature and time period for soaking.

The aqueous system can comprise any of the well-known systems such as potable water or a combination of potable water and organic solvents. Preferably, the organic solvent is alcohol and more preferably, ethanol. Other organic solvents such as hexane, dichloromethane, ethyl acetate will also be effective. The percentage of water can range from 100% to 50%. The percentage of water may be 100%, 95%, 90%, 85%, 80%, 75%, 70%, 65%, 60%, 55% or 50%. If the organic solvent is not part of the initial aqueous system, it can be added to the liquid phase during the soaking period, at least 1 hour before heat is applied to the aqueous system. It is also possible to add the organic solvent to the solid phase, after separation from the heated liquid phase. A second soaking step is then required, with the liquid and solid phase separation being carried out as previously described. One of the effects of the addition of the organic solvent is to cause the extraction and removal of hydrophobic, lipidic compounds that

have energy-yielding properties, such as plant oils. Organic solvent can be added up to 300% by volume. A person of skill in the art is readily able to select other suitable solvents.

After a sufficient period of time for the diffusion of the active compounds
5 into the aqueous system, the liquid may then be separated from the solid by any one of the well-known techniques such as filtration and centrifugation. Any suitable separation process may be used. A person of skill in the art is readily able to select a suitable mechanical, chemical and/or physical separation process. Preferably the separation is mechanical separation such as, sieving. The sieving
10 may be conducted with a fine wire mesh.

The solid phase may then be ground into a slurry. Preferably the grinding is a wet-grinding. The grinding may be performed with a grinding machine. Preferably the grinding machine is a wet-grinding machine.

Grinding as used herein means to reduce to fine particles, and may be
15 performed by pounding or crushing to reduce to fine particles.

The grinding preferably produces a homogenous, purified, fibrous isolate that may be manipulated into a food product, such as a chip and/or a biscuit.

An optional additional stage may be introduced to further purify the ground fibrous isolate of unwanted compounds. After completion of the aqueous purging
20 stage and grinding stage, the fibrous isolate may be percolated with a continuously refluxed solvent system such as the soxhlet-type method for extraction. The highly purified solid isolate may then be separated from the liquid containing the unwanted compounds, by using any one of the well known

separation methods such as filtration and/or centrifugation.

The food product may be a behaviorietary food. "*Behaviorietary food*" as used herein includes an edible solid, a potable liquid and/or other edibles and potables in varying degree of physical state, which is taken for recreational and lifestyle purposes. Preferably the behaviorietary food has a low biologically-usable food energy, negligible vitamin and/or mineral content to the human user (Ong, 2007). The "physical state" referred to herein, includes but is not limited to, solid, semi-solid, semi-liquid, viscous liquid, gel solid and forms thereof.

Behavioriet is behaviorietary foods and/or the consumption, taking and/or use of "*behaviorietary food*".

A food product according to the invention may comprise half or less than half an energy yield of a convention food product of comparable weight. The food product of the invention may comprise 50%, 45%, 40%, 35%, 30%, 25%, 20%, 15%, 10% or less than 10% the energy yield of a convention food product of comparable weight.

The food may have a chemopreventive property. The chemopreventive property may include an anti-cancer effect, but is not limited thereto.

The food may include one or more water-soluble fiber. Suitable water-soluble fibers include acacia gum and konjac gum.

The food may also include one or more food additive. The food additive may be a flavouring and/or a sweetener. Suitable food additives include a sugar, a sugar substitute, a flavouring and or a colouring. Suitable sugar substitutes include natural and artificial sugar substitutes including both natural and artificial

intense sweeteners. Preferably the sugar substitute is a zero or low calorie sugar substitute. Suitable natural sugar substitutes include erythritol. Suitable flavourings include curry spice, salt, cocoa powder and vanillin.

A person of skill in the art is able to select suitable water-soluble fibers and
5 additives as well as suitable relative amounts thereof.

FIG. 1 illustrates one embodiment of a method 100 of the invention. In step 20 plant material is soaked. In step 30 the soaked plant material is separated. In step 40 the separated solid phase is ground.

FIG. 2 illustrates method 200 which includes optional step 10 washing the
10 plant material.

FIG. 3 illustrates method 300 which includes optional step 50 adding one or more food additive.

FIG. 4 illustrates method 400 which includes optional step 60 heating. The heating may be dry heating, microwave radiation or any suitable heating. A
15 person of skill in the art is readily able to select a suitable heating method. The heating may result in cooking.

The invention is directed to a composition comprising one or more edible non-starch polysaccharide agent useful for bulking the aforesaid processed food product, without the concomitant liberation of energy-yielding, glycemic
20 polysaccharides, disaccharides and monosaccharides in the stomach and small intestine of humans through physiological enzymatic digestion by eukaryotic (human) gastric and intestinal amylases and the like, but act as a source of lignins, cutins and anti-cancer chemopreventive phytochemicals. The

composition of the present invention preferably comprises water-insoluble fibrous isolates of botanicals or vegetative or horticultural equivalents of the botanicals or chemical or functional equivalents of one or more components of the botanical isolates; in combination with water-soluble, gum fibres of botanical or microbial
5 origins, or vegetative or horticultural equivalents of the botanicals or chemical or functional equivalents of one or more components of the botanicals or microbials.

Accordingly, one aspect of the present invention is a method of purifying fibrous isolates from a Brassica, Apium and/or Ipomoea genera plant. Fresh Brassica, Apium and/or Ipomoea genera plant parts are rinsed with water and the
10 purging process (Stage 1) initiated. Although purified fibrous isolate can be obtained from different parts of the plants, the preferred part of the plant for isolation is the aerial part, comprising of leaves and stems tissue.

Another aspect of the present invention contemplates a method of modulating hyperphagia and hypercalorification in a subject with weight-related
15 condition, said method comprising administering to said subject an effective amount of a formulation comprising a purified fibrous Brassica, Apium and/or Ipomoea genera plant isolate or botanical or horticultural equivalents of these plants or chemical or microbial or functional equivalents of the fibrous isolate or a purified or chemical synthetic form of one or more components of the fibrous
20 isolate.

A "weight-related condition" includes excess body mass index, normal body mass index with excess body fat, type 2 diabetes mellitus, dyslipidaemia, hypertension, metabolic syndrome and/or other pathophysiological condition

associated with obesity. Anti-hyperphagia agents are useful in behavior modification therapy in orexigenic conditions such as but not limited to obsessive-compulsive eating, snacking, over-sized meal consumption. Anti-hypercalorification agents are useful in abnormal body weight states such as but
5 not limited to obesity and adiposity.

Yet another aspect of the present invention is directed to the use of a Brassica, Apium and/or Ipomoea genera plant or a botanical or horticultural equivalent thereof or a purified isolate thereof or a chemical or a microbial or functional equivalent of the purified fibrous isolate or an extract or chemical
10 synthetic form of one or more components of the purified fibrous isolate in the manufacture of a medicament for the treatment of weight-related conditions.

Still yet another aspect of the present invention provides a method for anti-cancer therapy in a subject, said method comprising administering to said subject an effective amount of a purified fibrous isolate of Brassica, Apium and/or
15 Ipomoea genera or botanical or horticultural equivalents of Brassica, Apium and/or Ipomoea genera under conditions to produce anti-cancer activity. The administration may be for an extended period of weeks, months or years or for a life-time.

Another aspect of the invention resides in a composition or pharmaceutical
20 composition for treatment or prophylaxis of obesity, a body mass index condition, a body weight-related condition and/or chemoprevention comprising an effective amount of the composition of the invention.

Dosage forms include tablets, dispersions, suspensions, injections,

solutions, syrups, troches, capsules, suppositories, aerosols, transdermal patches and the like. These dosage forms may also include injecting or implanting devices designed specifically for, or modified to, control release of the pharmaceutical composition. Controlled release of the therapeutic agent may be
5 affected by coating, for example, with hydrophobic polymers including acrylic resins, waxes, higher aliphatic alcohols, polyactic and polyglycolic acids and certain cellulose derivatives such as hydroxypropylmethyl cellulose. In addition, the controlled release may be effected or affected by using other polymer matrices, liposomes and/or microspheres.

10 Pharmaceutically acceptable carriers for systemic administration may also be incorporated into the compositions of this invention.

Suitably, the composition or pharmaceutical composition comprises an excipient or pharmaceutically-acceptable excipient. By "excipient" or "pharmaceutically-acceptable excipient" is meant a solid or liquid filler, diluent or
15 encapsulating substance that may be safely used in systemic administration. Depending upon the particular route of administration, a variety of carriers, well known in the art may be used. These carriers or excipients may be selected from a group including sugars, starches, cellulose and its derivatives, malt, gelatine, talc, calcium sulphate, vegetable oils, synthetic oils, polyols, alginic acid,
20 phosphate buffered solutions, emulsifiers, isotonic saline, and pyrogen-free water.

Any suitable route of administration may be employed for providing a patient with the composition or pharmaceutical composition of the invention. For

example, oral, rectal, parenteral, sublingual, buccal, intravenous, intraarticular, intra-muscular, intra-dermal, subcutaneous, inhalational, intraocular, intraperitoneal, intracerebroventricular, transdermal and the like may be employed.

5 Pharmaceutical compositions of the present invention suitable for administration may be presented in discrete units such as vials, capsules, sachets or tablets each containing a predetermined amount of one or more behaviorietary or pharmaceutically active compounds of the invention, as a powder or granules or as a solution or a suspension in an aqueous liquid, a non-
10 aqueous liquid, an oil-in-water emulsion or a water-in-oil emulsion. Such compositions may be prepared by any of the method of pharmacy but all methods include the step of bringing into association one or more behaviorietary and/or pharmaceutically active compounds of the invention with the carrier which constitutes one or more necessary ingredients. In general, the compositions are
15 prepared by uniformly and intimately admixing the agents of the invention with liquid carriers or finely divided solid carriers or both, and then, if necessary, shaping the product into the desired presentation.

So that the invention may be readily understood and put into practical effect, the following non-limiting Examples are provided.

20

EXAMPLES

EXAMPLE 1

Purification and Isolation

To characterize the changes to the structures of BG aerial parts as it

underwent the invented processes, macroscopic and microscopic photographs were taken.

FIG. 5A shows the microscopic changes of the three treatment stages:

FIG. 5Ai-raw BG aerial parts

5 FIG. 5Aii-purged, recovered BG aerial parts after Stage 1

FIG. 5Aiii-purified, wet-grinded BG fibrous isolate after Stage 2

FIG. 5B shows the macroscopic changes of the three treatment stages:

FIG. 5Bi-raw BG aerial parts

FIG. 5Bii-purged, recovered BG aerial parts after Stage 1

10 FIG. 5Biii-purified, wet-grinded BG fibrous isolate after Stage 2

1 kg of raw aerial parts, comprising stem and leaves, of the BG plant (*Brassica oleracea*), was weighed and washed free of soil and other surface contaminants (FIG. 5Ai and FIG. 5Bi). Other suitable plants may be selected. The aerial parts are then soaked in 5 liters of 100% water at 100°C for 30 mins, to
15 extract out the unwanted compounds from the aerial parts into the aqueous system. The liquid phase was then separated from the solid phase by sieving with a fine wire mesh (FIG. 5Aii and FIG. 5Bii). This shows that purification results in lysis of the cells, release of unwanted cellular compounds into aqueous solution, with formation of larger vacuoles in the BG aerial parts. The solid phase
20 was then wet-grounded into a slurry with a grinding machine, thereby producing a fibrous BG isolate (FIG. 5Aiii and FIG. 5Biii). The wet-grinding process, Stage 2, produces a homogenous, purified BG fibrous isolate suitable for downstream manipulation, such as production of behaviorietary chips.

EXAMPLE 2

Combination of Fibrous Compounds

The heterogenous mix of fibrous compounds according to the invention, especially those compounds having a water-soluble characteristic, with the
5 fibrous isolate, can be applied in combination to obtain a low and/or non-energy yielding foods that may have chemopreventive properties. A composition of the invention is preferably one with water-insoluble fibrous BG isolate with water-soluble fibers of acacia and konjac gums. In an example of this combination, 2.2g of the acacia gum with 1.4g of the konjac gum, together with suitable quantity of
10 flavourings and sweeteners, are added to 7.5g of the fibrous BG isolate (FIG. 6). Note the difference in the final composition formed from the fibrous BG isolate (FIG. 7Ai and FIG. 7Bi) in combination with the individual components of acacia gum (FIG. 7Aii and FIG. 7Bii) and konjac gum (FIG. 7Aiii and FIG. 7Biii).

EXAMPLE 3

Formation Studies

Experiments were conducted to determine the capacity of the fibrous BG isolate alone and in combination with other fibers, to successfully form chips and cookies with the likes of similar consistency and palatability (FIG. 6 and FIG. 8).

20 FIG. 6 shows the microscopic, macroscopic and gross physical characteristics of behaviorietary chips formed through subjecting the purified fibrous BG isolate, with spices and other suitable additives, to 90°C dry heat for 300 mins. Table 1a shows one such exemplary formulation involving curry powder, erythritol and salt.

More strikingly, the purified fibrous BG isolate, in combination with acacia and konjac gums, produced porous dried bulk, with the consistency and friability of cookies (FIG. 8). Additives such as flavourings, salt and zero calorie sweeteners were added to enhance taste. Table 1b shows an example of such flavoured cookie formulations.

EXAMPLE 4

Energy-yield Studies

Behaviorietary chips thus formed, were subjected to energy yield calculations, to determine their caloric content, post-formation. As shown in Table 2a, behaviorietary chips thus formed has approximately 10 times fewer calories than typical chips made from potato or corn.

Similarly, behaviorietary cookies produced from a composition of purified BG fibrous isolate and water-soluble fibers, maintained the drastic reduction in calorie count relative to ordinary cookies, with a 10:1 ratio (Table 2b).

Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described. It is to be understood that the invention includes all such variations and modifications. The invention also includes all of the steps, features, compositions, compounds and botanicals referred to or indicated in this specification, individually or collectively, and any and all combinations of any two or more of said steps or features.

Various articles of the scientific and patent literature are cited throughout this paper. Each such article is hereby incorporated by reference in its entirety and for all purposes by such citation.

TABLE 1: Example compositions

Table 1a Exemplar composition of behaviorietary chips made from purified, water-insoluble, fibrous BG isolate	
	Quantity (gram)
Fibrous BG isolate	200
Erythritol	20
Curry spices (flavour)	5
Salt	0.1

Table 1b Exemplar composition of behaviorietary cookies made from purified, water-insoluble, fibrous BG isolate	
	Quantity (gram)
Fibrous BG isolate	75
Acacia gum fiber	22
Konjac gum fiber	14
Erythritol	7.5
Intense sweetener (natural or artificial)	0.01
Cocoa powder (flavour)	2
Vanillin (flavour)	3.75
Water	12

5

TABLE 2a: Energy Yield

10

Table 2a Comparative energy yield of behaviorietary chips made from purified, water-insoluble, fibrous BG isolate versus ordinary chips made from potato or maize		
	Quantity (gram)	Energy (calorie)
Behaviorietary chips	1	0.35 ¹
Potato chips	1	5.38 ²
Corn chips	1	5.00 ³

¹ Calculated value using standard erythritol (1g = 0.2 Cal) and boiled cabbage (1g = 0.153 Cal) calorie count. Reported calorie count of boiled cabbage

obtained from:

http://www.weightlossresources.co.uk/calories/calorie_counter/vegetables.htm.

² Reported calorie count obtained from the nutrition information panel of Twisties™ potato chips, Danone Group 2007.

5 ³ Reported calorie count obtained from the nutrition information panel of Chacho's™ corn chips, Danone Group 2007.

TABLE 2 (cont'd)

10

Table 2b Comparative energy yield of behaviorietary cookies made from purified, water-insoluble, fibrous BG isolate versus ordinary cookies made from wheat flour base		
	Quantity (gram)	Energy (calorie)
Behaviorietary cookies	1	0.40 ¹
Behaviorietary cookies	1	0.49 ²
Chocolate chip cookies	1	5.18 ³

¹ Calculated value using standard erythritol (1g = 0.2 Cal), boiled cabbage (1g = 0.153 Cal) and cocoa powder (1g = 2.3 Cal) calorie count. Reported calorie count
15 of boiled cabbage obtained from:

http://www.weightlossresources.co.uk/calories/calorie_counter/vegetables.htm.

Reported calorie count of cocoa powder, unsweetened obtained from
<http://www.calorie-count.com/calories/item/19165.html>.

20

² Actual laboratory analysis carried out by ALS Laboratory Group, Reference

number ATS/NF/387/07/sk.

³ Reported calorie count obtained from the nutrition information panel of Famous Amos™ cookies, Famous Amos Chocolate Chip Cookie Co., LLC 2007.

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CLAIMS

1. A composition comprising an isolated ground fibrous preparation of an
5 extract of Brassica, Apium and/or Ipomoea genera.
2. The composition of claim 1 wherein the isolated ground fibrous preparation has been heated.
3. The composition of claim 1 further comprising one or more food additive.
4. The composition of claim 3 wherein the one or more food additive is a
10 water-soluble fiber.
5. The composition of claim 4 wherein the water-soluble fiber is acacia gum.
6. The composition of claim 4 wherein the water-soluble fiber additive is konjac gum.
7. The composition of claim 3 wherein the additive is erythritol.
- 15 8. The composition of claim 3 wherein the one or more food additive is erythritol, curry spice and salt.
9. The composition of claim 3 wherein the one or more food additive is acacia gum, konjac gum, erythritol, an intense sweetener, cocoa powder and vanillin.
- 20 10. The composition of claim 1 wherein the isolated ground fibrous preparation is an extract of a Brassica genus.
11. The composition of claim 1 wherein the isolated ground fibrous preparation is an extract of Brassica oleracea.
12. The composition of claim 1 further comprising a carrier, diluent and/or

excipient.

13. A food product comprising an isolated ground fibrous preparation of an extract of Brassica, Apium and/or Ipomoea genera.

14. A method of producing a composition including the steps of:

5 soaking isolated Brassica, Apium and/or Ipomoea genera plant material;

 separating a solid phase from the soaked plant material; and

 grinding the separated solid phase to thereby produce the composition.

10 15. The method of claim 14 further including the step of washing the isolated Brassica, Apium and/or Ipomoea genera plant material.

16. The method of claim 14 further including the step of adding one or more food additive to the ground separated solid phase.

15 17. The method of claim 14 further including the step of heating the ground separated solid phase.

18. The method of claim 14 further including the step of purifying the ground separated solid phase.

19. A food product produced according to the method of claim 14.

20 20. A composition comprising an extract of Brassica, Apium and/or Ipomoea genera prepared by water purification thereof and grinding in a wet state, and recovered as solid phase for the formation of a low and/or non-energy yielding food.

21. The composition of claim 20, wherein the composition comprises at least

one insoluble fibrous compound.

22. The composition of claim 20, wherein the composition comprises at least one cellulosic structure.

23. The composition of claim 20, wherein the composition comprises at least
5 one lignin structure.

24. The composition of claim 20, wherein the composition comprises at least one suberin structure.

25. The composition of claim 20, wherein the composition comprises at least one cutin structure.

10 26. The composition of claim 20, wherein the composition comprises at least one cellulosic structure and at least one soluble fiber.

27. The composition of claim 20, wherein the composition comprises at least one food-grade additive.

28. A method of modulating an excess body mass index condition in a subject,
15 said method comprising administering to said subject the composition of claim 1 to thereby modulate the excess body mass index.

29. The method of claim 28 wherein the administration is *ad libitum*.

30. The method of claim 28 wherein the composition is administered to a human.

20 31. The method of claim 28 wherein the excess body mass index is due to hyperphagia.

32. The method of claim 28 wherein the excess body mass index is due to hypercalorification.

33. The method of claim 28 wherein the excess body mass index is due to behavior.

34. The method of claim 28 wherein the excess body mass index is due to behavioriet.

5 35. The method of claim 28 wherein the excess body mass index is due to diet.

36. A method of modulating an excess body mass index condition in a subject, said method comprising administering to said subject the composition of claim 20 to thereby modulate the excess body mass index.

10 37. The method of claim 36 wherein the administration is *ad libitum*.

38. The method of claim 36 wherein the composition is administered to a human.

39. The method of claim 36 wherein the excess body mass index is due to hyperphagia.

15 40. The method of claim 36 wherein the excess body mass index is due to hypercalorification.

41. The method of claim 36 wherein the excess body mass index is due to behavior.

42. The method of claim 36 wherein the excess body mass index is due to behavioriet.
20

43. The method of claim 36 wherein the excess body mass index is due to diet.

44. A method of modulating a cancer risk in a subject, said method comprising

administering to said subject the composition of claim 1 to thereby lower the cancer risk in the subject.

45. The method of claim 44 wherein the composition is administered *ad libitum*.

5 46. The method according to claim 44, wherein the composition is administered to a human.

47. An article of manufacture comprising the composition according to claim 1 and written material that provides instructions or urges the use of the composition to modulate, a body mass index condition, a body weight-related condition or
10 lifelong chemoprevention mediated by behavior, behavioriet and/or diet.

48. The food product of claim 1, wherein said food product comprises half or less than half an energy yield of a conventional edible chip.

49. The food product of claim 1, wherein said food product comprises half or less than half an energy yield of a conventional edible cookie.

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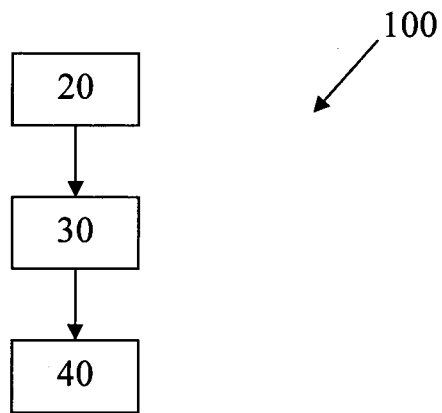


FIG. 1

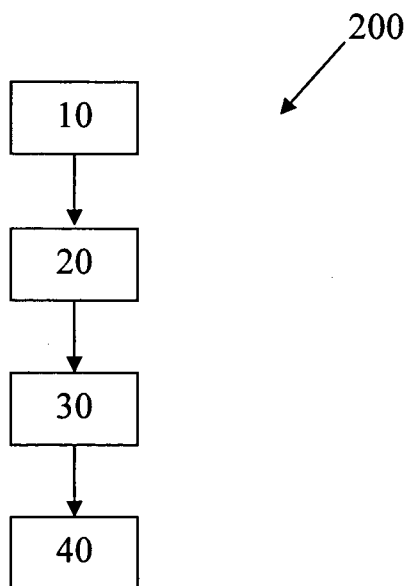


FIG. 2

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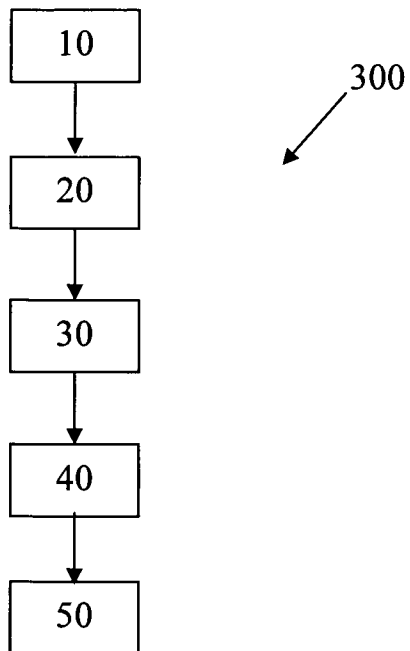


FIG. 3

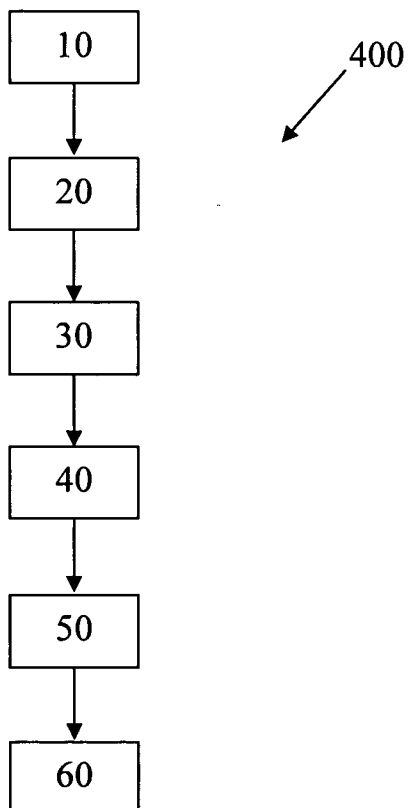


FIG. 4

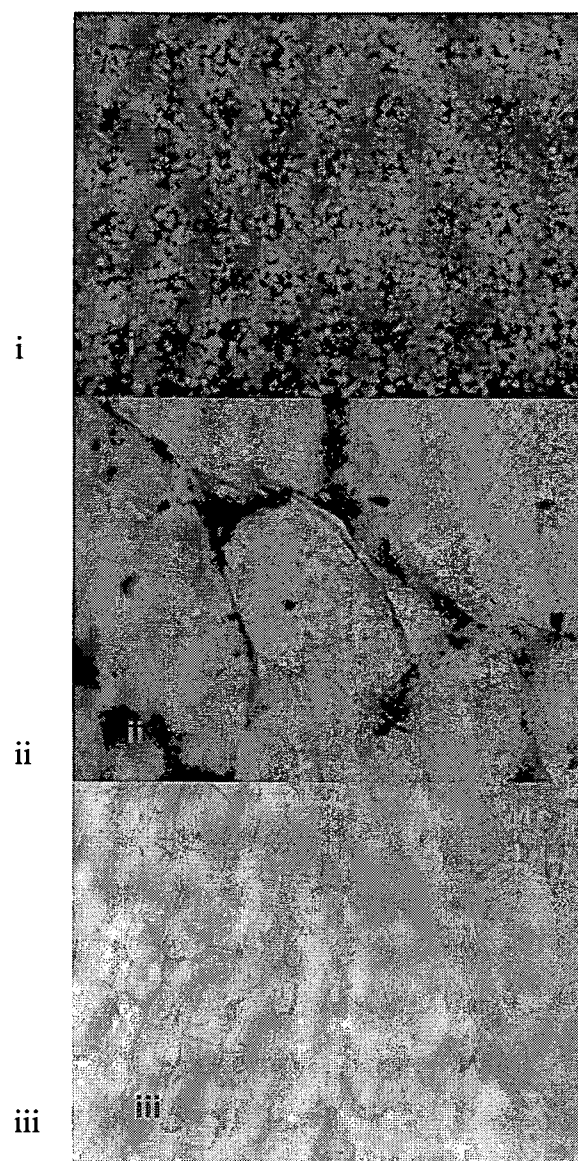


FIG. 5A

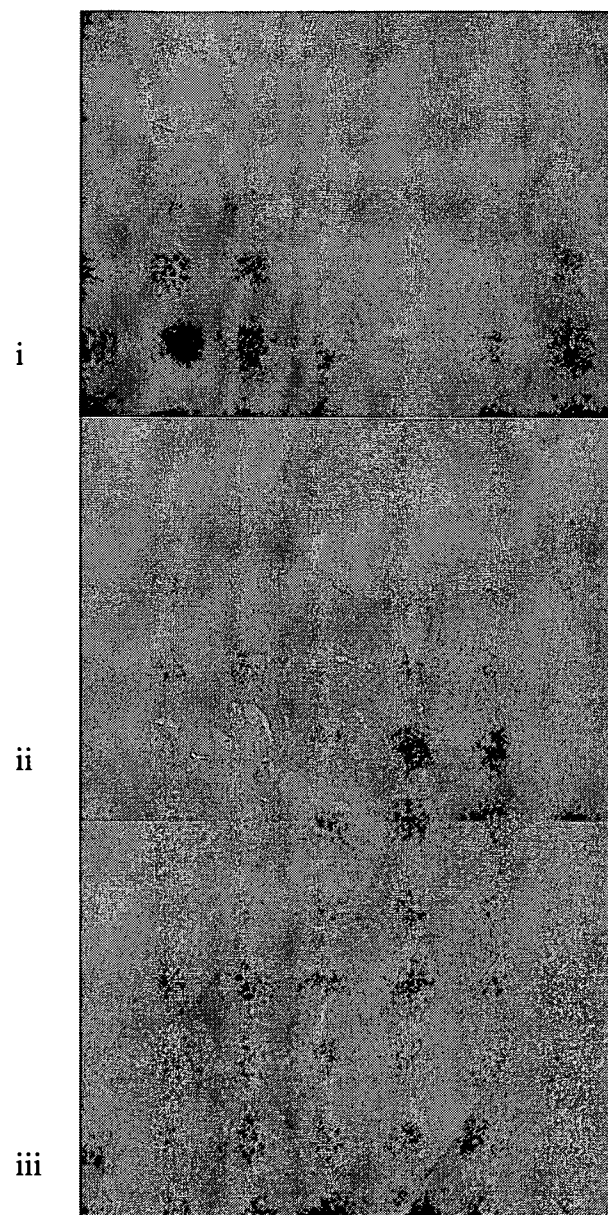


FIGURE 5B

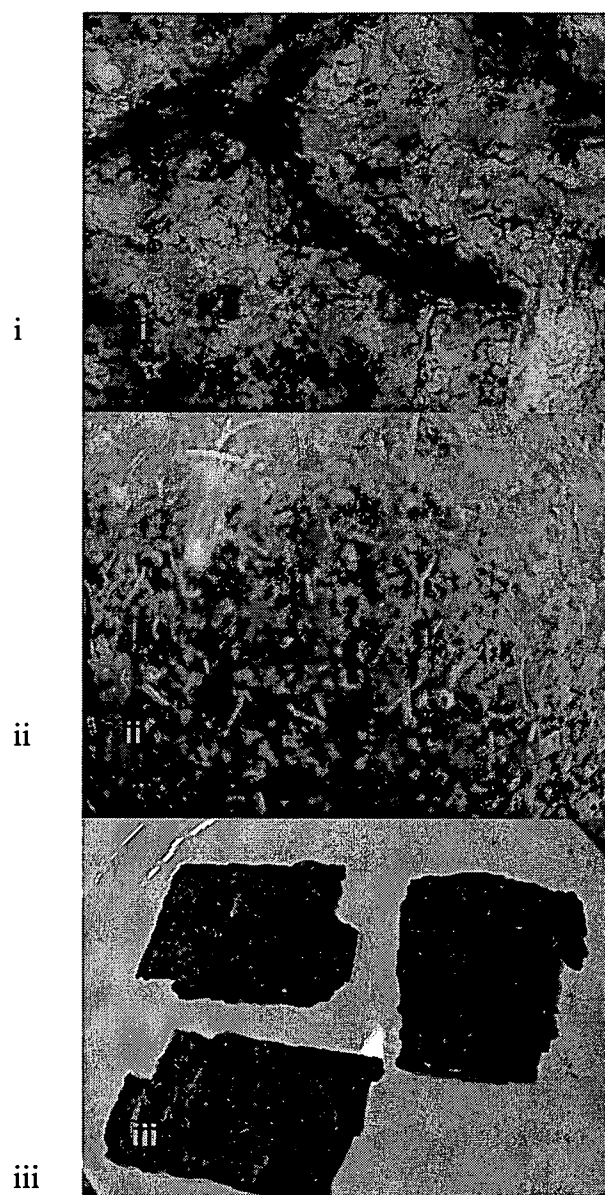


FIGURE 6

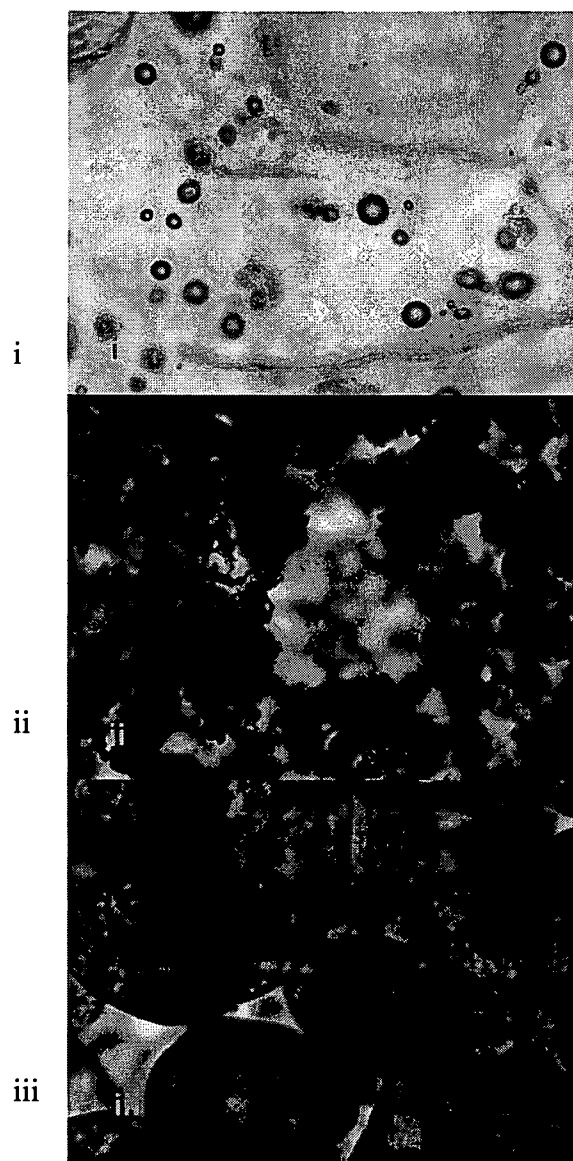


FIGURE 7A

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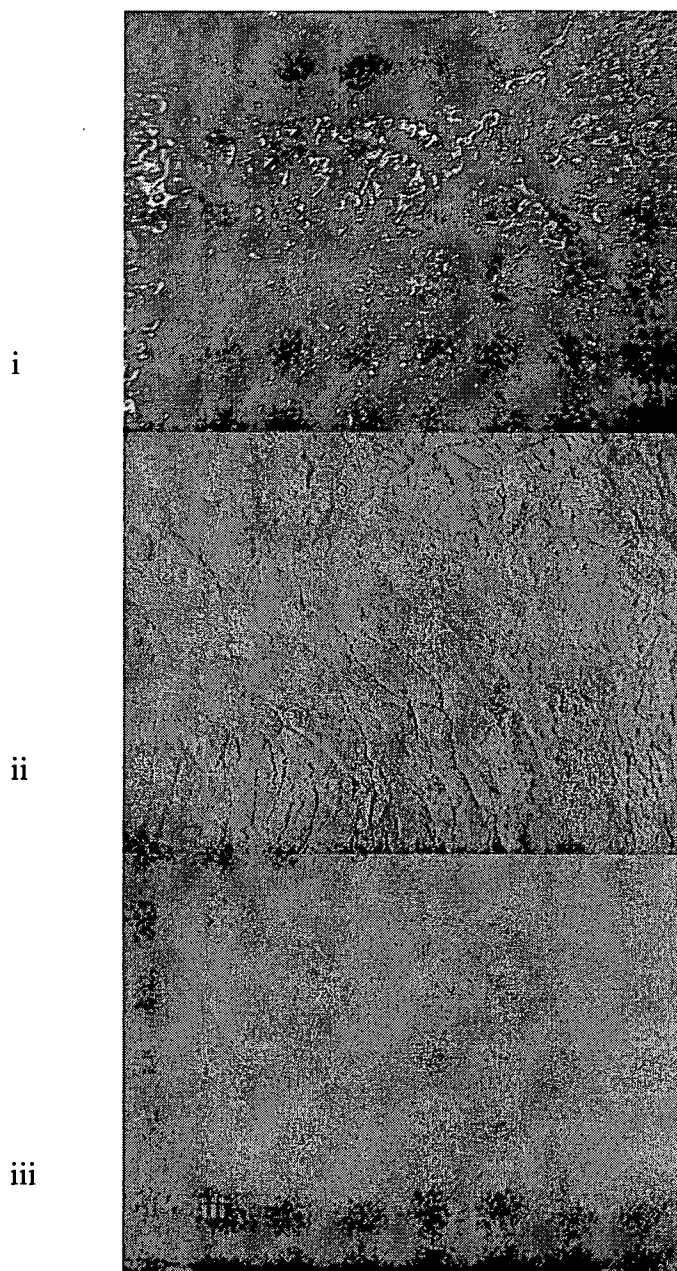


FIGURE 7B

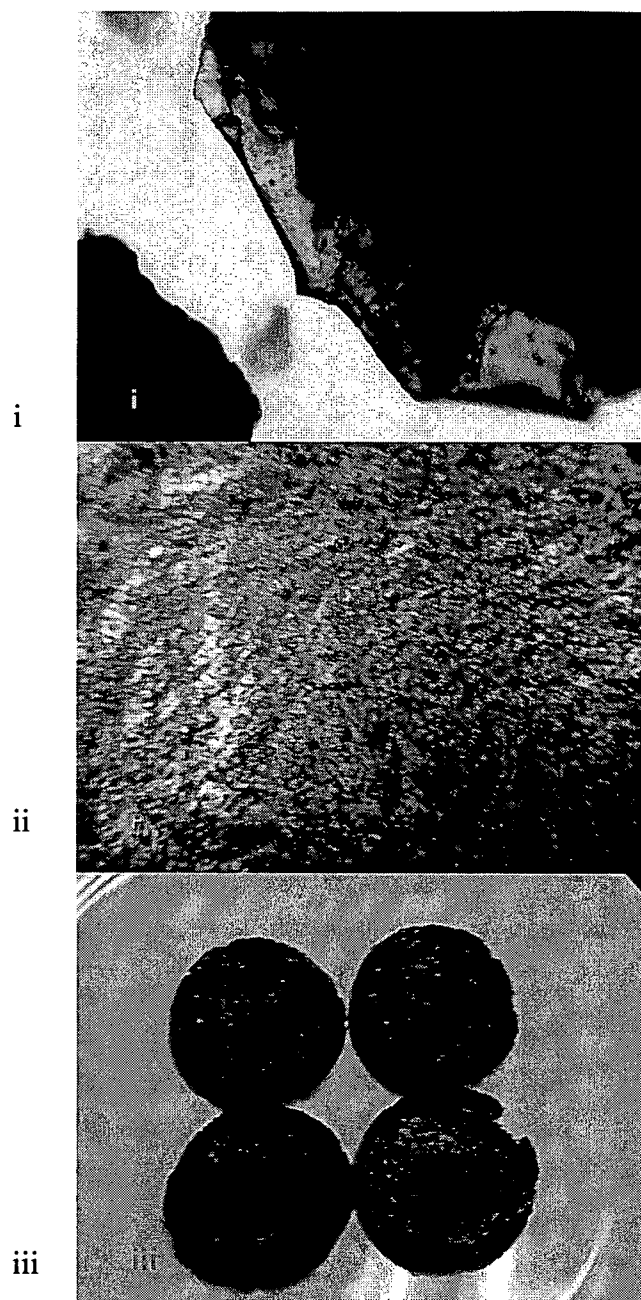


FIGURE 8