The Production of Imitation Bird's Nest

By

Mr. Sittiwat Nantapanichsakul
ID. 402-8902

A special project submitted to the Faculty of Biotechnology, Assumption University in part fulfillment of the requirements of the degree of Bachelor of Science in Biotechnology

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SENIOR PROJECT

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Title:	**The Production of Imitation Bird's Nest**
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Department:	**Food-Technology**
Faculty:	**Biotechnology**
Academic Year:	**2002**

Pornpen P. .... **Advisor**

(A. Pornpen Panjapiyakul)

ACKNOWLEDGEMENTS

I would like to express my sincere thanks to, A. Pornpen Panjapiyakul, advisor who pleased to provide the information, instruction, and consultation including inspection and help me through the project.

I would like to thanks the officers of Faculty of Biotechnology, Assumption University for their support and general assistance in the completion of this project.

Thanks for my friends and my junior students of Faculty of Biotechnology, Assumption University for the in participation in sensory analysis.

Finally, I would like to thank my parents for their patience, encouragement, and support during my undergraduate studied.

Mr. Sittiwat Nantapanichsakul

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ABSTRACT

The research was studied on the product of imitation bird's nest. The research was separated into four parts. The first part was determined the shape formation of imitation bird's nest by controlling the proper ratio of water to alginate. It was vary the water ratios to alginate as 7.5:1, 10:1, 12.5:1 and 15:1, respectively. The result was shown that the proper ratio was 12.5:1.

The second part was determined the color of imitation bird's nest by varying types of sugar such as pure refined sugar, rock sugar, natural mineral sugar and brown sugar. The rock sugar was given color nearly to the reference.

The third part was determined the texture of imitation bird's nest by sensory evaluation. In this part, it were vary the ratios between sodium alginate manugel (G) with manucol (M) (G: M) as 100: 0, 80: 20, 60:40, 50:50, 40:60, 20:80, and 0:100, respectively. From the experiment, there were significant differences among samples and the panelist preferred the ratio as G (50): M (50) more than others.

The finally part was determined the marketing test of bird's nest from the project. In this part, the sample were compared with the two commercial of bird's nest as commercial A and commercial B. There were significant difference among the sample and the panelist's preferred the imitation bird's nest and the commercial B more than the commercial A.

In this project, the proper ratio of water is 12.5:1. The proper color makes from the rock sugar. The proper ratio between sodium alginate Manugel (G) with Manucol (M) was 50:50. The panelist preferred the imitation bird's nest from this project.

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INTRODUCTION

There are many health foods in Thailand market such as: Bird’s nest, chicken soup and herb beverage, which are varieties. Bird’s nest is a popular health food for Chinese group. It is more expensive and cannot be daily food.

Bird's nest is pleasant on the palate, contains plenty of nourishment and possesses what the Chinese call "rejuvenating effects". Modern science has help ascertain the age-old belief that Bird's nest contains a host of different proteins (So essential to life), vitamins and various other minerals. Research has also found that bird's nest contains the epidermal growth factor. This helps explain why Chinese herbalists often prescribe Bird's nest to people who fail to thrive or grow for no apparent reason. Independent laboratory investigation has also revealed that Bird's nest contains a water soluble glyco-protein that promotes cell division within the immune system. These findings lend support to the belief that Bird's nest promotes growth and tissue repair. Not only that, Bird's nest strengthens the body's self-regulating actions and provides resistance to disease. (www.naturalnest.com)

The nature Bird’s nest can find at the southtern island of Thailand. The nature Bird’s nest is difficult find to eat and it is so expensive.

Recently, the natural dried brown seaweed is partially replaced the nature Bird’s nest for reducing the cost in Bird’s nest beverage. The brown seaweed is non-toxic which is ease to use and mix in the making beverage. It is cheap and long shelf life, which is suitable for business.

Nowadays, Thais are now consuming more of Bird’s nest drinking gives more benefit for the healthy. For this reason, process of imitation Bird’s nest is more profitable and no dangerous for healthy. Because, it is an alternative to appeals to the consumer and more acceptable by improving production. This study presented an innovative product ‘production of imitation bird’s nest.

Objectives

1. To study the shaping formation of imitation bird's nest in sodium alginate.

2. To study the processing of imitation bird's nest.

3. To study the optimum ratio of water in the imitation bird's nest.

4. To study the optimum type of sugar in the imitation bird's nest.

5. To study the optimum ratio of sodium alginate in the imitation bird's nest.

6. To study the acceptance of the imitation bird's nest.

Literature Review

Introduction

Barn Swallow

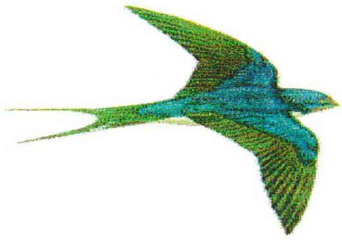


Figure 1. Barn Swallow

Swallow has common name for many species of passerine birds of the family Hirundinidae. (Figure 1)

Their long and pointed wings round heads, and small legs and feet distinguish the members of this family. Like the unrelated swifts, which also feed on flying insects, swallows have short bills but wide mouths. The family is cosmopolitan in distribution and contains about 80 to 85 species (species relationships of several swallows are unclear). Swallows are gregarious, and some species nest colonially. They are almost wholly insectivorous, and include many flies, mosquitoes, gnats, and agricultural pests in their diet.

Only eight species breed in North America and two of these are also found widely in the Old World. One of these, the barn swallow, *Hirundo rustica,* is probably the most abundant swallow in the world. The other, the bank swallow, *Riparia riparia*, is called sand martin in Europe; it is the smallest North American species, and nests in colonies in holes in earthen banks. The largest North American swallow is the purple martin, *Progne subis*, which takes readily to apartment-style nest boxes. Two species that will also nest in boxes, originally in tree holes, are the members of the genus *Tachycineta*, the violet-green swallow, *T. thalassina*, of the western states and provinces, and the widely distributed tree swallow, *T. bicolor*, which is steel blue or green above and pure white below. It is able to winter farther north than any of the other species, since after insects have disappeared for the season, tree swallows feed heavily on bayberries and other small fruits. Superficially similar to the bank swallow and also a nester in holes in banks, but less gregarious, is the northern rough-winged swallow, *Stelgidopteryx* *serripennis*. Two species that construct nests composed of little mud pellets are the cliff swallow, *Hirundo pyrrhonota*, whose nests, often placed in rows on the outside walls of barns near the eaves, are closed and flask-shaped, and the cave swallow, *H. fulva*, whose nests are open at the top; the latter is a tropical species that reaches the southeastern United States. (www.cnet.windsor.html)

Bird's Nest

Since thousands of years ago, the kings and the noble of China has been interested to consumed swallow's nest. (Figure 2)

Bird's nest is a Chinese delicacy that has been claimed by Chinese of centuries to be an effective health-giving tonic. The 'nest' in itself is made by swifts (bird) form a nourishment-rich gel secretion which modern research has revealed to contain a number of health promoting qualities. (www.swallowbirdnest.com)

Figure 2. The Swallow's Nest

The swift lets build their saucer-shaped nests in dark caves usually on the rock surface or deep crevices, thus making harvesting them a precarious task. Then, there are also bird's nests that are cultivated in birdhouses and harvesting them is a much easier task. For thousands of years, bird's nests are traditionally known as the best nutritious tonic food. It is an ideal supplement for people suffering from digestive problems. Helps strengthen lungs, clears phlegm and relieves coughs. A trusted tonic for nurturing and rejuvenating the skin for all ages. In ancient times, women folks had used bird's nests as a tonic food for maintaining their beauty and youthfulness. (Figure 3)

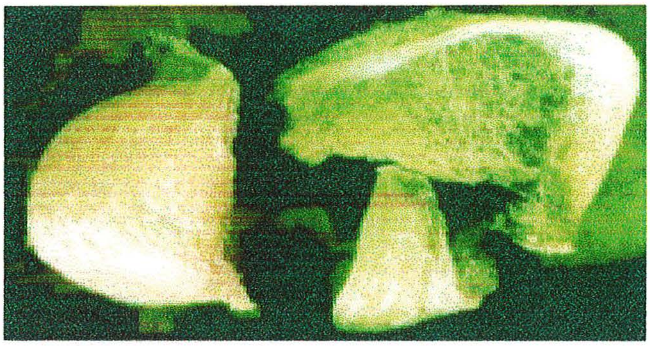


Figure 3. Bird's Nest

Bird's nest is pleasant on the palate, contains plenty of nourishment and possesses what the Chinese call "rejuvenating effects". Modern science has help ascertain the age-old belief that bird's nest contains a host of different proteins (so essential to life), vitamins and various other minerals. Research has also found that bird's nest contains the epidermal growth factor. This helps explain why Chinese herbalists often prescribe bird's nest to people who fail to thrive or grow for no apparent reason.

Independent laboratory investigation has also revealed that bird's nest contains a water-soluble glyco-protein that promotes cell division within the immune system. These findings lend support to the belief that bird's nest promotes growth and tissue repair. Not only that, bird's nest strengthens the body's self-regulating actions and provides resistance to disease. (www.natural.com)

Until now the Chinese still consume it because there are a lot of advantage by consuming swallow's nest, for example:

1. To speed up blood circulation and to refine skin.
2. Strengthen our lungs
3. Maintain our health
4. Also the Chinese have a belief that by consuming swallows nest can make them to remain young. (www.swallowbirdnest.com)

Alginate

Source

Alginates (E400-E404) are produced by brown seaweeds (*Phaeophyceae*, mainly *Laminaria*).

History

Alginic acid, a phycocolliod, was discovered in 1883 by E. C. C. Stanford, a British pharmacist who called it algin. In seaweeds, algin is present as a mixed salt of sodium and/or potassium, calcium and magnesium. The exact composition varies with algal species. Since Stanford discovered algin, the name has been applied to a number of substances, e.g. Alginic acid and all alginates, derived from Alginic acid. A compound called Fucin has been reported in the past but there is no distinction between it and Alginic acid.Commercial production of alginates did not begin until Kelco, now a division of Merck, was founded in 1929 in California. Since then the alginate industry has grown with major producers being the United States, the United Kingdom, Norway, Canada, France, Japan and China.

Extraction and Processing

Alginate can be obtained from fresh (wet) or dry material. The preparation of the pure material is said to be difficult and firms do not reveal their techniques. Lewis, Stanley and Guist (1990) describe the typical alginate manufacturing process (figure 4). In this process insoluble alginate salts in the seaweed may be converted with alkali to sodium alginate, which is readily soluble in water. Further dilution of the mixture with fresh water causes the algal cell structure to break down and release the sodium alginate into solution. Insoluble seaweed particles are then separated from the sodium alginate solution by standard solid-liquid clarification techniques such as centrifugation. Alginate is then recovered from the clarified sodium alginate solution by various techniques including precipitation with calcium chloride or sulfuric acid, electrolysis, or direct drying. Alginic acid is subsequently neutralized with appropriate cation bases, then dried and milled to produce the final product. (www.uct.ac.zu)

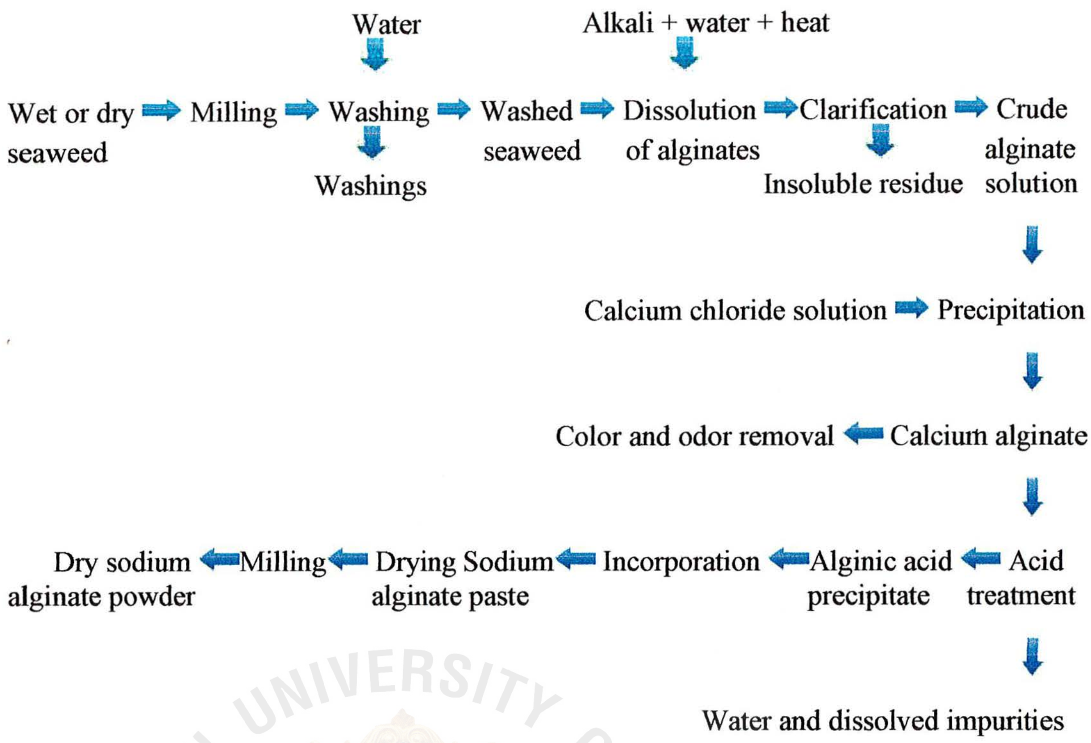


Figure 4: Typical alginate manufacturing process.

Molecular structure

Structural unit

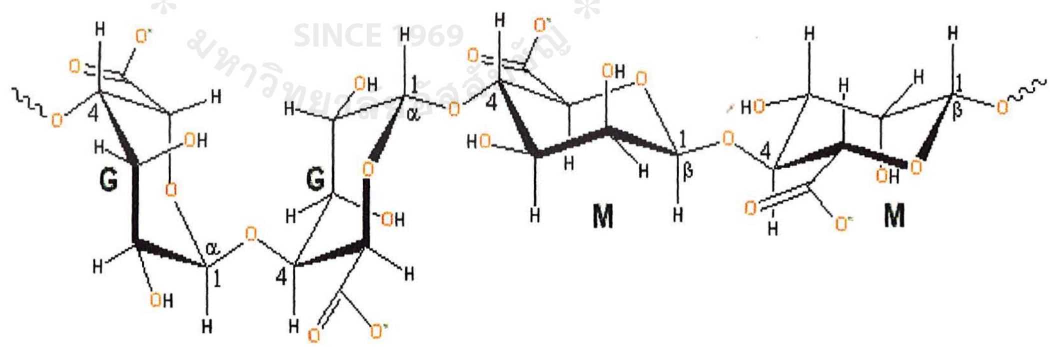


Figure 5: Structure of Alginate

Alginates are linear unbranched polymers containing β-(1→4)-linked D-mannuronic acid (M) and α-(1→4)-linked L-guluronic acid (G) residues. Although these residues are epimers (D-mannuronic acid residues being enzymatically converted to L-guluronic after polymerisation) and only differ at C5, they possess very different conformations; D-mannuronic acid being $^{4}C_{1}$ with diequatorial links between them and L-guluronic acid being $^{1}C_{4}$ with diaxial links between them. Bacterial alginates are additionally O-acetylated on the 2 and/or 3 positions of the D-mannuronic acid residues. The bacterial O-acetylase may be used to O-acetylate the algal alginates, so increasing their water binding. (Figure 5) (www.sbu.ac.uk/water/hyalg.html)

Alginic acid is a complex organic compound composed of D-mannuronic acid and L-guluronic acid monomers .

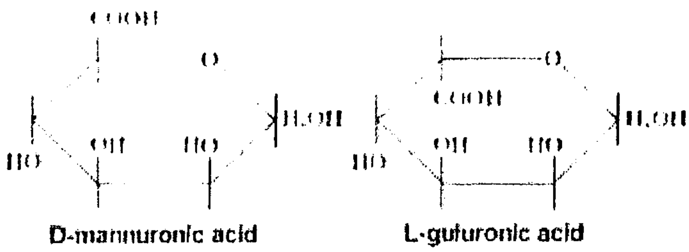


Figure 6: Monomer structure of alginate

Alginic acid polymers occur as three types, depending on the algae from which they are extracted. One type consists entirely of D-mannuonic acid units; a second type consists entirely of L-guluronic acid units; and the third type alternates D-mannuronic acid and L-guluronic acid units. (Figure 6)

— M — M — M — M — M — — G — G — G — G — G — — M — G — M — G — M

Figure 7: Structure of Alginic acid polymers

The chain arrangement is of the greatest importance, because it provides strength for the molecule and is responsible for the power of forming fibers. Various seaweeds have different proportions of the three types of Alginic acid polymers. (Figure 7) (www.uct.ac.zu)

Alginates are not random copolymers but, according to the source algae, consist of blocks of similar and strictly alternating residues (i.e. **MMMMMM, GGGGGG** and **GMGMGMGM**), each of which have different conformational preferences and behaviour. They may be prepared with a wide range of average molecular weights (50 - 100000 residues) to suit the application. (Figure 8)

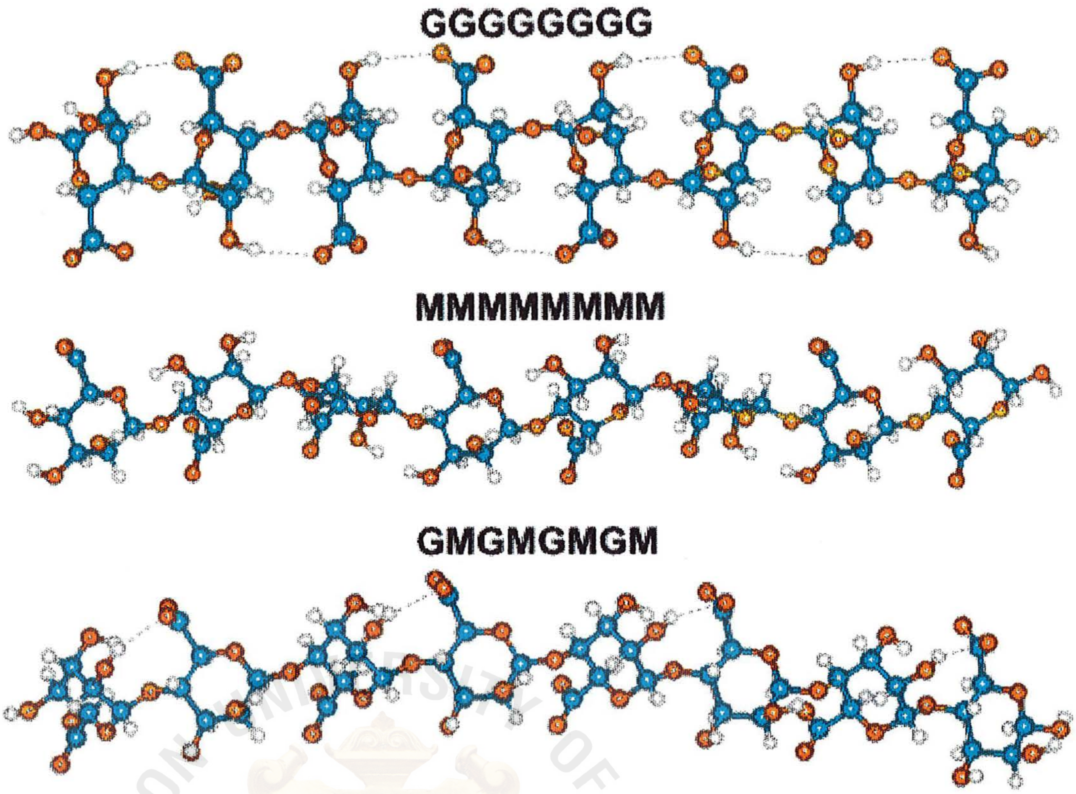


Figure 8: Molecular structure of Alginate

Poly β-(1→4)-linked D-mannuronate prefers forming a 3-fold left-handed helix with (weak) intra-molecular hydrogen bonding between the hydroxyl group in the 3 positions and the subsequent ring oxygen (i.e. O3-H→O'). Poly α-(1→4)-linked L-guluronate forms stiffer (and more acid-stable) 2-fold screw helical chains, preferring intra-molecular hydrogen bonding between the carboxyl group and the 2-OH group of the prior residues and (weaker) the 3-OH group of the subsequent residues. Alternating poly α-(1→4)-linked L-guluronate-β-(1→4)-linked D-mannuronate contains both equatorial-axial and axial-equatorial links and take up dissimilar rather disorderly conformations. They have hydrogen bonds between the carboxyl group on the mannuronate and the 2-OH and 3-OH groups of the subsequent guluronate but the differing degrees of freedom of the two residues gives greater overall flexibility than the poly β-(1→4)-linked D-mannuronate chains. The free carboxylic acids (without countering) have a water molecule H_3O^+ firmly hydrogen bound to carboxylate. Ca^{2+} ions can replace this hydrogen bonding, zipping guluronate, but not mannuronate, chains together stoichiometrically in a supposedly egg-box like conformation (the ions being the eggs in the puckered box formed by sequential saccharides; the box possibly consists of six oxygen ligands from the 2-OH and 3-OH plus a carboxylate oxygen of the subsequent residue, supplied by each poly-guluronate chain) with 7th and 8th ligands from the (1→4)-O-linkages slightly further away. The chains are stabilized by hydrogen bonding between the other carboxylate oxygen and 2-OH groups on the subsequent residues. Poly-guluronate has specific binding sites for calcium consisting of five oxygen ligands from the 2-OH and 3-OH, (1→4)-O-linkage and carboxylate and ring oxygen of the subsequent residue, so holding the calcium ready for this junction zone formation. This junction zone optimally requires 10-12 residues (depending on parameterisation) to form half a complete revolution (as optimised using the AMBER-96 force field [313]) of the parallel left-handed double helix and consequent permanent junction zone formation. Interactions with further poly-guluronate segments favour an unwound sheet-like structure; the winding -unwinding only requiring changes in the anomeric linkage angles (ϕ and Ψ) of about 10° whilst retaining the hydrogen bonding and ionic linkages. Curiously, calcium poly-guluronate also forms a (only slightly less) stable parallel right-handed helix (f and y further changing by about 10°) of about the same number of residues per helix where the calcium ions sit in a pocket approximately equispaced. From 10 oxygen ligands (from the 2-OH and 3-OH, (1→4)-O-linkage and a carboxylate and ring oxygen of the subsequent residue from both chains). Where hydrogen bonds is found from alternative carboxyl groups and both the prior 2-OH group and the 3-OH group of the prior residues on the parallel strand. Under similar conditions, poly-mannuronic acid blocks take up a less-gelling ribbon conformation, where carboxylate groups on sequential residues may bind calcium intra- or inter-molecularly. (www.sbu.ac.uk/water/hyalg.html)

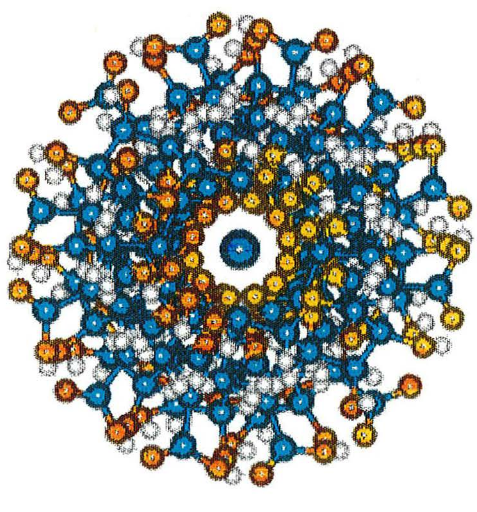


Figure 9: Calcium poly-α-L-guluronate

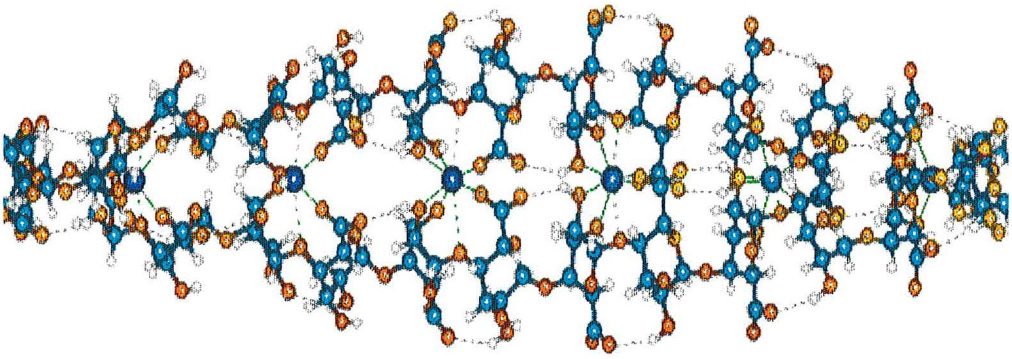


Figure 10: The hydrogen bonding and calcium binding sites.

'Designer' alginates may be available in the future by the 5-epimerization of β-(1→4)-linked D-mannuronic acid residues to α-(1→ 4)-linked L-guluronic acid residues in algal alginates using bacterial epimerases. An available natural alternative is to harvest the seaweed from exposed seaboards (more **G** giving the kelp strength) or sheltered bays (more **M**). (Figure 9-10) **(www.sbu.ac.uk/water/hyalg.html)**

Functionality

The primary function of the alginates are as thermally stable cold setting gelling agents in the presence of calcium ions; gelling at far lower concentrations than gelatine. Such gels can be heat treated without melting, although they may eventually degrade. Gelling depends on the ion binding ($Mg^{2+} << Ca^{2+} < Sr^{2+} < Ba^{2+}$) with the control of the dictation addition being important for the production of homogeneous gels (e.g. by ionic diffusion or controlled acidification of $CaCO_3$). High G content produces strong brittle gels with good heat stability (except if present in low molecular weight molecules) but prone to water weepage (syneresis) on freeze-thaw, whereas high M content produces weaker more-elastic gels with good freeze-thaw behaviour. However, at low or very high Ca^{2+} concentrations high M alginates produce the stronger gels. So long as the average chain lengths are not particularly short, the gelling properties correlate with average G block length (optimum block size ~12; see also the similarity to pectin gelling) and not necessarily with the M/G ratio, which may be primarily due to alternating MGMG chains. The future prospects are excellent as recombinant epimerases with different specificities may be used to produce novel designer alginates.

Alginate's solubility and water-holding capacity depend on pH (precipitating below about pH 3.5), ionic strength (low ionic strength increasing the extended nature of the chains) and the nature of the ions present. Generally alginates show high water absorption and may be used as low viscosity emulsifiers and shear-thinning thickeners. They can be used to stabilize phase separation in low fat fat-substitutes e.g. as alginate/caseinate blends in starch three-phase systems. Alginate is used in pet food chunks, onion rings, stuffed olives and pie fillings.

Algal, but not bacterial, alginates can also add L-guluronic acid residues directly to the biosynthesising chains. (www.sbu.ac.uk/water/hyalg.html)

Properties

Sodium, Potassium and Magnesium salts of Alginic acid are soluble in water, the other salts are insoluble. Almost all-metallic salts of Alginic acid react with Ammonia forming double salts. These salts are soluble in water. By adding Calcium ions to an aqueous solution of Alginic acid, the solution changes to a semi-solid state by forming the Calcium salt of alginate, Calcium alginate. The gel thus formed consists of 99.0-99.5% water and 0.5-1.0% Calcium alginate. From the technical point of view, the importance of Alginic acid lies in the properties of its salts, although the acid itself is of interest because of its capacity to absorb 200-300 times its weight in water.

Water solutions of alginate are strongly viscous, even at a 1-% solute concentration, and the viscosity increases logarithmically in accordance with an increase in concentration. The viscosity of an alginate solution change according to the degree of polymerization of the alginate molecule, which can be adjusted, too specific requirements during the manufacturing, process. The viscosity can be reduced by increasing the temperature of the solution and can also be affected by the addition of electrolytes. The viscosity is greatly affected by the addition of small amounts of sodium salts in which case the viscosities are constant between pH 5 and pH 10. Below pH 4.5 the viscosity increases and precipitation occurs below pH 3. The various alkali solutions are tasteless, odorless and almost colorless. (www.uct.ac.zu)

Thickening, Stabilizing, Film Forming, and Gelling

Typically, sodium alginates are used for their gelling, thickening, stabilizing and film forming properties at concentrations of 0. 1 to 1.0%. Sodium alginate is used to thicken aqueous solutions and forms gels in both cold and hot food systems. It is stable over the pH range of 3.5 - 7.

Stable in Acid Conditions

Propylene glycol alginates have enhanced stability to acid conditions. They are therefore, used to thicken and stabilize low pH foods in the range 0f 2.8-7.0.

Emulsifying and stabilizing

As a result of the ester group, propylene glycol alginates have secondary emulsifying characteristics and are used to enhance the stability of oil-in-water emulsions.(www.admix.com/Alginate.htm)

Use of Hydrocolloids in gelled Foods

Alginates can also be used to make fruit-flavored dessert gels, but this has to be done under carefully controlled conditions whereby soluble sodium alginate is reacted with a calcium salt to give a homogeneous gel. In order to make a good alginate gel, it is essential to balance four components of the system within very narrow limits of tolerance. These are:

1. Type and concentration of sodium alginate;
2. Type and concentration of slowly soluble calcium salt;
3. Type and concentration of sequestrate for control of polyvalent cations;
4. Acid-buffer system to control pH.

Hydrocolloid	Solubility		Affected by electrolytes	Effect of heat	Gelling mechanism		Special condition	Type of texture	Appearance	Application
	Hot	Cold			Thermal	Chemical				
Gelatin	X		No	Melts RT	X			Tender, elastic	Clear	Dessert, Conflection Canned meat
Agar	X		No	Can withstand autoclaving	X			Firm, brittle	Clear	Canned meat Conflection bakery icing
Carrageenan	X		No	No melt at ambient tem.	X		Need K^+ for gelling	Brittle	Clear	Dessert, Canned food Pudding
Furcellaran	X		No		X		Need K^+ for gelling	Brittle water gel	Clear	Dessert, Pudding
Sodium Alginate		X	Yes	No melting irreversible		X	React to Ca to gel	Brittle	Clear	Dessert, Pudding
Pectin	X		No		X		Need sugar and acid to gel	Spreadable	Clear	Jam Jellies
Starches	X		Yes	Retrograde on storage	X			Spreadable to soft rigid texture	Cloudy Opaque	Dessert, Pudding

Table 1: HYDROCOLLOID GELLING SYSTEMS

Since this type of gel is chemically set, it is not thermo reversible. The gel does not melt in the mouth but breaks up and disintegrates upon eating. In well-formulated products, this textural deficiency can be minimized so that it is not too noticeable; buy in all types of alginate desserts the flavor release is poor because of this non-melting character.

As the control of calcium ions is critical to the preparation of the gel, in areas where the hardness of the water varies widely, such as in the United States, it is almost impossible to formulate alginate dessert gels that can be prepared in homes all over the country with similar acceptable results. A few years ago, a major company started to market a quick setting alginate based dessert called Insta-Jel. It was an excellent product, but unsuccessful because of difficult in certain areas. A successful alginate dessert mix product is being marketed today in Mexico under the Pronto tradename. This is not a quick-setting recipe however, but require a boiling water preparation and a fairly long setting time. (Glicksman ,1979)

Industrial applications

Alginates Product

Alginic acid, its salts and esters are derived from selected varieties of brown seaweed. The sodium salt is the most widely used in the food industry. The reaction of alginates with calcium ions to form gels is used throughout the industry to texturize and stabilize many food products. (www.admix.com/Alginate.htm)

Sodium alginates can be used to produce a wide range of reformed fruit and vegetable products such as cherries, potatoes, peppers and mushrooms. Different alginate products are available to impart a variety of textures. (www.seaweed.ucg.ie/seaweed.html)

Bakery

Sodium alginates or algin performance blends are used to produce high quality bakery goods. Fillings with good bakefast properties, excellent flavor release, and a variety of textures can be prepared. Our diverse line of performance blends is well suited to both dairy and fruit-based fillings. They impart such functions as texture modification, moisture retention, bake stability, and freeze-thaw stability. Fillings can be made up hot or cold. In fruit preparations, sauces and toppings, sodium alginates provide thickening and enhance shelf stability. Fillings can be made up hot and cold. In icings and glazes, sodium alginates enhance moisture binding properties, modify texture, and improve freeze-thaw stability.

Meat and Fish Products

Sodium alginates provide excellent binding and gelling properties in structured meat and fish products. In these products, binding is retained under retort conditions, natural meat flavors are not masked and good color is maintained.

Other Foods

Other applications for sodium alginates include: Low fat spreads, hot and cold milk flans and puddings, gelled desserts, coatings batters, sauces and marinades, ice cream, whipped creams, syrups and toppings. Alginates are used in canned pet food to give retort-stable meat chunks. (www.admix.com/Alginate.htm)

Main Applications

- Dairy:
  - Creams and whipped creams
  - Dessert creams
  - Mixes for dessert creams
  - Processed cheese
  - Ice Creams

- Powder products
  - Baking bakery creams
  - Batter mix
  - Béchamel sauce

- Restructured products:
  - Meat, fruits, vegetables, fishes (internal/external gelation)

- Technical applications:
  - Textile (color fixing)
  - Welding rods
  - Water treatment
  - Cosmetics (masks, dental prints)

Fabricated Food

The use of hydrocolloid gelling agents has been particularly effective in the area of fabricated foods, where it is required to form and fix various shaped and textured foods. A few of these products will be discussed to illustrate some of the novel uses of food polysaccharides.

Alginates have been effectively employed in making spun alginate-protein fibers; in the fabrication of vegetable protein fibers for use in making fibrous meat analogues of beef, chicken, etc. By forcing a solution of sodium alginate through fine spinnerets into a solution of a soluble calcium salt, a fine thread or fiber is instantly formed, bundles of which can be compressed and compacted to form meat-like chunks.

By incorporating protein into the alginate solution before spinning, protein fibers can be formed from denatured, inactive, nonfunctional protein materials. This technique has been used successfully and is described in the patent literature. This process uses sodium alginate or low methoxyl pectin in combination with various protein meals, which is extruded into a calcium acetate bath to form alginate-protein fibers. By incorporating aluminum salts before spinning the alginate-protein fibers, the protein fibers can be further modified to withstand boiling in salt water. An Additional modification makes use of a mixture of alginate, carrageenan, peroxide and soy flour to yield a modified spun protein fiber when extruded into an aqueous calcium chloride bath.

A more recent system used to form fibers without spinning is based on carboxymethyl guar or carboxymethyl locust bean. These gum solutions react with solutions of calcium salts to form large sac-like precipitates, which are subjected to vigorous mixing and agitation. This action ruptures or severs the sac-like precipitates to form fibrous gel-like masses resembling crabmeat in texture and appearance. This fibrous material can be formulated into a variety of foods where a texture is desired that is similar to breakfast sausage, hamburger, crabmeat salad or chicken loaf. While these fibrous sacs are essentially composed of non-nutritive carbohydrate polymers, there is no reason why pertinacious materials cannot be incorporated into the gum solutions before reacting with calcium salts to form the same type of fibrous masses for use as a textures protein material. (Whistler Roy and James, 1993)

Commercial alginate gel restructured products (Imeson, 1992)

Among the restructured products already on the market are following:

- Onion rings
- Pimiento olive fillings
- Anchovy olive fillings

- Apple pieces for pie fillings
- Cocktail berries
- Meat chunks for pet food
- Shrimp-like fish products
- Fish patties

All the product examples mentioned above have one thing in common; they utilize the specific properties of alginate to obtain shape control. Alginate offers controlled gelling, even at temperatures close to freezing, it gives complete heat resistance and freeze-thaw stability, and it provides the desired mechanical strength. The amount of alginate needed is usually between 1 and 2% of the final product weight. Some recipe examples are given here.

Restructured onion rings

Ingredients

Alginate (fine mesh, high viscosity, high gel strength)	8.2 g.
Wheat flours	126.4 g.
Salt (NaCl)	1.4 g.
Onion power (16 mesh grade)	159.0 g
Distilled water	705.0 g
Total	1000 g.

Setting bath: Calcium chloride, $CaCl_2 .2H_2O$, 5%solution in water (2.51 setting bath per 1000.0 g onion mass)

Method

1. Mix the dried onion with 634 ml of the distilled water.
2. Allow rehydrating for approximately 1 h.

3. Thoroughly blend alginate, flour and salt to a dry mix.

4. When the onion is rehydrated, stir the onion mass into the rest of the water.

5. Prepare the setting bath

6. Extrude the onion mass through an annulus, and transfer to the setting bath where restructuring of the onion takes place.

Pimiento filling for olives

Ingredients

Alginate (standard mesh, high viscosity, high gel strength)	18 g.
Guar gum	10 g.
Pimiento pulp	300 g.
Water	672 g.
Total	1000 g.

Setting bath

Calcium chloride ($CaCl_2 .2H_2O$)	50 g.
Water	950 g.

Ripening brine

Calcium chloride ($CaCl_2 .2H_2O$)	30 g.
Sodium chloride	80 g.
Lactic acid	8 g.
Water	882 g.

Method

1. Alginate (gel former) and guar gum (thickener and water binder) are dissolved on the water and added to the pimiento pulp.

2. The mix is stirred for 2-3 minutes and extruded onto a conveyor belt.

3. The mix is formed to a sheet approximately 2-3 mm. Thick. This is done by feeding the pimiento mix between two rolls, which are lightly sprayed with calcium chloride to prevent the mix sticking to the rolls.

4. The conveyor belt runs into a setting bath of 5% calcium chloride. Calcium ions react with the alginate molecules and instantaneously form a heart stable gel.

5. The setting time depends on the thickness of the sheet. For a thickness of approximately 2-3 mm. This will take 10-15 min.

6. The pimiento sheets are stored in an ageing bath.

7. After storage the sheets are washed to remove excess calcium chloride. They now have a strong and non-brittle texture, allowing them to be cut, sharply bent and rapidly injected into pitted olives.

Materials and Methods

Materials

1. Rock sugar
2. Natural mineral sugar
3. Brown sugar
4. Pure refined sugar
5. Water
6. Calcium lactate
7. Sodium citrate
8. Citric acid
9. Algogel ®(V.MANE FILS (THAILAND) CO., LTD)

Apparatus

1. pH meter (Derver instrument model 15)
2. Hot plate (Veip scientific BT 11,4)
3. Digital Balance (OHAUS HR-200 Serial No.2302962)
4. Mixer machine (Cordless electric No. 2011707)

Method of Imitation Bird's nest drink:

The production of bird's nest drink was consisted of two parts, which were the gel formation and the drinking process.

The gel formation was consisted two fractions. The first fraction was mixture of sugar and sodium alginate. The second was mixture of calcium lactate. The both functions was slowly dropped into 1% cold calcium lactate to form gel and incubated for 20 minutes. The gel was separated from solution by filtration. Rinse the gel with water to remove traces of Calcium lactate.

After gel formation, gels were added into $10\,^{0}$ Brix syrup and adjust pH 6.5 and filled into the bottle. (Figure 11)

Dissolve sugar with sodium alginate in water.

↓

Dissolve calcium lactate, sodium citrate and citric acid in the solution.

↓

Slowly pour mixture into a 1% cold calcium lactate solution.

↓

Incubation for 20 minutes.

↓

Rinse the gel with water.

↓

Small broken gel mix is ready to be incorporated into the drink.

Figure11. The process flowchart of Bird's nest drink

Experiment

1. To study the proper ratio of water to the mixer in the making imitation bird's nest.

This experiment was determined the shape of imitation bird's nest by varying the ratios of water to sodium alginate as 7.5:1, 10:1, 12.5:1 and 15:1, respectively. The determination was sensory evaluation.

2. To study the optimum type of sugar in the making bird's nest.

This experiment was determined the color of imitation bird's nest by varying the types of sugar as pure refined sugar, rock sugar, natural mineral sugar and brown sugar. The determination was sensory evaluation.

3. To study the optimum ratio of sodium alginate in the making bird's nest.

This experiment was studied about the optimum ratio of G: M of the imitation bird's nest. There was divided into three experiments.

3.1 The first experiment, was determine the texture of the imitation bird's nest by varying between Sodium Alginate Manugel with Manucol (G: M) as following 100:0, 80:20, 60:40, 50:50, 40:60, 20:80 and 0:100, respectively. The treatments were determined by sensory evaluation. (Appendix B1)

3.2 The second experiment was varying the ratios of G to M as 60:40, 50:50, 40:60, 20:80 and 0:100, respectively. The treatments were determined by sensory evaluation. (Appendix B2)

3.3 The third experiment was varying the ratio of G to M as 50: 50, 40: 60 and 30: 70, respectively. The treatments were determined by sensory evaluation. (Appendix B3)

4. To study the marketing of the bird's nest.

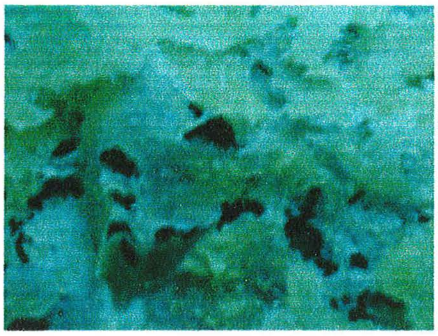
This experiment was comparing the acceptance of imitation bird's nest with commercial bird's nest by sensory evaluation. It was vary three commercial products of as bird's nest commercial A, commercial B and imitation bird's nest. The treatments were determined by sensory evaluation. (Appendix B4)

5. Analysis

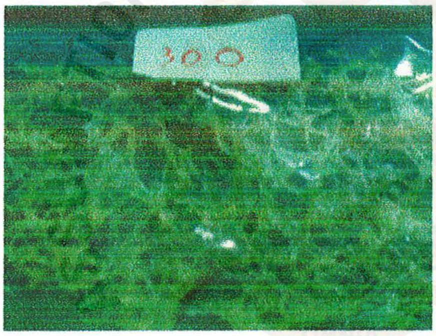
- Sensory evaluation (Appendix A1-3)
- Statistical analysis (Appendix B1-4)

Result and Discussion

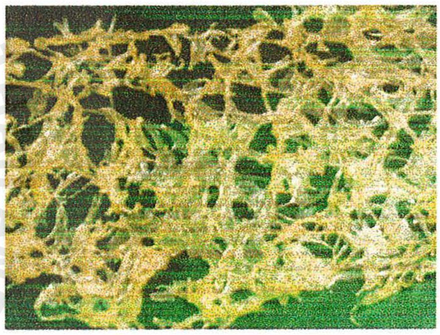
1. To study the optimum ratio of water to the imitation bird's nest.



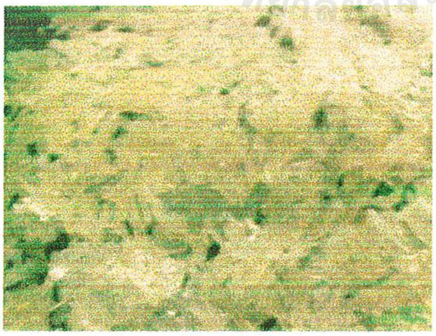
Reference (Crude brown seaweed)



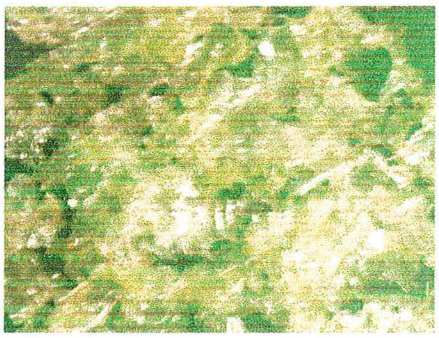
Ratio 7.5:1



Ratio 10:1



Ratio 12.5:1



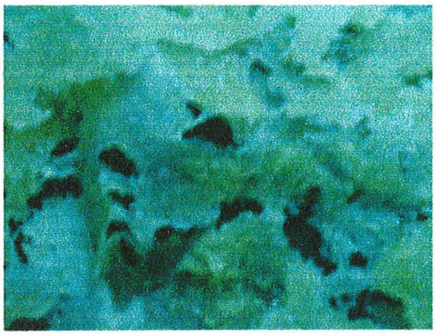
Ratio 15:1

Figure12: The varying ratios of water to sodium alginate in imitation bird's nest

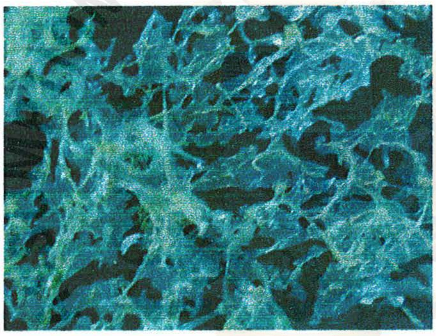
This experiment was studied the shape of gel formation by varying the ratio of water to sodium alginate .

From the result (figure 12), the gel shape of the ratio 7.5: 1 and 10: 1 were formed as fiber, not like a sheet. But the shape of ratio 12.5: 1 and 15: 1 were form as a sheet and similarly to reference which was dried seaweed. In the standard point of business view, the lower cost was the criteria factor for the selection of the treatment especially the volume of water. Therefore this experiment was selected the ratio as 12.5: 1 as the basis formula in the further experiment.

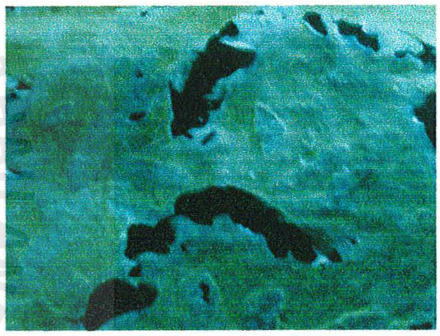
2. To study the optimum type of sugar in the imitation bird's nest.



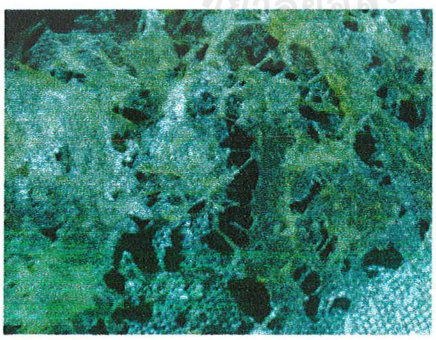
Reference (Crude brown seaweed)



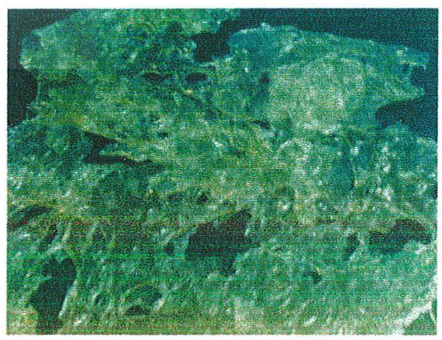
Pure Refined Sugar



Rock Sugar



Natural Mineral Sugar



Brown Sugar

Figure13: The various types of sugar in the imitation bird's nest

This experiment was studied the color of Bird's nest that it was varied type of sugar.

From this result (figure 13), the color of the pure refined sugar was too light, but the color of natural mineral sugar and brown sugar which were too brown. The color of rock sugar treatment was similarly to the reference more than others. Therefore this experiment was selected the rock sugar as the basis formula in the further experiment.

3. To study the optimum ratio of sodium alginate of the imitation bird's nest.

3.1 The 1st experiment of the various ratios of sodium alginate Manugel : Manucol (G:M)

Table 2: The sensory evaluation of the ratio of G: M for testing the attribute of imitation bird's nest.

Treatment G: M	Elastic	Gel strength	Shape	Overall Acceptance
100: 0	2.47^a	2.70^a	2.98^a	2.57^a
80: 20	3.30^a	2.87^a	3.16^a	3.29^a
60: 40	3.44^a	3.27^a	3.75^a	4.42^b
50: 50	4.79^b	5.36^b	5.03^b	4.54^b
40: 60	3.97^a	5.18^b	3.82^a	4.55^b
20: 80	3.91^a	4.91^b	3.29^a	4.49^b
0: 100	3.48^a	4.86^b	2.93^a	3.34^a

Note: Samples with different subscribe letters are significantly difference.

From the result (table 2), the result was inconsistency due to the panelists didn't familiar to the product. The G-alginate content produces strong brittle gels with heat stability (except if present in low molecular weight molecules) but prone to water weepage (syneresis) on freeze-thaw, whereas high M content produces weaker more-elastic gels with good freeze-thaw behaviour. (www.sbu. ac.uk/water/hyalg.html.). Thus the result were variable and significant difference at $\alpha = 0.05\%$. The manucol was increased, the elastic and gel strength was decreased and the shapes were more the globular heads. The shapes of ratio 50: 50 were not the globular heads,which like the reference. From the overall acceptance, the panelist preferred the ratio as 60: 40, 50: 50, 40: 60 and

20: 80, respectively. The project was selected these treatments for the further experiment.

3.2 The 2nd experiment of the various ratios of sodium alginate Manugel : Manucol (G:M)

Table 3: The intensity of elastic and gel strength in the ratio of G: M in .

Treatment G: M	Elastic	Gel strength
60: 40	5.93^{b}	4.82^{b}
40: 60	6.72^{b}	5.73^{b}
20: 80	3.09^{a}	2.33^{a}
0: 100	2.23^{a}	1.89^{a}
Reference	6.07^{b}	5.53^{b}

Note: Samples with different subscribe letters are significantly difference.

Table 4: The sensory evaluation of the ratio of G: M for testing the attribute of imitation bird's nest .

Treatment G:M	Texture	Shape	Overall Acceptance
60: 40	5.95^{b}	6.00^{b}	5.57^{b}
40: 60	6.17^{b}	6.17^{b}	5.65^{b}
20: 80	5.76^{b}	3.67^{a}	5.50^{b}
0: 100	4.33^{a}	3.58^{a}	4.42^{a}
Reference	6.25^{b}	6.25^{b}	5.67^{b}

Note: Samples with different subscribe letters are significantly difference.

From the result (table 3-4), this experiment was selected four ratios as 60: 40, 40: 60, 20: 80 and 0: 100, respectively which the panelists were more preferred for comparison with the reference product. The result were variable and significant difference at α = 0.05%. The manucol was increased; the elastic and gel strength was decreased and the shapes were more the globular heads. The shapes of ratio 40: 60 were less the globular heads. The panelists preferred in all attributes at ratio 60: 40 and 40: 60 which were similar to reference. The project was selected these treatments for the further experiment.

3.3The 3th experiment of the various ratios of sodium alginate Manugel : Manucol (G:M)

Table 5: The intensity of elastic and gel strength in the ratio of G: M in.

Treatment G:M	Elastic	Gel strength
50: 50	6.17^b	6.29^b
40: 60	6.03^b	5.87^b
30: 70	5.64^b	5.86^b
Reference	6.19^b	6.27^b

Note: Samples with different subscribe letters are significantly difference.

Table 6: The sensory evaluation of the ratio of G: M for testing the attribute of imitation bird's nest.

Treatment G:M	Texture	Shape	Overall Acceptance
50: 50	6.27^b	6.27^b	6.47^b
40: 60	5.60^b	5.47^b	5.93^b
30: 70	5.13^a	5.00^a	5.30^a
Reference	6.33^b	6.40^b	6.53^b

Note: Samples with different subscribe letters are significantly difference.

From the result (table 5-6), this experiment was, selected three ratios as 50: 50, 40: 60 and 30: 70, respectively. Which the panelists were more preferred for comparison with the reference product. The result significant difference at $\alpha = 0.05\%$. The manucol was increased; the elastic and gel strength was also decreased and the shapes were more the globular heads. The shapes of ratio 50: 50 were not the globular heads. The manucol was increased, the shape were more the globular head. Thus the best overall acceptance was 50: 50 it show the overall acceptance at 6.47^b, The panelist's preferred the ratio as 50: 50 and 40: 60. but nearly the Reference is 50: 50. The project was selected these treatments for the further experiment.

4. To study the marketing of the bird's nest.

Table 7: Sensory evaluation of the marketing test of bird's nest

Treatment	Overall Acceptance
Commercial A	6.25[b]
Commercial B	5.67[a]
Imitation bird's nest	6.20[b]

Note: Samples with different subscribe letters are significantly difference.

From the result (table 7), There was determined the marketing test of bird's nest which were commercial A, B and project's Treatment. The panelists were accepted in then sample and the treatment was similarly to commercial. The panelist's similarly the imitation bird's nest from this project.

Conclusion

1.The optimum ratio of water is 12.5: 1.

2.The optimum color makes from the rock sugar.

3.The optimum ratio between sodium alginate manugel (G) with manucol (M) is 50:50.

4.The panelist's similarly the imitation bird's nest from this project.

Reference

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Appendix

Appendix A
Questionnaire

Table.A1

Questionnaire for Bird's nest

Name: I.D.:

Date:

- Please evaluate the attribute of these seven samples.
- Taste the samples in the order indicated and evaluate the attribute of the samples, which has the least intensity of attribute to the greatest intensity of attribute in each samples.
- Place a check on the scale below indicating your evaluation for each sample from the left to the right.

Attribute

Elastic ________________________________

Gel strength ________________________________

Shape ________________________________

Overall ________________________________

Comment;

____

____

Table.A2

Questionnaire for Bird's nest

Name: I.D.:

Date:

- Please evaluate the attribute of these seven samples.
- Taste the samples in the order indicated and evaluate the attribute of the samples, which has the least intensity of attribute to the greatest intensity of attribute in each samples.
- Place a check on the scale below indicating your evaluation for each sample from the left to the right.

Attribute

Elastic ______________________________

Gel strength ______________________________

- Please taste these samples. Rinse your month every time before taking

different samples. Please score these samples according to your preference as these following:

9 Extremely like

8 Very like

7 Moderately like

6 Slightly like

5 Neither likes nor dislike

4 Slightly dislike

3 Moderately dislike

2 Very dislike

1 Extremely dislike

Sample No.	Shape	Taste	Overall

Comment;

____

____

Table.A3

Questionnaire for Bird's nest

Name: I.D.:
Date:

- Please evaluate the attribute of these three samples.
- Taste the samples in the order indicated and evaluate the attribute of the samples, which has the least intensity of attribute to the greatest intensity of attribute in each samples.
- Place a check on the scale below indicating your evaluation for each sample from the left to the right.

Attribute

Overall ______________________________

Comment;

____

____

Appendix B

Statistical Analysis

Table B1.Statistical analysis of the variation of sodium alginate: 3.1test(α=0.05)

ANOVA: Elastic

SOV	df	SS	MS	F_0	F_{table}
SST	6	288.52	48.09	11.74	2.25**
SSE	63	258.00	4.10		
TOTAL	69	546.52			

ANOVA: Gel strength

SOV	df	SS	MS	F_0	F_{table}
SST	6	344.90	57.48	13.73	2.25**
SSE	63	263.70	4.19		
TOTAL	69	608.60			

ANOVA: Shape

SOV	df	SS	MS	F_0	F_{table}
SST	6	311.80	51.97	11.71	2.25**
SSE	63	279.49	4.44		
TOTAL	69	591.29			

ANOVA: Overall Acceptance

SOV	df	SS	MS	F_0	F_{table}
SST	6	256.39	42.73	12.01	2.25**
SSE	63	224.15	3.56		
TOTAL	69	480.54			

Table B2.Statistical analysis of the variation of sodium alginate: 3.2test(α=0.05)

ANOVA: Elastic

SOV	df	SS	MS	F_0	F_{table}
SST	4	247.15	61.79	62.89	2.25**
SSE	55	54.04	0.98		
TOTAL	59	301.19			

ANOVA: Gel Strength

SOV	df	SS	MS	F_0	F_{table}
SST	4	192.21	48.05	77.46	2.25**
SSE	55	34.12	0.62		
TOTAL	59	226.32			

ANOVA: Texture

SOV	df	SS	MS	F_0	F_{table}
SST	4	94.98	23.75	19.86	2.25**
SSE	55	65.75	1.20		
TOTAL	59	160.73			

ANOVA: Shape

SOV	df	SS	MS	F_0	F_{table}
SST	4	150.93	37.73	34.88	2.25**
SSE	55	59.50	1.08		
TOTAL	59	210.43			

ANOVA: Overall Acceptance

SOV	df	SS	MS	F_0	F_{table}
SST	4	112.98	28.25	16.34	2.25**
SSE	55	95.08	1.73		
TOTAL	59	208.07			

Table B3.Statistical analysis of the variation of sodium alginate: 3.3test(α=0.05)

ANOVA: Elastic

SOV	df	SS	MS	F_0	F_{table}
SST	3	21.66	7.22	21.59	2.25**
SSE	56	18.73	0.33		
TOTAL	59	40.39			

ANOVA: Gel Strength

SOV	df	SS	MS	F_0	F_{table}
SST	3	19.14	6.38	29.26	2.25**
SSE	56	12.21	0.22		
TOTAL	59	31.35			

ANOVA: Texture

SOV	df	SS	MS	F_0	F_{table}
SST	3	40.33	13.44	29.41	2.25**
SSE	56	25.60	0.46		
TOTAL	59	65.93			

ANOVA: Shape

SOV	df	SS	MS	F_0	F_{table}
SST	3	48.18	16.06	31.82	2.25**
SSE	56	28.27	0.50		
TOTAL	59	76.45			

ANOVA: Overall Acceptance

SOV	df	SS	MS	F_0	F_{table}
SST	3	34.98	11.66	22.67	2.25**
SSE	56	28.80	0.51		
TOTAL	59	63.78			

Table B4.Statistical analysis of the variation of marketing of Bird's nest: (α=0.05)

ANOVA: Overall Acceptance

SOV	df	SS	MS	F_0	F_{table}
SST	2	24.74	12.37	47.94	2.25**
SSE	75	19.35	0.26		
TOTAL	77	44.09			