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APPENDICES

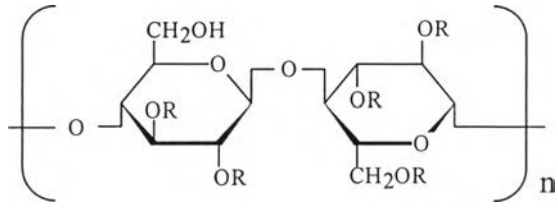
Appendix A

Physicochemical Properties of Substances

1. Polymer

1.1 Hydroxypropyl Methylcellulose (HPMC) (Kibbe, 2000)

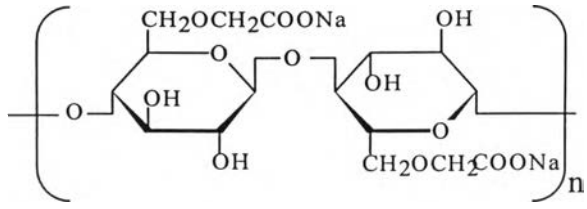
Nonproprietary Names:
USP : Hydroxypropyl Methylcellulose 2208,2906,2910
BP : hypromellose
Function Categories
USP : Suspending and/or viscosity-increasing agent ; Tablet binder, coating agent
BP : Viscosity-increasing agent; adhesive anhydrous ointment ingredient
Others: Film former; emulsion stabilizer
Synonyms: Methyl hydroxypropylcellulose; propylene glycol ether of methylcellulose; methylcellulose propylene glycol ether
Chemical formulation: $C_8H_{15}O_6$ - $(C_{10}H_{18}O_6)_n$ - $C_8H_{15}O_6$
Molecular weight range:10,000-1,500,000
Structure formula:



Where R is HCH_3 or $[CH_3CH(OH)CH_2]$

General appearance: Hydroxypropyl methylcellulose is an odorless and tasteless, white or creamy-white colored fibrous granular powder.
Acidity/Alkalinity: The pH of 1%w/v aqueous solution is 5.5-8.0.
Solubility: Hydroxypropyl methylcellulose is soluble in cold water, forming a viscous colloidal solution, insoluble in alcohol, ether, chloroform, but soluble in mixtures of methyl alcohol and methylene chloride.
Safety: Hydroxypropyl methylcellulose is widely used as an excipient in oral or topical pharmaceutical formulations. It is also extensively used in cosmetics and food products. Hydroxypropyl methylcellulose is generally regarded as high safety a nontoxic and nonirritant material although excessive oral consumption may have a laxative effect.

1.2 Carboxymethyl Cellulose Sodium (Kibbe, 2000)
Synonyms: CMC sodium, SCMC, Sodium CMC, Akucell, Cekol
Chemical name: Cellulose, Carboxymethyl ether, Sodium salt
Molecular formulation: $[C_6H_7O_2(OH)_{3-x}(OCH_2\text{-}COONa)_x]_n$
Molecular weight: Molecular weight range: 90,000-700,000
Structure formula:



Appearance: Carboxymethylcellulose sodium occurs as a white to almost white colored, odorless, granular powder
Solubility: Carboxymethylcellulose sodium is practically insoluble in acetone, ethanol, ether and toluene. Easily dispersed in water at all temperatures, forming clear, colloidal solutions. The aqueous solubility varies with the degree of substitution.
Melting point: Carboxymethylcellulose sodium is browns at 252° C , chars at approximately 252° C
Dissociation constant: The pKa of carboxymethyl cellulose sodium is 4.30
Safety: Carboxymethylcellulose sodium is used in oral, topical and some parentral formulations. It is also widely used in cosmetics, toiletries and food products and is generally regared as a nontoxic and nonirritant material. However, oral consumption of large amounts of carboxymethylcellulose sodium can have laxative effect; therapeutically, 4-10 g in daily divided doses of the medium and high viscosity grades of carboxymethylcellulose sodium have been used as bulk laxatives.

2. Solubilizer

2.1 TWEEN 20

Trade Name: TWEEN 20
Chemical Description: Polyoxyethylene (20) sorbitan monolaurate, Polysorbate 20
Product Summary: Cleansing agent. Solubilizer
Physical Appearance: Yellow Liquid
Chemical Family: Non-ionic
HLB Value: 16.7
Solubility: soluble in water, low concentration of propylene glycol and isopropyl alcohol

2.2 Poloxamer 188(Pluronic F-68)
Structure of Polyoxyethylene-polyoxypropylene block copolymer of the general Formula :

$$HO\text{-}(CH_2\text{-}CH_2\text{-}O)_x\text{-}(CH_2\text{-}\underset{\displaystyle CH_3}{\underset{|}{CH}}\text{-}O)_y\text{-}(CH_2\text{-}CH_2\text{-}O)_x\text{-}H$$

Where x= approx. 79 and y = approx. 28; proportion of weight of polyoxyethylene is approx. 80%.
Description:White to slightly yellowish waxy substance in the form of micropearls; weak odor.
Application: Used as an emulsifying agent in intravenous fat emulsions, and as solubilizing agent to maintain the clarity of elixirs and syrups. May also be used

as a wetting agent in eye drops, ointments, suppository bases, gels, and as tablet binders and coatings.
Solubility: Readily soluble in ethanol, dissolves readily in water to give an opalescent solution, and is insoluble in diethyl ether, paraffin and fatty oils.
Storage/Stability: Meets specification after at least 2 years stored in the unopened original containers at room temperature.

2.3 Cremophor RH 40

Generic name: Polyoxyl 40 Hydrogenated Castor Oil (USP/NF).
Chemical nature: Cremophor RH 40 is a nonionic solubilizer, surfactant and emulsifying agent obtained by reacting 45 moles of ethylene oxide with 1 mole of hydrogenated castor oil.
The main constituent of Cremophor RH 40 is glycerol polyethylene glycol oxystearate, which together with fatty acid glycerol polyglycol esters, forms the hydrophobic part of the product. The hydrophilic part consists of polyethylene glycols and glycerol ethoxylate.
pH: 6-7
Properties
Cremophor RH 40 is a white to yellowish thin paste at 20 °C. The HLB value lies between 14 and 16. Particular features are that it has very little odour and in aqueous solutions is almost tasteless.
Solubility
Cremophor RH 40 forms clear solutions in water, ethanol, 2-propanol, n-propanol, ethyl acetate, chloroform, carbon tetrachloride, toluene and xylene.
Stability
Pure Cremophor RH 40 is chemically very stable. Prolonged exposure to heat can cause physical separation into a liquid and a solid phase on cooling but the product can be restored to its original form by homogenization. Cremophor RH 40 is stable in aqueous alcohol and purely aqueous solutions. However, it must be noted that strong bases or acids should not be added, as otherwise the ester components may be saponified. Aqueous Cremophor RH 40 solutions can be sterilized by heating to 120 °C. Allowance must be made for the fact that this can cause a slight decrease in the pH value. The phases may also separate during sterilizatlon, but this can be remedied by agitating the solution while it is still hot. The preservatives normally used in the pharmaceuticals industry may be added to the aqueous solutions. The requisite concentrations should be determined in tests.
Application

Solubilization
Aqueous solutions of vitamins A, D, E and K for oral and topical administration can be prepared with the aid of Cremophor RH 40. The fact that the solubilizer has very little taste and odour is an asset for such applications.
In order to ensure that clear, aqueous solutions are obtained, the fat-soluble vitamins must first be intimately mixed with the solubilizer.
The vitamin is mixed with Cremophor RH 40 and heated to 60- 65 °C. The water, also heated to 60- 65 °C, is added very slowly with thorough stirring into this mixture. As a result of hydration, the solution thickens, with the viscosity attaining a maximum after about half of the water has been added. Further addition of water then decreases the viscosity again. If the first half of the water is added too quickly, the solution can

become opalescent. Alternatively, the warm mixture of the vitamin and Cremophor RH 40 can be slowly stirred into the water, which results in a lower increase in intermediate viscosity. The following three diagrams demonstrate the use of Cremophor RH 40 for producing clear, highly concentrated, aqueous solutions of vitamin A palmitate, vitamin A propionate and vitamin E acetate.

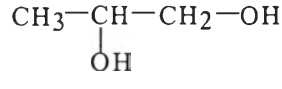
Miscellaneous solubilizer applications
Clear, aqueous solutions of hydrophobic substances other than vitamins can be obtained with Cremophor RH 40. Examples are essential oils and certain drugs for oral and topical application. A feature of the solutions thus obtained is their good stability.

Use as emulsifier
Cremophor RH 40 is also very suitable as an emulsifying agent. It will emulsify a wide range of hydrophobic substances, e. g. fatty acids, fatty alcohols and drugs.

Compatibility with the skin and mucous membranes
Swab tests have demonstrated that Cremophor RH 40 is compatible with human skin. The compatibility with the mucous membranes was investigated by applying a 30% aqueous solution of Cremophor RH 40 to the eyes of rabbits. This solution did not cause any inflammation.

General
In common with other surfactants, Cremophor RH 40 may alter the rate of absorption of active substances. For this reason, it is advisable to subject preparations containing Cremophor RH 40 to pharmacological and clinical tests before they are released for general use. Attention is also drawn to local legislation concerning the handling of foodstuffs, food wrappings, cosmetics etc.
Storage: The drums in which Cremophor RH 40 is stored should be kept tightly closed.

3. Plasticizers and Humectant
3.1 Propylene glycol (American Pharmaceutical Association and the Pharmaceutical Society of Great Britain, 1986)
Structure formula:



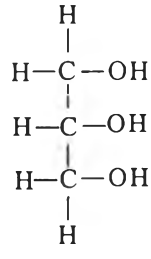
Chemical name: (±) - Propane -1,2 –diol, 1,3-Propanediol
The empirical structure is $CH_3CHOHCH_2OH$ with molecular weight 76.10. Propylene glycol is clear, colorless, water-white viscous liquid and practically odorless liquid having a sweet, slightly acrid taste. It has boiling point at 188°c and flash point at 99°c. It is miscible with water, acetone, alcohol, glycerin and chloroform, and immiscible with light mineral oil and fixed oils. Propylene glycol has a bitter taste which restricts its use in oral products and cosmetics subject to incidental ingestion such as lip glosses.

Use: Propylene glycol is a solvent or co-solvent used in solutions parenterals, topical preparations and aerosol solutions and used as humectant in topical preparations. Propylene glycol is more volatile and less viscous than glycerin. It is not as hygroscopic as glycerin, having one less hydroxyl group, but exhibits greater solvent powers for the same reason.

Incompatibility: It is incompatible with oxidizing reagents such as potassium permanganate.

Stability and storage condition: It is stable in well-closed containers, but at high temperature in the open it trends to oxidise, giving the products such as propionaldehyde, lactic acid, pyruvic acid and acetic acid. It absorbs moisture when is exposed to moist air. This material should be stored in well-closed container and protected from light.

3.2 Glycerin (American Pharmaceutical Association and the Pharmaceutical Society of Great Britain, 1986)
Structure formula:

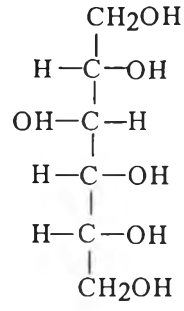


Chemical name: Glycerol, Glycerine, 1,2,3-propanetriol
It has the empirical formula $C_3H_8O_3$ and a molecular weight of 92.09. The simplest trihydric alcohol, when pure, is a colorless, odorless, viscous liquid with a sweet taste at ordinary room temperature and stable under most conditions.

Uses: Glycerin is a versatile chemical. It is found in baby care products and in embalming fluids used by morticians, in glues that hold things together and in explosives to blow them apart; in throat lozenges and in suppositories. Glycerin is nontoxic, easily digested, and is environmentally safe. It has a pleasant taste and odor, which makes it an ideal ingredient in food and cosmetic applications.
Stability and storage condition: It is stable in well-closed

3.3 Sorbitol (Merck index,1989)
Chemical Name : glucitol, sorbit, Sorbo, Sorbol, Sorbicolan D- Glucitol; D-sorbitol; L-gulitol; sorbit
Molecular Formula: $C_6H_{14}O_6$
Molecular weight: 182.17.

Structure formula:



Chemical name:
Sorbitol is a hexahydric alcohol with the empirical structure is $C_6H_{14}O_6$ wit molecular weight 182.17 which occurs naturally in fruits, but is prepared synthetically from glucose b y h igh p ressure h ydrogenation. H igh % s orbitol s olution a re much m ore viscous than correspond glycerin solution. It is quite soluble in hot alcohol, sparingly solution in cold alcohol and also soluble in methanol, isopropanol, butanol, cyclohexanol, phenol, acetone and acetic acid. Practically insoluble in most other organic solvents.

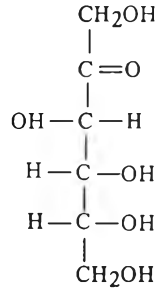
Use: Sorbitol is used in pharmaceutic aid ; sweetener , tablet, excipient.

Incompatibility: Not attacked in the cold when mixed with dilute acids, alkalies or mild oxidizing substance.

Stability and storage condition: Sorbitol is nontoxic, being classified as GRAS (Generally Recognized As Safe) by the FDA as a food additive. It is nonirritating to both skin and eyes. Since sorbitol is widely occurring in foods that are frequently ingested in significant quantities, its relatively free usage as a food additive is not surprising. Sorbitol is most commonly available for cosmetic and drug use as a 70% aqueous solution, usually meeting the criteria of the USP or the Food Chemicals Codex (FCC). The 70% solution is a clear colorless, water-white, viscous liquid. Sorbitol is also available in crystalline form (100% active) where its principal use is as the major component of sugarless gums. It is also utilized in pharmaceutical tablets and compressed mints and hard candy when noncariogenic properties are desired. Since sorbitol does not provoke the same insulin response as sucrose in the human body, it is the key bulk sweetener used in diabetic foods such as candy. Sorbitol is widely used as a partial or total replacement for glycerin in creams and lotions. Simple substitution on an equal weight basis for glycerin is seldom possible. However, the changes in product consistency, viscosity, and feel may often be readily compensated for by minor formula modifications. Sorbitol is often more cost effective than glycerin, and more stable in price. Sorbitol, as well as other polyols, provides smooth application properties as shown by good spreading action. It also facilitates gradual release of water from emulsions, as well as lubricity and emollience in these systems. Sorbitol retains a high level of water at various humidities and exhibits a low rate of moisture gain or loss. It is less hygroscopic than other polyols and is claimed to be more likely to give a smooth dry effect when the cosmetic product is spread on the skin. This is contrasted to the damp, slippery feel that can be imparted by more hygroscopic humectants. In stearic acid soap type hand creams, sorbitol is more effective at retarding moisture loss than glycerin or propylene glycol.

Sorbitol is widely used in shave creams; both in the tube and aerosol variety. It provides protection against premature drying out of the foam on the face, and softens the cream in the tube to help prevent it from drying out. Typical use levels in aerosol shave creams are in the range from 3-10%.

4. Sweeteners
4.1 Fructose
Structure formula:

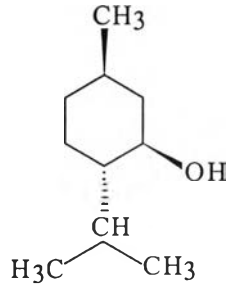


Chemically, fructose is an oxyketone or ketosenatural sweetness with important health benefits fructose, also known as fruit sugar, is the sweetest natural sugar and is found in fruits, vegetables, and honey. The body responds to fructose in a different way than to glucose and sucrose. Fructose is more satiating, and it is up to 1.8 times sweeter than sucrose, making it useful in foods and beverages for the health conscious. Fructose is also ideal for use in diabetic foods as it has very little effect on blood glucose and only a negligible effect on the secretion of insulin.Fructose, laevulose or fruit-sugar, a carbohydrate of the formula $C_6H_{12}O_6$. It is closely related to ordinary dglucose, with which it occurs in many fruits, starches and also in honey. It is a hydrolytic product of inulin, from which it may be prepared; but it is more usual to obtain it from "invert sugar," the mixture obtained by hydrolysing cane sugar with sulphuric acid. Cane sugar then yields a syrupy mixture of glucose and fructose, which, having been freed from the acid and concentrated, is mixed with water, cooled in ice and calcium hydroxide added. The fructose is precipitated as a saccharate, which is filtered, suspended in water and decomposesl by carbon dioxide. The liquid is filtered, the filtrate concentrated, and the syrup so obtained washed with cold alcohol. On cooling the fructose separates. It may be obtained as a syrup, as fine, silky needles, a white crystalline powder, or as a granular crystalline, somewhat hygroscopic mass. When anhydrous it melts at about 95°C. It is readily soluble in water and in dilute alcohol, but insoluble in absolute alcohol. It is sweeter than cane sugar and is more easily assimilated. It has been employed under the name diabetin as a sweetening agent for diabetics, since it does not increase the sugar-content of the urine; other medicinal applications are in phthisis (mixed with quassia or other bitter), and for children suffering from tuberculosis or scrofula in place of cane sugar or milk-sugar.

5. Flavor
5.1 Menthol (USP ,1995; Foster, 1996)

Menthol is the primary component of the essential oil of peppermint. It occurs naturally as a colorless crystal or powder.
Synonyms: Hexahydrothymol, Peppermint camphor
Chemical name:Cyclohexanol, 5-methyl-2-(1-methylethyl)

(1RS,2RS,5RS)-(±)-5-Methyl-2-(1-methylethyl)cyclohexanol
Molecular formulation: $C_{10}H_{20}O$
Molecular weight: 156.27
Structure formula:



Description: Menthol USP-colorless, hexagonal crystals, usually needle-like, or in fused masses, or crystalline powder. It has a pleasant, peppermint-like odor
NF category: Flavors and perfumes.
Solubility: Menthol USP- Slightly soluble in water ; very soluble in alcohol, in chloroform, in ether , and in solvent hexane; freely soluble in glacial acetic acid , in mineral oil, and in fixed and volatile oils.
USP requirements:
Menthol USP- Preserve in tight containers, preferably at controlled room temperature. An alcohol obtained from diverse mint oils or prepared synthetically. Menthol may be levorotatory (*l*- Menthol), from natural or synthetic sources, or racemic (*dl*-Menthol). Label it to indicate whether it is levorotatory or racemic. Meets the requirement for Identification, Melting range of *l*-Menthol (41-44°C) ,
Congealing range of *dl*-Menthol, Specific rotation (-45° to -51° for *l*-Menthol;-2° to +2° for *dl*-Menthol), Limit of non-volatile residue (no more than 0.05%), Chromatographic purity , Readily oxidizable substances in *dl*-Menthol, and Organic volatile impurities.
Menthol Lozenges USP-Preserve in well-closed containers. Contain the labeled amount in a suitable molded base, within –10% to +25%. Meet the requirement for Identification.
Appearance
Racemic menthol is a mixture of equal parts of the (1R,2S,5R)- and (1S,2R,5S)-isomers of menthol. It is a free-flowing or agglomerated crystalline powder or colorless, prismatic or acicular shiny crystals, with a strong characteristic odor and taste. The crystalline form may change with the time due to sublimation within a closed vessel.
Melting point: The melting point of menthol is 34-36° C.
Safety: Almost all toxicological data for menthol relates to its use as the therapeutic agent rather than as an excipient. Inhalation or ingestion of large qualities can result in serious adverse reactions such as ataxia and CNS depression. Although menthol is essentially nonirritant there have been some reports of hypersensitivity following topical application.

5.2 Peppermint Oil (Eccles, 1994; Murry, 1995)

Peppermint's Latin name: *Mentha piperita*

Peppermint is widely used in food, cosmetics and medicines. It is one of the world's oldest medicinal herbs, and is used in both Eastern and Western traditions. Ancient Greek, Roman, and Egyptian cultures used the herb in cooking and medicine. Peppermint oil is the most extensively used of all the volatile oils.

Use: Peppermint leaf and oil used for medicine, as flavoring agents, and in cosmetic and pharmaceutical products.

6. Vitamin

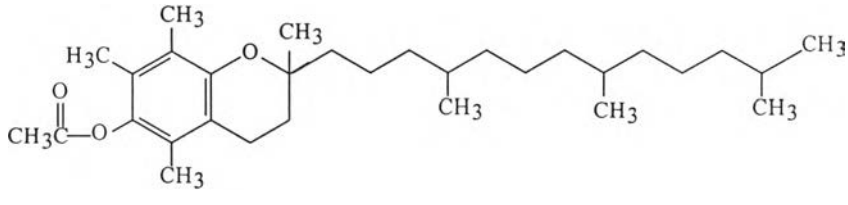
6.1 Vitamin E acetate (Djerassi, *et al.*,1986; Mayer and Pittermann,1993; Alfonso, 2000)

Chemical Name : *dl*-Alpha Tocopherol; Synthetic Alpha Tocopherol; Synthetic n-Tocopherol; *dl*-α- Tocopherol; all-*rac*-α- Tacopherol. (±)-2.5.7.8-Tetramethyt- 2 -(4 ,8,12 trimethyltridecyl)chroman-6-ol.

Molecular Formula: $C_{29}H_{50}O_2$

Molecular weight: 430.7

Structure formula:



Description: A practically odourless. clear. colourless or yellowish-brown viscous oil.

Solubility: Practically insoluble in water; freely soluble in dehydrated alcohol, in acetone. in dichloromethane. in ether, and in fixed oils.

Storage conditions and precautions: Store in airtight containers under an inert gas Protect from light.

Uses: Antioxidant

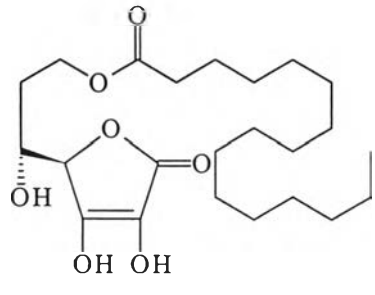
6.2 Vitamin C palmitate (Silva, and Maia Campos, 2001)

Chemical Name : L-Ascorbyl 6-Palmitate; 6-O-Palmitoyl-L-ascorbic acid

Molecular Formula: $C_{22}H_{38}O_7$

Molecular weight: 414.54

Structure formula :



Description: White to yellowish powder with light orange smell
Solubility: fat-soluble
Storage conditions and precautions: Store in airtight containers under an inert gas. Protect from light.
Uses: Antioxidant
There are different forms of Vitamin C, Ascorbic acid, the most common form, is water soluble. It dissolves quickly in water and is therefore excreted out of the body through the body relatively quickly. Ascorbyl palmitate is a fat (oil) soluble form of vitamin C that is used as an antioxidant and preservative in foods, vitamins, drugs and cosmetics. Being fat soluble, it is absorbed into the cell membrane where ascorbic acid cannot reach. It is therefore retained in the body for a longer period of time.
Ascorbyl palmitate is a fat-soluble form of ascorbic acid, or vitamin C. Unlike ascorbic acid, which is water-soluble, ascorbyl palmitate is able to be stored in cell membranes until needed by the body. Many people think vitamin C is only used for immune support, but it has many other important functions. A major role of vitamin C is in manufacturing collagen, a protein that forms the basis of connective tissue (the most abundant tissue in the body). Ascorbyl palmitate is an effective free radical-scavenging antioxidant which promotes skin health and vitality. Ascorbic Acid vs. Ascorbyl Palmitate. The simplest and most available form of vitamin C is ascorbic acid. However, the chemical reality of ascorbic acid will always make its bioavailability and absorption a problem because it is water soluble. In the body, the uptake of a water soluble vitamin is quick but its penetration of the cellular membrane is limited. Unlike vitamin E, a fat soluble vitamin, vitamin C is not stored in the body, which makes smart supplementation beneficial.

Remarks: Ascorbyl Palmitate is an ascorbate bonded to palmitic acid to form a Vitamin C ester, used as an anti-staling compound which retard the staling of food products, and soften the crumb. Other anti-staling compounds are sucrose stearate, polyoxyethylene monostearate, glyceryl monostearate, stearoyl tartrate (polyoxyethylene and monoglyceride derivatives of fatty acids)

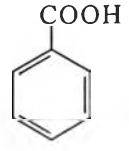
7. Alkalizing agent

7.1 Triethanolamine
Synonyms: 2,2',2"- Nitrilotriethanol; trihydroxytriethylamine; tris (hydroxyethyl) amine; triethlolamine.
Chemical name: $N(CH_2CH_2OH)_3$
Molecular formulation: $C_6H_{15}NO_3$
Molecular weight: 149.19
Chemical structure: $N(CH_2CH_2OH)_3$
Appearance: Produced along with mono- and diethanolamine by ammonolysis of ethylene oxide, Very hygroscopic, viscous liquid. Slight ammoniacal odor. Turns brown on exposure to air and light, Viscosity (centipoise) at 25°C 590.5, Viscosity (centipoise) at 60°C 65.7. pH of 0.1N aqueous solution 10.5 Miscible with water, methanol, acetone. Soluble at 25° in benzene, 4.2%
USE: Pharmaceutic aid (alkalizing agent).

8. Preservative

8.1 Benzoic Acid.

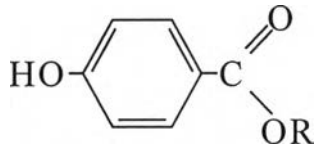
Chemical Name : Benzenecarboxylic acid; phenylformic acid; dracylic acid
Molecular Formula: $C_7H_6O_2$
Molecular weight: 122.12
Structural formula:



Description: Monoclinic tablets, plates, leaflets. White crystalline powder or colorless crystals.
Solubility: Slightly soluble in water, free soluble in alcohol and methanol.
Toxicity: Mild irritant to skin. eyes. mucous membranes.
Storage conditions and precautions: Store in a well–closed container protected from light.
Uses: Preserving foods, fats. fruit juices, alkaloidal solns, etc. Pharmaceutic aid (antifungal agent, antimicrobial agent).

8.2 Parabens

Structure of Parabens



R = CH_3 to C_4H_9

Parabens, esters of p-hydroxybenzoic acid, have been used as preservatives of cosmetics for over 60 years. The methyl and propyl parabens are the most commonly used preservatives for cosmetics and they are widely used for pharmaceuticals as well. As has been demonstrated over their long history, the parabens are very safe. They can , however, sensitize the skin and cause contact dermatitis, although the incidence of this is low.

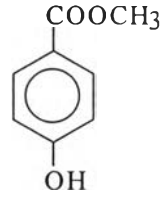
The parabens are most effective against fungi, yeasts, and gram-positive bacteria. They can be considered only bacteriostatic against *Pseudomonas* sp. and as such are not adequate by themselves to preserve ophthalmic products. Combining parabens with bactericidal agents is a common means of ensuring complete microbicidal activity of a formulation. Some of these combinations are marketed: Phenonip is a blend of methyl-, ethyl-, propyl-, isobutyl-, and n-butylparabens in phenylethyl alcohol. Germaben II has already been mentioned in this regard.

The utility of parabens is often limited by their low water solubility. They are readily extracted into organic solvents and oils and can also be lost from a product by absorption into rubber closures. Parabens are subject to neutralization by nonionic surfactants: they bind to or become trapped into micelles. These properties all serve to reduce the concentration of preservative in the aqueous phase where it is needed. Increasing the length of the alkyl group generally increases antimicrobial activity but decreases water solubility. The pentyl and higher esters are too insoluble for practical

use, however methyl- and propylparabens are often used in tandem to increase their efficacy: antimicrobial activity is the sum of the concentrations while the solubilities of the two compounds are independent. There is an extensive literature on the properties and interactions of the parabens.

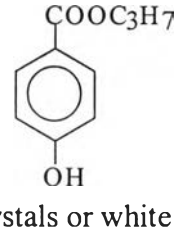
Parabens are stable and effective in the pH range of 4-8. However, the pKa of the hydroxyl group is about 8.5. Thus, at the higher end of the effective pH range, the parabens ionize. The charged species cannot cross the microbial membrane and so the efficacy of the preservative is reduced. In addition, the parabens are subject to base-catalyzed hydrolysis and so are not used in strongly basic formulations.

8.2.1 Methyl paraben B.P.
Chemical Name : Methyl 4-Hydroxybenzoate, 4-Hydroxybenzoic acid methyl ester, methyl p-hydroxybenzoate
Molecular Formula: $C_8H_8O_3$
Molecular weight: 152.15
Structural formula



Description: Colorless crystals or white needles crystalline powder.
Solubility: Free soluble in Ethanol(95%), in ether and in methanol, very slightly soluble in water. One gram dissolves in 400 ml water. 40 ml warm oil. about 70 ml warm glycerol; freely sol in alcohol. acetone, ether and propylene glycol.
Storage conditions and precautions: Store in a well-closed containers.
Uses: Pharmaceutical aid (antimicrobial preservative). As preservative in foods, beverages and cosmetics. (0.1-0.3%)

8.2.2 Propyl paraben USP.
Chemical Name : Propyl 4-Hydroxybenzoate, 4-Hydroxybenzoic acid propyl ester; propyl p-hydroxybenzoate
Molecular Formula: $C_{10}H_{12}O_3$
Molecular weight: 180.20
Structural formula:



Description: Small, colorless crystals or white powder.
Solubility: Miscible with alcohol and with fatty and essential oils, very slightly soluble in water.
Storage conditions and precautions: Store in a well-closed containers and protected from light.
Uses: Pharmaceutical aid (antimicrobial preservative).
8.3 Sorbic Acid

Chemical Name : 2,4-Hexadienoic acid; 2-propenylacrylic acid.
Molecular Formula: $C_6H_8O_2$
Molecular weight: 112.12
Structural formula: $CH_3CH=CHCH=CHCOOH$
Description:Needles from water. Should be stored at temps
Solubility: Solubility in water slightly
USE: Mold and yeast inhibitor. Fungistatic agent for foods
Incompatibility

Obvious sources of pharmaceutical instability include the incompatibility of various ingredients within a formulation. It has been defined as a physical or chemical interaction between two or more ingredients that leads to a visibly recognizable change. The latter may be in the form of a gross precipitate, haze, or color change. On the other hand, a chemical incompatibility is classified as a reaction in which a visible change does not occur. Since there is no visible evidence of deterioration, this type of incompatibility requires trained, knowledgeable personnel to recognize it, should it occur.

APPENDIX B

Physical properties of Polysaccharide gel powder

Table B1 Physical properties of polysaccharide gel

Properties	Results
Color	light brown
Taste	sour
Smell	sour
pH	2.2-2.3

Table B2 Apparent viscosity profile

%	Viscosity (cps)		
	PG	CMC	Carbomer 940 (Neutralized to pH 7.0 with TEA)
1	73.15±1.06	725.30±32.57	>10,000
2	130.86±3.98	1015.45±74.26	>10,000
2.5	307.03±3.10	1201.11±66.38	>10,000
3	405.23±4.61	2446.42±168.94	>10,000
4	617.8±3.88	5012.75±308.64	>10,000
5	2660.9±5.52	>10,000	>10,000
6	5077±2.19	>10,000	>10,000

Table B3 pH profile

%	pH		
	PG	CMC	Carbomer940
1	2.231	6.414	2.231
2	2.312	6.532	2.312
2.5	2.306	6.741	2.306
3	2.298	6.773	2.298
4	2.291	6.821	2.291
5	2.288	7.011	2.288
6	2.231	7.151	2.231

Table B4 Rheological properties of PG

Rate of shear (rpm)	PG 3%		PG 4%	
	Viscosity (cps)	Shearing stress	Viscosity (cps)	Shearing stress
0.5	864.90	4.32	2065.22	10.33
1	792.54	7.93	1992.82	19.93
2.5	749.13	18.73	1853.43	46.34
5	686.65	34.33	1723.73	86.19
10	619.40	61.94	1567.65	156.76
20	553.36	110.67	1395.99	279.20
50	461.89	230.95	1212.22	432.2
100	405.25	405.25	617.8	617.8

Table B5 Rheological properties of CMC and Carbomer940

Rate of shear (rpm)	CMC 2.5%		Carbomer940 1%	
	Viscosity (cps)	Shearing stress	Viscosity (cps)	Shearing stress
0.5	1286.39	6.432	>10000	-
1	958.64	9.586	>10000	-
2.5	896.35	22.408	9555.71	238.892
5	855.71	42.785	7955.38	397.769
10	838.63	83.863	4689.38	468.938
20	771.11	154.22	3698.26	739.652
50	721.86	360.93	1547.97	773.985
100	546.41,	546.41	1355.12	1355.12

Table B6 Effect of acid and base

PG 3%		PG 4%		CMC 2.5%		Carbomer 1%	
pH	Viscosity (cps)	pH	Viscosity (cps)	pH	Viscosity(cps)	pH	Viscosity(cps)
2.468	405.23±4.61	2.290	617.80±1.23	2.032	Precipitation	2.563	86.23±10.11
3.019	249.43±1.26	3.007	515.33±1.21	3.216	545.17±46.71	3.005	202.35±35.79
4.076	160.21±1.52	4.009	349.66±0.75	4.008	579.68±31.42	4.103	1110.30±308.61
5.762	173.57±1.24	5.136	358.45±1.16	5.125	586.39±70.11	5.034	3556.78±565.68
6.068	183.18±0.77	6.097	364.00±0.30	6.144	1308.61±208.94	6.023	>10,000
7.098	195.18±0.67	7.08	342.81±0.28	7.032	1325.40±134.65	7.110	>10,000
8.458	183.37±1.02	8.414	324.45±1.14	8.221	1362.19±211.46	8.036	>10,000
9.235	161.5±0.86	9.057	296.24±0.51	9.016	1384.23±143.67	9.023	>10,000

Table B7 Effect of preservative

% Paraben concentrate	Viscosity (cps)		
	PG	CMC 2.5%	Carbomer 1%
0	405.23±4.61	1201.11±66.38	>10,000
0.25	412.38±1.88	1292.34±46.11	>10,000
0.5	419.47±0.55	1208.31±153.16	>10,000
1	435.76±0.32	1126.04±141.28	>10,000
1.5	432.52±2.96	1105.15±109.66	>10,000
2	438.24±4.49	1032.30±52.51	>10,000
% Benzoic acid	PG	CMC2.5%	Carbomer
0	405.23±4.61	1201.11± 66.38	>10,000
0.25	424.13±0.84	incompatible	incompatible
0.5	413.34±1.13	incompatible	incompatible
1	410.75±0.26	incompatible	incompatible
1.5	408.37±0.24	incompatible	incompatible
2	406.82±1.24	incompatible	incompatible
% Sorbic acid	PG	CMC2.5%	Carbomer
0	405.23±4.61	1201.11±66.38	>10,000
0.25	427.37±1.86	incompatible	incompatible
0.5	411.24±0.11	incompatible	incompatible
1	406.49±0.03	incompatible	incompatible
1.5	401.59±2.83	incompatible	incompatible
2	392.92±2.30	incompatible	incompatible

Table B8 Effect of humectant

% Propylene glycol	Viscosity (cps)		
	PG	CMC2.5%	Carbomer
0	405.23±4.61	1201.11±66.38	>10,000
5	702.14±1.31	1201.61±59.31	A little decreasing viscosity
10	933.8±1.27	1214.13±41.65	A little decreasing viscosity
15	931.63±4.12	1232.55±133.41	A little decreasing viscosity
20	1122.89±0.31	1229.32±51.16	A little decreasing viscosity
25	1419.17±0.84	1228.58±132.041	A little decreasing viscosity
30	1817.17±1.69	1216.64±115.14	A little decreasing viscosity
% Glycerin	PG	CMC2.5%	Carbomer
0	405.23±4.61	1201.11±66.38	>10,000
5	544.5±0.91	1196.36±138.43	A little decreasing viscosity
10	657.61±0.56	1183.26±46.21	A little decreasing viscosity
15	735.67±0.93	1179.02±28.25	A little decreasing viscosity
20	767.67±0.52	1175.85±135.41	A little decreasing viscosity
25	778.44±0.84	1172.68±104.36	A little decreasing viscosity
30	788.28±0.61	1172.14±166.80	A little decreasing viscosity

Table B9 Effect of solvent

%Ethyl alcohol	Viscosity (cps)		
	PG	CMC2.5%	Carbomer
0	405.23±4.61	1201.11±66.38	>10,000
5	1073.3±0.82	1049.18±147.13	A little decreasing viscosity
10	1582.93±1.03	1011.15±56.16	A little decreasing viscosity
15	2436.26±0.27	1003.91±115.7	A little decreasing viscosity
20	3389.99±1.95	945.48±26.82	A little decreasing viscosity
25	4138.39±1.22	938.32±42.7	A little decreasing viscosity
30	8825.04±1.66	901.26±78.71	A little decreasing viscosity
% Isopropyl alcohol	PG	CMC 2.5%	Carbomer
0	405.23±4.61	1201.11±66.38	>10,000
5	1107.72±1.57	1133.85±46.13	A little decreasing viscosity
10	1869.49±0.14	1105.96±54.39	A little decreasing viscosity
15	2336.97±2.01	1048.63±70.2	A little decreasing viscosity
20	2903.86±0.85	1028.27±22.8	A little decreasing viscosity
25	4638.63±0.64	956.13±49.2	A little decreasing viscosity
30	9268.45±1.34	958.78±81.61	A little decreasing viscosity
%Butyl alcohol	PG	CMC 2.5%	Carbomer
0	405.23±40.5	1201.11±6.12	>10,000
5	418.6±23.61	1052.13±7.56	A little decreasing viscosity
10	422.4±12.8	1008.62±22.57	A little decreasing viscosity
15	432.8±17.32	992.48±45.6	A little decreasing viscosity
20	445.6±42.10	957.15±21.5	A little decreasing viscosity
25	454.3±9.45	931.52±47.6	A little decreasing viscosity
30	469.8±3.12	917.2±12.2	A little decreasing viscosity

Table B10 Effect of electrolyte

NaCl(M)	Viscosity (cps)		
	PG	CMC 2.5%	Carbomer
0	405.23±4.61	1201.11±66.38	>10,000
0.0325	417.22±1.31	incompatible	incompatible
0.065	446.94±1.75	incompatible	incompatible
0.0975	419.75±1.57	incompatible	incompatible
0.13	412.8±2.16	incompatible	incompatible
0.2275	413.2±1.15	incompatible	incompatible
0.2925	421.59±1.50	incompatible	incompatible
0.39	435.55±0.88	incompatible	incompatible
KCl(M)	PG	CMC 2.5%	Carbomer
0	405.23±4.61	1201.11±66.38	>10,000
0.037	435.76±0.51	incompatible	incompatible
0.074	705.62±1.31	incompatible	incompatible
0.148	828.91±0.42	incompatible	incompatible
0.222	1143.14±0.73	incompatible	incompatible
0.296	1294.7±1.47	incompatible	incompatible
0.37	1403.2±0.56	incompatible	incompatible
$MgCl_2$(M)	PG	CMC 2.5%	Carbomer
0	405.23±4.61	1201.11±66.38	>10,000
0.082	819.95±1.95	incompatible	incompatible
0.164	1066.21±0.91	incompatible	incompatible
0.328	1553.23±0.57	incompatible	incompatible
$CaCl_2$(M)	PG	CMC 2.5%	Carbomer
0	405.23±4.61	1201.11±66.38	>10,000
0.0008	816.05±0.74	incompatible	incompatible
0.0016	811.73±1.19	incompatible	incompatible
0.002	814.13±1.47	incompatible	incompatible
0.0028	867.66±1.13	incompatible	incompatible
0.0032	889.49±0.19	incompatible	incompatible
0.0036	957.78±1.00	incompatible	incompatible
0.004	938.54±1.30	incompatible	incompatible

Table B11 Mixing ingredients with vortex mixer and visully appearance solution.

	Appearance
P*10/0	Cloudy solution
P10/T*1	Cloudy solution
P10/P*1	Cloudy solution
P10/C*1	Cloudy solution
P10/T5	Cloudy solution
P10/P5	Cloudy solution
P10/C5	Cloudy solution
P10/T10	Cloudy solution
P10/P10	Cloudy solution
P10/C10	Clear solution , transparent solution
P*15/0	Cloudy solution
P15/T*1	Cloudy solution
P15/P*1	Cloudy solution
P15/C*1	Cloudy solution
P15/T5	Cloudy solution
P15/P5	Cloudy solution
P15/C5	Cloudy solution
P15/T10	Cloudy solution
P15/P10	Cloudy solution
P15/C10	Clear solution , transparent solution

Assessment of gel formulation

Table B12 Preparation of vitamin E PG gel using 2.5%PG with different concentration of $CaCl_2$

PG gel preparations	Description of gel products		
	After prepared	After 6 temperature cycling tested	After 30 days stand at ambient temperature
Vit.E-PG gel (2.5PG, 0 $CaCl_2$)	Texture: smooth homogenous Flow: easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity 1013±225cps pH 5.04	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity 7300±300cps pH 4.98	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity 3250±125cps pH 5.43
Vit.E-PG gel (2.5PG, 0.05M $CaCl_2$)	Texture: smooth homogenous Flow: easy Air bubbles: less Color: natural Viscosity decrease by agitation Viscosity 1273.5±137cps pH 5.19	Texture: smooth homogenous Flow: not easy Air bubbles: less Color: natural Viscosity decrease by agitation Viscosity >10000cps pH 4.98	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity 4816±455cps pH 5.24
Vit.E-PG gel (2.5PG, 0.1M $CaCl_2$)	Texture: smooth homogenous Flow: easy Air bubbles: less Color: natural Viscosity decrease by agitation Viscosity 1420 ± 264cps pH 5.19	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity >10000cps pH 5.06	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity >10000cps pH 5.30
Vit.E-PG gel (2.5PG, 0.2M $CaCl_2$)	Texture: smooth homogenous Flow: easy Air bubbles: less Color: natural Viscosity decrease by agitation Viscosity 1535±532 cps pH 5.52	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity >10000 cps pH 5.09	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity >10000 cps pH 5.48

Table B13 Preparation of Vitamin E PG gel using 3 %PG with different concentration of $CaCl_2$

PG gel preparations	Description of gel products		
	After prepared	After 6 temperature cycling tested	After 30 days stand at ambient temperature
Vit.E-PG gel (3.0PG+ 0.1 $MCaCl_2$)	Texture: smooth homogenous Flow: not easy Air bubbles: much Color: natural Viscosity decrease by agitation Viscosity >10000cps pH 4.88	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity >10000 cps pH 5.05	Texture: smooth homogenous Flow: not easy Air bubbles: much Color: natural Viscosity decrease by agitation Viscosity >10000cps pH 5.02
Vit.E-PG gel (3.0PG+0.2 $MCaCl_2$)	Texture: smooth homogenous Flow: not easy Air bubbles: much Color: natural Viscosity decrease by agitation Viscosity >10000cps pH 5.12	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity >10000 cps pH 5.00	Texture: smooth homogenous Flow: not easy Air bubbles: less Color: natural Viscosity decrease by agitation Viscosity >10000cps pH 5.03

Table B14 Effect of pH on the Vitamin E PG gel preparation

PG gel preparations	Description of gel products		
	After prepared	After 6 temperature cycling tested	After 30 days stand at ambient temperature
Vit.E-PG gel (3.0PG+ 0.1 $MCaCl_2$) pH4.5	Texture: smooth homogenous Flow: easy Air bubbles: less Color: natural Viscosity decrease by agitation Viscosity 2830±45cps pH 4.51	Texture: smooth homogenous Flow: not easy Air bubbles: less Color: natural Viscosity decrease by agitation Viscosity 5470±450 cps pH 4.53	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity >10000cps pH 4.41
Vit.E-PG gel (3.0PG+0.1 $MCaCl_2$) pH5.0	Texture: smooth homogenous Flow: easy Air bubbles: much Color: natural Viscosity decrease by agitation Viscosity 3100±20cps pH 4.93	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity >10000cps pH 4.77	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity >10000cps pH 4.73
Vit.E-PG gel (3.0PG+ 0.1 $MCaCl_2$) pH5.5	Texture: smooth homogenous Flow: easy Air bubbles: much Color: natural Viscosity decrease by agitation Viscosity 2568±43cps pH 5.53	Texture: smooth homogenous Flow: not easy Air bubbles: less Color: natural Viscosity decrease by agitation Viscosity 5270±50cps pH 5.48	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity >10000cps pH 5.36

Table B15 Preparation of Vitamin E PG gel using 3.5 %PG with different concentration of $CaCl_2$

PG gel preparations	Description of gel products		
	After prepared	After 6 temperature cycling tested	After 30 days stand at ambient temperature
Vit.E-PG gel (3.5PG+0.05 $MCaCl_2$)	Texture: smooth homogenous Flow: easy Air bubbles: less Color: natural Viscosity decrease by agitation Viscosity 4075 ± 50cps pH 5.69	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity 6814±240cps pH 5.70	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: natural Viscosity decrease by agitation Viscosity 5390±254cps pH 5.80
Vit.E-PG gel (3.5 PG+ 0.1 $MCaCl_2$)	Texture: smooth homogenous Flow: not easy Air bubbles: much Color: natural Viscosity decrease by agitation Viscosity >10000cps pH 5.65	Texture: smooth homogenous Flow: not easy Air bubbles: much Color: natural Viscosity decrease by agitation Viscosity >10000 cps pH 5.29	Texture: smooth homogenous Flow: not easy Air bubbles: much Color: natural Viscosity decrease by agitation Viscosity >10000 cps pH 5.35

Table B16 Preparation of Vitamin C PG gel using 3% PG

PG gel preparations	Description of gel products		
	After prepared	After 6 temperature cycling tested	After 30 days stand at ambient temperature
Vit.C-PG gel (3.0PG+ 0.1 $MCaCl_2$)	Texture: smooth homogenous Flow: easy Air bubbles: less Color: natural Viscosity decrease by agitation Viscosity 3650±300 cps pH 4.44	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: pale yellow Viscosity decrease by agitation Viscosity 4262±421cps pH 4.47	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: pale yellow Viscosity decrease by agitation Viscosity >10000cps pH 4.25

Table B17 Preparation of Vitamin E & C PG gel using PG 3%

PG gel preparations	Description of gel products		
	After prepared	After 6 temperature cycling tested	After 30 days stand at ambient temperature
VitE+.C-PG gel ($3.0PG+ 0.1 MCaCl_2$)	Texture: smooth homogenous Flow: easy Air bubbles: less Color: natural Viscosity decrease by agitation Viscosity 3100±150 cps pH 4.53	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: pale yellow Viscosity decrease by agitation Viscosity 6535±223cps pH 4.53	Texture: smooth homogenous Flow: not easy Air bubbles: non Color: pale yellow Viscosity decrease by agitation Viscosity >10000cps pH 4.41

Appendix C

Paraben concentrate

20%w/v methyl paraben and 2%w/v propyl paraben in propylene glycol

Phosphate buffer saline solution (simulated saliva solution) (Peh, and Wong, 1999)

2.38 g Na_2HPO_4, 0.19 g KH_2PO_4 and 8.00 g NaCl per liter of distilled water adjusted with phosphoric acid to pH 6.75

Appendix D

แบบสอบถาม

ความพึงพอใจในการทดลองใช้แผ่นฟิล์มปากสดชื่น

ชื่อ-สกุล..... อายุ.....ปี

เพศ.....

1. เคยรู้จักผลิตภัณฑ์ในรูปแบบนี้ ที่จำหน่ายในท้องตลาดหรือไม่

   ☐ เคย .... ☐ ไม่เคย

2. โดยปกติมีการใช้ผลิตภัณฑ์ทำให้ปากสดชื่นรูปแบบใด(เลือกได้มากกว่า1ข้อ)

   ☐ ลูกอม/ ลูกกวาด

   ☐ หมากฝรั่ง

   ☐ ยาอมผสมตัวยา

   ☐ อื่นๆ.....(โปรดระบุ)

3. ลักษณะผลิตภัณฑ์ตัวอย่าง

(ระดับคะแนน 1=พอใจน้อยที่สุด, 2=พอใจน้อย, 3=พอใจ, 4=พอใจมาก, 5=พอใจมากที่สุด)

3.1 ลักษณะภายนอก

ลักษณะ	1	2	3	4	5
สี					
ความหนาบาง					
ความใส					
ความเรียบ					
ขนาดตัวอย่าง					

3.2 ความพึงพอใจต่อแผ่นฟิล์มหลังจากทดลอง

ลักษณะ	1	2	3	4	5
การละลาย					
ความยืดหยุ่น					
ความหวาน					
ความเย็น					
ความแสบร้อน					
ความสดชื่น					
ความสนใจใน ผลิตภัณฑ์					

4. หากมีการพัฒนารูปแบบผลิตภัณฑ์ที่ให้ปากสคชื่นที่มีลักษณะเป็นแผ่นฟิล์มท่านคิดว่า

☐ สนใจ ☐ ไม่สนใจ

5. ข้อเสนอแนะเพิ่มเติม (กรุณาแสดงความคิดเห็นเพื่อประโยชน์ในการวิจัย)

.....

.....

ขอบคุณค่ะ

แบบสอบถาม

ความพึงพอใจในการทดลองใช้วิตามิน อี เจล (Vitamin E gel) เตรียมจากเจลเปลือกทุเรียน

ชื่อ-สกุล..... อายุ.....ปี เพศ.....

1. ท่านเคยใช้เครื่องสำอางทาผิวหรือไม่

O เคย O ไม่เคย

2. โดยปกติท่านใช้เครื่องสำอางทาผิวรูปแบบใด(เลือกได้มากกว่า1ข้อ)

O โลชั่น/ครีม

O เจลบำรุงผิว

O เบบี้ออย (Baby Oil)

O อื่นๆ.....(โปรดระบุ)

3. ลักษณะผลิตภัณฑ์เจลตัวอย่าง

3.1 ลักษณะของเนื้อเจล

(ระดับคะแนน 1=พอใจน้อยที่สุด, 2=พอใจน้อย, 3=พอใจ, 4=พอใจมาก, 5=พอใจมากที่สุด)

ลักษณะ	1	2	3	4	5
สี					
ความใสของเนื้อเจล					
ความหนืดของเนื้อเจล					
ความเนียนของเนื้อเจล					
ความแน่นของเนื้อเจล					
ความพึงพอใจลักษณะภายนอกโดยรวม					

3.2 ขณะทาผิวหนัง

ลักษณะ	1	2	3	4	5
ความเย็น					
การกระจายเนื้อเจลสม่ำเสมอไม่เป็นก้อน					
ความเหนียวเหนอะหนะขณะทา					
ระยะเวลาการซึมจนรู้สึกแห้ง					
ความเหนียวเหนอะหนะหลังการทา					
คราบที่หลงเหลือบริเวณที่ทา					
ความรู้สึกชุ่มชื้นผิวหลังการทา					
ความพึงพอใจโดยรวมหลังการใช้					

4. หากมีการพัฒนารูปแบบผลิตภัณฑ์ท่านสนใจการใช้ผลิตภัณฑ์เจลที่เตรียมจากสารก่อเจลจากธรรมชาติหรือไม่

O สนใจ O ไม่สนใจ

5. ข้อเสนอแนะเพิ่มเติม (กรุณาแสดงความคิดเห็นเพื่อประโยชน์ในการวิจัย)

.....

.....

.....

ขอบคุณค่ะ

VITA

Miss Jittima Lertchaiporn was born on July 8, 1977 in Bangkok, Thailand. She received her Bachelor's Degree of Science in Biochemistry in 2000 from the Faculty of Science, Chulalongkorn University.