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APPENDICES

APPENDIX A

1. Media

All media were dispensed and sterilized in autoclave for 15 min at 15 pounds pressure (121°C). They were prepared in distilled water.

Media composition (g/l)

1.1 Tryptic soy agar (TSA)

Peptone from casein	17.0	g
Peptone from soy meal	3.0	g
Sodium chloride	5.0	g
Agar	15.0	g

pH 7.3 ± 0.2

1.2 Tryptic soy broth (TSB)

Peptone from casein	17.0	g
Peptone from soy meal	3.0	g
D(+) glucose	2.5	g
Sodium chloride	5.0	g
Di-potassium hydrogen phosphate	2.5	g

pH 7.3 ± 0.2

1.3 Mueller hinton agar (MHA)

Beef extract powder	2.0	g
Casein hydrolysate	17.5	g
Soluble starch	1.5	g
Agar	13.0	g

pH 7.4 ± 0.2

1.4 Mueller hinton broth (MHB)

Beef extract powder	2.0	g
Casein hydrolysate	17.5	g
Soluble starch	1.5	g
	pH 7.4± 0.2	

1.5 Sabouraud dextrose agar (SDA)

Dextrose	20.0	g
Enzymatic digest of casein	10.0	g
Agar	15.0	g
	pH 5.6 ± 0.2	

1.6 Sabouraud dextrose broth (SDB)

Dextrose	20.0	g
Enzymatic digest casein	10.0	g
	pH 5.6± 0.2	

APPENDIX B

Physicochemical Properties of Substance

1. Sorbitol (Merck index, 1989)

Chemical name: D-Glucitol, Sorbitolum

Molecular formulation: $C_6H_{14}O_6$

Molecular weight: 182.17

Appearance: White granules, flakes, or microcrystalline powder, odourless

Solubility: Soluble in 0.5 part of water; sparingly soluble in ethanol; practically insoluble in chloroform and in ether

Stability and storage condition: It is slightly hygroscopic. Sorbitol shall be kept in tightly closed containers.

Use and Safety: Sorbitol is a polyhydric alcohol with half the sweetening power of sucrose. It has been employed as a 30% solution as an alternative to glucose in potential nutrition but its use is not recommended because of the risk of lactic acidosis. Sorbitol also acts as a bulk-sweetening agent. It is used in limited quantities either as a sweetening agent or as a source of carbohydrate in diabetic food products. It is also used as a sweetening agent instead of sucrose in many sugar-free oral liquid preparations and in sugar-free preparations for the prevention of dental caries. Sorbitol also has humectants and stabilizing properties and is used various pharmaceutical and cosmetic products including toothpaste. Excessive ingestion of sorbitol may cause flatulence, abdominal distension and diarrhea.

2. Glycerin (American Pharmaceutical Association and the Pharmaceutical Society of Great Britain, 1986)

Chemical name: Glycerol, Glycerine, 1, 2, 3- propanetriol

Molecular formulation: $C_3H_8O_3$

Molecular weight: 92.09

Appearance: The simplest trihydric alcohol, when pure, is a colorless, viscous liquid with a sweet taste at ordinary room temperature and stable under most conditions.

Stability and storage condition: It is stable in well-closed

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.

3. **Propylene glycol** (American Pharmaceutical Association and the Pharmaceutical Society of Great Britain, 1986)

Chemical name: (\pm) – propane-1, 2 – diol, 1, 3- propanediol

Molecular formulation: $\text{CH}_3\text{CHOHCH}_2\text{OH}$

Molecular weight: 76.10

Appearance: clear, colorless, water-white viscous liquid and practically odorless liquid having a sweet, slightly acid 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 that restricts its use in oral products and cosmetics subject to incidental ingestion such as lip-glosses.

Stability and storage condition: It is stable in well-closed containers, but at high temperature in the open it trends to oxidize, 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 b stored in well-closed container and protected from light.

Uses: Propylene glycol is a solvent or co-solvent used in solutions parenterals, topical preparations and aerosol solutions and humectants in topical preparations. It 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 incompatibility with oxidizing reagents such as potassium permanganate.

4. Cremophore RH 40[®]

Chemical name: Polyoxyl 40 Hydrogenated Castor Oil (USP/NF)

pH: 6-7

Appearance: Cremophore 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 Cremophore RH 40[®] is glycerol polyethylene glycol oxystearate, which together with fatty acid glycerol polyglycol ester, forms the hydrophobic part the product. The hydrophilic part consists of polyethylene glycols and glycerol ethoxylate.

Properties: Cremophore 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.

Stability and storage condition: Pure Cremophore RH 40[®] is chemically very stable. Prolonged exposure to heat can cause physical separation into a liquid and a phase on cooling but the product can be restored to its original form by homogenization. Cremophore 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 Cremophore 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 sterilization, but this can remedy 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 Cremophore 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 Cremophore 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 Cremophore 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 Cremophore RH 40[®] for producing clear, highly concentrated, aqueous solutions of vitamin A palmitate, vitamin A propionate and vitamin E acetate.

Miscellaneous: Clear, aqueous solutions of hydrophobic substances other vitamins can be obtained with Cremophore 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: Cremophore RH 40[®] is also very suitable as an emulsifying agent. It will emulsify a wide range of hydrophobic substances, e.g. fatty acid, fatty alcohols and drugs.

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

General: In common with other surfactants, Cremophore RH 40[®] may alter the rate of absorption of active substances. For this reason, it is advisable to subject preparations containing Cremophore RH 40[®] to pharmaceutical 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.

5. Tween 20 (Ainley Wade and Paul J Weller, 1994)

Chemical name: Polyoxyethylene (20) sorbitan monolaurate, Polysorbate 20

Synonyms: Armotan PML 20, Capmul POE-L, Crillet 1, E 432, Glycosperse L-20, Hodag PSML-20, Liposorb L-20K, Montanox 20, sorbitan monododecanoate poly (oxy-1, 2-ethanediyl) derivatives, Polyoxyethylene 20 laurate, Protasorb L-20, Tween 20

Molecular formulation: CH₅₈H₁₁₄O₂₆

Molecular weight: 1128

Functional Category: Cleansing agent, Solubilizing agent, Emulsifying agent, Surfactant, wetting agent

Chemical Family: Non-ionic

Appearance: yellow oily liquid

Flash point: 149 °C

HLB value: 16.7

Hydroxyl value: 96-108

Saponification value: 40-50

Solubility: soluble in water, low concentration of propylene glycol and isopropyl alcohol

Stability and Storage Conditions: Polysorbates are stable to electrolytes and weak acids and bases; gradual saponification occurs with strong acids and bases. The oleic acid esters are sensitive to oxidation. Polysorbates should be stored in a well-closed container, protected from light, in a cool, dry, place.

Applications in Pharmaceutical Formulation: Polyoxyethylene sorbitan fatty acids (polysorbates) are a series of fatty acid esters of sorbitol and its anhydrides copolymerized with approximately 20 moles of ethylene oxide for each mole of sorbitol and its anhydrides. Polysorbates are hydrophilic nonionic surfactants used widely as emulsifying agents in the preparation of stable oil-in-water pharmaceutical emulsions. They may also be used as solubilizing agents for a variety of substances including essential oils and oil stable vitamins, and as wetting agents in the formulation of oral and parenteral suspensions. Polysorbates are also widely used in cosmetics and food products.

6. Tween 60

Chemical name: Polyoxyethylene (20) sorbitan monostearate, Polysorbate 60

Synonyms: Armotan PMS 20, Capmul POE-S, Crillet 3, E435, Glycosperse S-20, Hodag PSMS-20, Liposorb S-20, Liposorb S-20K, Montanox 60, Polycan T 60 K, polyoxyethylene 20 stearate, sorbitan monooctadecanoate poly (oxy-1, 2-ethanediyl) derivatives, Protasorb S-20, Tween 60

Molecular formulation: $\text{CH}_{64}\text{H}_{126}\text{O}_{26}$

Molecular weight: 1312

Functional Category: Cleansing agent, Solubilizing agent, Emulsifying agent, Surfactant, wetting agent

Chemical Family: Non-ionic

Appearance: yellow oily liquid

Flash point: 149 °C

HLB value: 14.9

Hydroxyl value: 81-96

Saponification value: 45-55

Solubility: soluble in water, low concentration of propylene glycol and isopropyl alcohol

Stability and Storage Conditions: Polysorbates are stable to electrolytes and weak acids and bases; gradual saponification occurs with strong acids and bases. The oleic acid esters are sensitive to oxidation. Polysorbates should be stored in a well-closed container, protected from light, in a cool, dry, place.

Applications in Pharmaceutical Formulation: Polyoxyethylene sorbitan fatty acids (polysorbates) are a series of fatty acid esters of sorbitol and its anhydrides copolymerized with approximately 20 moles of ethylene oxide for each mole of sorbitol and its anhydrides. Polysorbates are hydrophilic nonionic surfactants used widely as emulsifying agents in the preparation of stable oil-in-water pharmaceutical emulsions. They may also be used as solubilizing agents for a variety of substances including essential oils and oil stable vitamins, and as wetting agents in the formulation of oral and parenteral suspensions. Polysorbates are also widely used in cosmetics and food products.

7. Tween 80

Chemical name: Polyoxyethylene (20) sorbitan monooleate, Polysorbate 80

Synonyms: Armotan PMO 20, Capmul POE-O, Crillet 4, Crillet 50, E433, Glycosperse O-20, Hodag PSMO-20, Liposorb O-20, Liposorb O-20K, Montanox 80, polyoxyethylene 20 oleate, (Z)-sorbitan mono-9-octadecanoate poly (oxy-1, 2-ethanediyl) derivatives, Protasorb O-20, Tween 80

Molecular formulation: $\text{CH}_{64}\text{H}_{124}\text{O}_{26}$

Molecular weight: 1310

Functional Category: Cleansing agent, Solubilizing agent, Emulsifying agent, Surfactant, wetting agent

Chemical Family: Non-ionic

Appearance: yellow oily liquid

Flash point: 149 °C

HLB value: 15.0

Hydroxyl value: 65-80

Saponification value: 45-55

Solubility: soluble in water, low concentration of propylene glycol and isopropyl alcohol

Stability and Storage Conditions: Polysorbates are stable to electrolytes and weak acids and bases; gradual saponification occurs with strong acids and bases. The oleic acid esters are sensitive to oxidation. Polysorbates should be stored in a well-closed container, protected from light, in a cool, dry, place.

Applications in Pharmaceutical Formulation: Polyoxyethylene sorbitan fatty acids (polysorbates) are a series of fatty acid esters of sorbitol and its anhydrides copolymerized with approximately 20 moles of ethylene oxide for each mole of sorbitol and its anhydrides. Polysorbates are hydrophilic nonionic surfactants used widely as emulsifying agents in the preparation of stable oil-in-water pharmaceutical emulsions. They may also be used as solubilizing agents for a variety of substances including essential oils and oil stable vitamins, and as wetting agents in the formulation of oral and parenteral suspensions. Polysorbates are also widely used in cosmetics and food products.

8. **Menthol** (USP, 1995; Foster, 1996.)

Menthol is the primary component of the essential oils of peppermint. It occurs naturally as a colorless crystal or powder.

Chemical name: Cyclohexanol, 5-methyl-2- (1-methylethyl), (1RS, 2RS, 5RS)- (±)-5-Methyl-2- (1-methylethyl) cyclohexanol

Synonyms: Hexahydrothymol, Peppermint camphore

Molecular formulation: C₁₀H₂₀O

Molecular weight: 156.27

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

Melting point: The melting point of menthol is 34-36°C.

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 laevorotatory (*l*-Menthol), from natural or synthetic sources, or racemic (*dl*-Menthol). Label it to indicate whether it is laevorotatory 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 modeled base, within -10% to -25%. Meet the requirement for identification.

Appearance: Racemic menthol is mixture of equal parts of the (1R, 2S, 5R)- and (1S, 2R, 5S)-isomers of menthol. It is 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.

Safety: Almost all toxicological data for menthol relates to its uses as the therapeutic agent rather than as an excipient. Inhalation or ingestion of large quantities 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.

9. **Vitamin E acetate** (Djerassi, *et al.*, 1956; Mayer and Pittermann, 1993; Alfonso, 2000)

Chemical name: *dl*-Alpha Tocopherol; Synthetic Alpha Tocopherol; Synthetic *n*-Tocopherol; *dl*- α -Tocopherol; *all-rac*- α -Tocopherol. (\pm)-2.5.7.8-Tetramethyl-2-(4, 8, 12 trimethyltridrcyl) chroman-6-ol.

Molecular formulation: C₂₉H₅₀O₂

Molecular weight: 430.7

Description: Practically odorless, 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

10. **Treiethanolamine**

Chemical name: N (CH₂CH₂OH)₃

Molecular formulation: N (CH₂CH₂OH)₃

Molecular weight: 149.19

Synonyms: 2, 2', 2''-Nitrilotriethanol, trihydroxytriethylamine, tris (hydroxyethyl) amine, triethanolamine.

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 (centipoises) at 25 °C 590.5, Viscosity (centipoises) at 60 °C 65.7. pH of 0.1 N aqueous solution 10.5 Miscible with water, methanol, acetone. Soluble at 25°C in benzene, 4.2%

Use: Pharmaceutical aid (alkalizing agent)

11. **Parabens**

Parabens, esters of *p*-hydroxybenzoic acid, have been used as preservatives of cosmetics for over 60 years. The methyl parabens 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 them 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.

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 surfactant: 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 decrease 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 in tandem to increase their efficacy: antimicrobial activity is the sum of the concentrations while the solubility of the two compounds are independent. Parabens are stable and effective in the pH range 4-5. 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.

Paraben concentrate

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

11.1 Methyl paraben B.P.

Chemical name: Methyl-4-Hydroxybenzoate, 4-Hydroxybenzoic acid methyl ester, methyl p-hydroxybenzoate

Molecular formulation: $C_8H_8O_3$

Molecular weight: 152.15

Description: Colorless crystals or white needless 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 and 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%)

11.2 Propyl paraben USP.

Chemical name: Propyl 4- Hydroxybenzoate, 4-Hydroxybenzoic acid propyl ester, propyl p-hydroxybenzoate

Molecular formulation: $C_{10}H_{12}O_3$

Molecular weight: 180.20

Description: Small, colorless crystals or white powder

Solubility: Miscible with alcohol and with fatty acid and essential oils very slightly soluble in water.

Storage conditions and precautions: Store in well-closed containers and protected from light.

Uses: Pharmaceutical aid (antimicrobial preservative).

APPENDIX C

Table 1. Formulation of PG gel base of durian polysaccharide gel (PG). TEA = Triethanolamine, DW = distilled water

Formula	Ingredients (%w/w)													Description of PG gel product (freshly prepared)
	PG	Amerchol L-101®	Creophore RH 40®	sorbital	Propylene glycol	Tween 80	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 1 PG gel base	2.5	0.5	10	5	5	1	5	0.5	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: easy Viscosity: 1365 ± 219 cps. pH: 2.79
NO. 2 PG gel base	2.5	0.5	10	10	5	1	5	0.5	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: easy Viscosity: 3150 ± 62.5cps. pH: 2.83
NO. 3 PG gel base	2.5	0.5	10	-	5	1	5	0.5	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.93

Table 1. (Continued p.2)

Formula	Ingredients (%w/w)													Description of PG gel product (freshly prepared)
	PG	Amerchol L-101®	Creophore RH 40®	sorbital	Propylene glycol	Tween 80	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 4 PG gel base	2.5	0.5	13	-	5	1	5	0.5	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: easy Viscosity: 1265 ± 119 cps. pH: 2.89
NO. 5 PG gel base	2.5	0.5	13	-	5	1	5	0.5	0.1	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: easy Viscosity: 2785 ± 62.0cps. pH: 2.84
NO. 6 PG gel base	2.5	0.5	13	-	-	1	5	0.5	0.1	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.93

Table 1. (Continued p.3)

Formula	Ingredients (%w/w)													Description of PG gel product (freshly prepared)
	PG	Amerchol L-101®	Creophore RH 40®	sorbital	Propylene glycol	Tween 80	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 7 PG gel base	2.5	0.5	13	-	-	1	-	0.5	0.1	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: easy Viscosity: 3092 ± 530cps. pH: 3.05
NO. 8 PG gel base	2.5	0.5	13	-	15	-	-	0.5	0.1	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: creamy white Flow: easy Viscosity: 1265 ± 130cps. pH: 3.05
NO. 9 PG gel base	2.5	0.5	13	-	15	-	-	1.0	0.1	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: creamy white Flow: easy Viscosity: 2192 ± 365 cps. pH: 3.02

Table 1. (Continued p.4)

Formula	Ingredients (%w/w)													Description of PG gel product (freshly prepared)
	PG	Amerchol L-101 [®]	Creophore RH 40 [®]	sorbital	Propylene glycol	Tween 80	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 10 PG gel base	2.5	0.5	13	-	15	-	-	1.2	0.1	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: pale brown Flow: not easy Viscosity: > 10,000 cps. pH: 2.98
NO. 11 PG gel base	2.5	0.5	13	-	15	-	-	1.2	0.1	0.2	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: pale brown Flow: easy Viscosity: 3092 ± 530cps. pH: 3.05
NO. 12 PG gel base	2.5	0.5	13	-	15	-	-	1.2	0.1	0.1	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: pale brown Flow: easy Viscosity: 2598 ± 230cps. pH: 3.05

Table 2. Formulation of antiseptic PG gel contained tea tree oil (TTO). TTO = Tea tree oil, TEA = Triethanolamine, DW = distilled water

Formula	Ingredients (%w/w)													Description of antiseptic TTO-PG gel product (freshly prepared)
	PG	TTO	Amerchol L-101 [®]	sorbital	Propylene glycol	Tween 80	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 13 TTO - PG gel	2.5	0.7	0.5	10	5	1	5	-	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: easy Viscosity: 3282 ± 52.0 cps. pH: 2.98
NO. 14 TTO - PG gel	2.5	0.7	0.5	10	5	1.5	5	-	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.95
NO. 15 TTO - PG gel	2.5	0.7	0.5	10	5	1.5	5	1.0	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: easy Viscosity: 3125 ± 125 cps. pH: 2.93

Table 2. (Continued p. 2)

Formula	Ingredients (%w/w)													Description of antiseptic TTO- PG gel product (freshly prepared)
	PG	TTO	Amerchol L-101®	sorbital	Propylene glycol	Tween 80	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 16 TTO - PG gel	2.5	0.7	0.5	5	5	1.5	5	1.0	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.88
NO. 17 TTO - PG gel	2.5	0.7	0.5	5	5	1.5	5	1.0	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.90
NO. 18 TTO - PG gel	2.5	0.7	0.5	5	10	1.5	5	1.0	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: cream; white Flow: not easy Viscosity: > 10,000 cps. pH: 2.97

Table 2. (Continued p. 3)

Formula	Ingredients (%w/w)													Description of antiseptic TTO-PG gel product (freshly prepared)
	PG	TTO	Amerchol L-101 [®]	Creophore RH 40 [®]	Propylene glycol	Tween 80	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 19 TTO - PG gel	2.5	0.7	0.5	-	10	1.5	5	1.0	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 0 cps. pH: 2.89
NO. 20 TTO - PG gel	2.5	0.7	0.5	-	10	1	5	1.0	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.79
NO. 21 TTO - PG gel	2.5	0.7	0.5	5	10	1	5	1.0	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.98

Table 2. (Continued p. 4)

Formula	Ingredients (%w/w)													Description of antiseptic TTO-PG gel product (freshly prepared)
	PG	TTO	Amerchol L-101®	Creophore RH 40®	Propylene glycol	Tween 80	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 22 TTO - PG gel	2.5	0.7	0.5	10	10	1	5	1.0	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: easy Viscosity: 4093 ± 120 cps. pH: 2.96
NO. 23 TTO - PG gel	2.5	0.7	0.5	11	10	1	5	1.0	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.89
NO. 24 TTO - PG gel	2.5	0.7	0.5	13	10	1	5	1.0	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.84

Table 2. (Continued p. 5)

Formula	Ingredients (%w/w)												Description of antiseptic TTO-PG gel product (freshly prepared)
	PG	TTO	Amerchol L-101 [®]	Creophore RH 40 [®]	Propylene glycol	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 25 TTO - PG gel	2.5	0.7	0.5	13	10	5	1.0	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.82
NO. 26 TTO - PG gel	2.5	0.7	0.5	13	10	-	1.0	-	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.95
NO. 27 TTO - PG gel	2.5	0.7	0.5	13	10	-	1.0	0.1	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: creamy white Flow: easy Viscosity: 4093 ± 120 cps. pH: 2.93

Table 2. (Continued p. 6)

Formula	Ingredients (%w/w)												Description of antiseptic TTO-PG gel product (freshly prepared)
	PG	TT O	Amerchol L-101®	Creophore RH 40®	Propylene glycol	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 28 TTO - PG gel	2.5	1.0	0.5	13	10	-	1.0	0.1	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture smooth homogenous gel Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.93
NO. 29 TTO - PG gel	2.5	1.0	0.5	13	15	-	1.0	0.1	-	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: pale brown Flow: not easy Viscosity: > 10,000 cps. pH: 2.97
NO. 30 TTO - PG gel	2.5	1.0	0.5	13	15	-	1.0	0.1	0.2	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: pale brown Flow: not easy Viscosity: > 10,000 cps. pH: 2.93

Table 2. (Continued p. 7)

Formula	Ingredients (%w/w)												Description of antiseptic TTO-PG gel product (freshly prepared)
	PG	TTO	Amerchol L-101®	Creophore RH 40®	Propylene glycol	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 31 TTO - PG gel	2.5	1.0	0.5	13	15	-	1.0	0.1	0.2	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture smooth homogenous gel Color: pale brown Flow: not easy Viscosity: > 10,000 cps. pH: 2.93
NO. 32 TTO - PG gel	2.5	1.0	0.5	13	15	-	1.0	0.1	0.1	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: pale brown Flow: easy Viscosity: 4980 ± 265 cps. pH: 3.01
NO. 33 TTO - PG gel	2.5	1.0	0.5	13	15	-	1.2	0.1	0.1	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: pale brown Flow: easy Viscosity: 4365 ± 640 cps. pH: 2.99

Table 2. (Continued p. 8)

Formula	Ingredients (%w/w)												Description of antiseptic TTO-PG gel product (freshly prepared)
	PG	TTO	Amerchol L-101 [®]	Creophore RH 40 [®]	Propylene glycol	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 34 TTO - PG gel	2.5	1.2	0.5	13	15	-	1.0	0.1	0.2	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture smooth homogenous gel Color: creamy white Flow: easy Viscosity: 2360 ± 275 cps. pH: 3.03
NO. 35 TTO - PG gel	2.5	1.5	0.5	13	15	-	1.0	0.1	0.1	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 3.09

Table 3. Formulation of antiseptic PG gel contained tea tree oil (TTO) and betel oil (BO). TTO = Tea tree oil, betel oil (BO), TEA = Triethanolamine, DW = distilled water

Formula	Ingredients (%w/w)														Description of antiseptic TTO/BO-PG gel product (freshly prepared)
	PG	TTO	BO	Amerchol L-101 [®]	Creophore RH 40 [®]	Propylene glycol	Sorbital	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 36 TTO/ BO PG gel	2.5	1.0	0.5	0.5	10	15	5	5	1.2	0.1	0.1	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.79
NO. 37 TTO/ BO PG gel	2.5	1.0	0.5	0.5	10	15	-	5	1.2	0.1	0.1	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.99
NO. 38 TTO/ BO PG gel	2.5	1.0	0.2	0.5	10	15	5	-	1.2	0.1	0.1	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 3.01

Table 3. (Continued p. 2)

Formula	Ingredients (%w/w)													Description of antiseptic TTO/BO-PG gel product (freshly prepared)
	PG	TTO	BO	Amerchol L-101 [®]	Creophore RH 40 [®]	Propylene glycol	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 39 TTO/ BO PG gel	2.5	1.0	0.5	0.5	10	15	-	1.2	0.1	0.1	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.79
NO. 40 TTO/ BO PG gel	2.5	1.0	0.5	0.5	11	15	-	1.2	0.1	0.1	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.89
NO. 41 TTO/ BO PG gel	2.5	1.0	0.5	0.5	11	15	-	1.2	0.1	0.1	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: creamy white Flow: easy Viscosity: 2150 ± 130 cps. pH: 2.98

Table 3. (Continued p. 3)

Formula	Ingredients (%w/w)													Description of antiseptic TTO/BO-PG gel product (freshly prepared)
	PG	TTO	BO	Amerchol L-101 [®]	Creophore RH 40 [®]	Propylene glycol	Glycerin	Menthol	Vitamin E acetate	CaCl ₂	Paraben conc.	TEA	DW	
NO. 42 TTO/ BO PG gel	2.5	1.0	0.5	0.5	13	15	-	1.2	0.1	0.1	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: pale brown Flow: easy Viscosity: 1365 ± 144 cps. pH: 2.93
NO. 43 TTO/ BO PG gel	2.5	1.0	0.2	0.5	13	15	-	1.2	0.1	0.1	1	qs.ad. pH 2.8-3.0	qs.ad. 100	Texture: smooth homogenous gel Color: pale brown Flow: easy Viscosity: 2778 ± 280 cps. pH: 3.02

Table 4. Formulation of antiseptic PG gel contained tea tree oil (TTO) and ethanol. TTO = Tea tree oil, TEA = Triethanolamine, DW = distilled water

Formula	Ingredients (%w/w)											Description of antiseptic TTO/ethanol-PG gel product (freshly prepared)
	PG	TTO	Amerchol L-101 [®]	Propylene glycol	Tween 80	Glycerin	ethanol	CaCl ₂	Paraben conc.	TEA	DW	
NO. 44 TTO - PG gel	2.0	0.5	0.5	5	2	5	10	0.1	1	-	qs.ad. 100	Texture non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.72
NO. 45 TTO - PG gel	2.0	0.5	0.5	15	2	5	10	0.1	1	-	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.51
NO. 46 TTO - PG gel	2.0	0.5	0.5	15	2	10	10	0.1	1	-	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.50

Table 4. (Continued p. 2)

Formula	Ingredients (%w/w)											Description of antiseptic TTO/ethanol-PG gel product (freshly prepared)
	PG	TTO	Amerchol L-101 [®]	Propylene glycol	Tween 80	Glycerin	ethanol	CaCl ₂	Paraben conc.	TEA	DW	
NO. 47 TTO -PG gel	2.0	0.5	0.5	10	2	10	10	0.1	1	-	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.61
NO. 48 TTO -PG gel	2.0	0.5	0.5	10	1	10	10	0.1	1	-	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.56
NO. 49 TTO -PG gel	2.5	0.5	0.5	10	1	10	10	0.1	1	-	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.75

Table 4. (Continued p. 3)

Formula	Ingredients (%w/w)											Description of antiseptic TTO/ethanol-PG gel product (freshly prepared)
	PG	TTO	Amerchol L-101 [®]	Propylene glycol	Tween 80	Glycerin	ethanol	CaCl ₂	Paraben conc.	TEA	DW	
NO. 50 TTO -PG gel	2.5	0.5	0.5	5	1	10	10	0.1	1	-	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.75
NO. 51 TTO -PG gel	2.0	0.5	0.5	5	1	5	10	0.1	1	-	qs.ad. 100	Texture: non-homogenous Color: white creamy Flow: not easy Viscosity: > 10,000 cps. pH: 2.68
NO. 52 TTO -PG gel	2.5	0.5	0.5	5	1	5	15	0.1	1	-	qs.ad. 100	Texture: non-homogenous Color: creamy white Flow: not easy Viscosity: > 10,000 cps. pH: 2.52

APPENDIX D

Table 1. TTO purchased from Menthol Thai import export. The data was shown certificate of analysis tea tree oil.

FROM : MENTHOL THAI

FAX NO. : 02 4340126

Oct. 02 2002 12:58P1 P2



**Southern Cross
botanicals**

Certified Botanicals: Extracts from Australia & New Zealand

Southern Cross Botanicals Pty Ltd
 ABN 97 087 089 854
 Head Office: 36 Blue Seas Parade
 Lennox Head NSW 2478 Australia
 Mail: PO Box 361, Barina NSW 2478
 Tel: +61-2-66876736
 Fax: +61-2-66875439
 E-mail: info@scbotanicals.com.au
 Web-site: www.scbotanicals.com.au

CERTIFICATE OF ANALYSIS

PRODUCT NAME:	Australian Tea Tree Oil - Pharmaceutical Grade
PRODUCT CODE:	RTTO1
BATCH No	2093
REFERENCE Nos.	WN02/3430
DESCRIPTION:	Essential oil produced by steam distillation of the foliage and terminal branchlets of <i>Melaleuca alternifolia</i> .
APPEARANCE (Visual):	Clear mobile liquid
COLOUR (Visual):	Colourless to pale yellow
ODOUR (Olfactory)	Characteristic
RELATIVE DENSITY (20°C):	0.897
REFRACTIVE INDEX (20°C):	1.478
OPTICAL ROTATION (20°C):	+9°
MISCIBILITY IN 85%(V/V) ETHANOL (20°C):	Conforms
CHROMATOGRAPHIC PROFILE	(%)
α-pinene	2.7
sabinene	0.1
α-terpinene	8.4
p-cymene	3.8
limonene	1.2
1,8-cineole	3.8
γ-terpinene	20.6
α-terpinolene	3.2
terpinen-4-ol	39.0
α-terpineol	3.0
aromadendrene	1.4
δ-cadinene	1.0
globulol	0.3
viridiflorol	0.3

Retest Due: September 2004

Approved By: 

D Priest BSc. FRACI.Chem

Date: 27.09.02

Doc.No. CA-TTO1	Rev.No. 2	Date: 7.9.02	Auth. By D. Priest	Page 1 of 1
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APPENDIX E

Table 1. In-vivo studies of antiseptic PG gel finished products NO.33, 43 by hand washing test. The colony counts were performed after incubation at 37°C for 24 hrs of each finger pressed an MHA plates for 30 sec.

Process	Colony counts represented by the score number (colony counts observed per each step of finger pressed on MHA agar plates for 30 seconds)				
	Step 1	Step 2	Step 3	Step 4	Step 5
1	+4	+4	+4	+1	+1
2	+4	+3	+1	+1	+1
3	+4	+3	+1	+1	+1

Score no: 1 = 0 - 50 colony, 2 = 50 -100 colony, 3 = 100 - 200 colony, 4 = >200 colony

APPENDIX F

In-vivo evaluation by hand washing test of gel commercial product (clean feel[®]), antiseptic PG gel NO.33 and NO.43, tap water was control. The test of before hand washing test was statistical analyses by using one way ANOVA test in version 11.5.

One way

Descriptives

Analysis

group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Tap water	10	3.8000	.42164	.13333	3.4984	4.1016	3.00	4.00
gel commercial	10	3.5000	.52705	.16667	3.1230	3.8770	3.00	4.00
TTO	10	3.3000	.48305	.15275	2.9544	3.6456	3.00	4.00
TTO+BO	10	3.5000	.52705	.16667	3.1230	3.8770	3.00	4.00
Total	40	3.5250	.50574	.07996	3.3633	3.6867	3.00	4.00

ANOVA

Analysis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.275	3	.425	1.759	.173
Within Groups	8.700	36	.242		
Total	9.975	39			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: Analysis

LSD

(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Tap water	gel commercial	.3000	.21985	.181	-.1459	.7459
	TTO	.5000(*)	.21985	.029	.0541	.9459
	TTO+BO	.3000	.21985	.181	-.1459	.7459
gel commercial	Tap water	-.3000	.21985	.181	-.7459	.1459
	TTO	.2000	.21985	.369	-.2459	.6459
	TTO+BO	.0000	.21985	1.000	-.4459	.4459
TTO	Tap water	-.5000(*)	.21985	.029	-.9459	-.0541
	gel commercial	-.2000	.21985	.369	-.6459	.2459
	TTO+BO	-.2000	.21985	.369	-.6459	.2459
TTO+BO	Tap water	-.3000	.21985	.181	-.7459	.1459
	gel commercial	.0000	.21985	1.000	-.4459	.4459
	TTO	.2000	.21985	.369	-.2459	.6459

* The mean difference is significant at the .05 level.

In-vivo evaluation by hand washing test of gel commercial product (clean feel®), antiseptic PG gel NO.33 and NO.43, tap water was control. The test of after washing test for 5 minutes was statistical analyses by using one way ANOVA test in version 11.5.

One way

Descriptives

Analysis

group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
					Tap water	10		
Gel commercial	10	2.70000	.823273	.260342	2.11107	3.28893	2.000	4.000
TTO	10	2.30000	.823273	.260342	1.71107	2.88893	1.000	3.000
TTO+BO	10	2.80000	.632456	.200000	2.34757	3.25243	2.000	4.000
Total	40	2.77500	.767530	.121357	2.52953	3.02047	1.000	4.000

ANOVA

Analysis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.075	3	1.692	3.402	.028
Within Groups	17.900	36	.497		
Total	22.975	39			

Multiple Comparisons

Dependent Variable: SCORE

LSD

(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
					Tap water	Gel commercial
	TTO	1.00000(*)	.315348	.003	.36044	1.63956
	TTO+BO	.50000	.315348	.122	-.13956	1.13956
gel commercial	Tap water	-.60000	.315348	.065	-1.23956	.03956
	TTO	.40000	.315348	.213	-.23956	1.03956
	TTO+BO	-.10000	.315348	.753	-.73956	.53956
TTO	Tap water	-1.00000(*)	.315348	.003	-1.63956	-.36044
	Gel commercial	-.40000	.315348	.213	-1.03956	.23956
	TTO+BO	-.50000	.315348	.122	-1.13956	.13956
TTO+BO	Tap water	-.50000	.315348	.122	-1.13956	.13956
	Gel commercial	.10000	.315348	.753	-.53956	.73956
	TTO	.50000	.315348	.122	-.13956	1.13956

* The mean difference is significant at the .05 level

In-vivo evaluation by hand washing test of gel commercial product (clean feel®), antiseptic PG gel NO.33 and NO.43, tap water was control. The test of after washing test for 15 minutes was statistical analyses by using one way ANOVA test in version 11.5.

One way

Descriptives

Analysis

group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Tap water	10	2.90000	.316228	.100000	2.67378	3.12622	2.000	3.000
gel commercial	10	1.60000	.516398	.163299	1.23059	1.96941	1.000	2.000
TTO	10	1.40000	.516398	.163299	1.03059	1.76941	1.000	2.000
TTO+BO	10	1.50000	.527046	.166667	1.12297	1.87703	1.000	2.000
Total	40	1.85000	.769615	.121687	1.60387	2.09613	1.000	3.000

ANOVA

Analysis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	14.900	3	4.967	21.805	.000
Within Groups	8.200	36	.228		
Total	23.100	39			

Multiple Comparisons

Dependent Variable: SCORE

LSD

(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Tap water	Gel commercial	1.30000(*)	.213437	.000	.86713	1.73287
	TTO	1.50000(*)	.213437	.000	1.06713	1.93287
	TTO+BO	1.40000(*)	.213437	.000	.96713	1.83287
gel commercial	Tap water	-1.30000(*)	.213437	.000	-1.73287	-.86713
	TTO	.20000	.213437	.355	-.23287	.63287
	TTO+BO	.10000	.213437	.642	-.33287	.53287
TTO	Tap water	-1.50000(*)	.213437	.000	-1.93287	-1.06713
	Gel commercial	-.20000	.213437	.355	-.63287	.23287
	TTO+BO	-.10000	.213437	.642	-.53287	.33287
TTO+BO	Tap water	-1.40000(*)	.213437	.000	-1.83287	-.96713
	Gel commercial	-.10000	.213437	.642	-.53287	.33287
	TTO	.10000	.213437	.642	-.33287	.53287

* The mean difference is significant at the .05 level.

In-vivo evaluation by hand washing test of gel commercial product (clean feel®), antiseptic PG gel NO.33 and NO.43, tap water was control. The test of after washing test for 30 minutes was statistical analyses by using one way ANOVA test in version 11.5.

One way

Descriptives

Analysis

group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Tap water	10	2.80000	.421637	.133333	2.49838	3.10162	2.000	3.000
Gel commercial	10	1.10000	.316228	.100000	.87378	1.32622	1.000	2.000
TTO	10	1.00000	.000000	.000000	1.00000	1.00000	1.000	1.000
TTO+BO	10	1.10000	.316228	.100000	.87378	1.32622	1.000	2.000
Total	40	1.50000	.816497	.129099	1.23887	1.76113	1.000	3.000

ANOVA

Analysis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	22.600	3	7.533	79.765	.000
Within Groups	3.400	36	.094		
Total	26.000	39			

Multiple Comparisons

Dependent Variable: SCORE

LSD

(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Tap water	Gel commercial	1.70000(*)	.137437	.000	1.42127	1.97873
	TTO	1.80000(*)	.137437	.000	1.52127	2.07873
	TTO+BO	1.70000(*)	.137437	.000	1.42127	1.97873
gel commercial	Tap water	-1.70000(*)	.137437	.000	-1.97873	-1.42127
	TTO	.10000	.137437	.472	-.17873	.37873
	TTO+BO	.00000	.137437	1.000	-.27873	.27873
TTO	Tap water	-1.80000(*)	.137437	.000	-2.07873	-1.52127
	Gel commercial	-.10000	.137437	.472	-.37873	.17873
	TTO+BO	-.10000	.137437	.472	-.37873	.17873
TTO+BO	Tap water	-1.70000(*)	.137437	.000	-1.97873	-1.42127
	Gel commercial	.00000	.137437	1.000	-.27873	.27873
	TTO	.10000	.137437	.472	-.17873	.37873

* The mean difference is significant at the .05 level.

APPENDIX G

แบบสอบถาม

ความพึงพอใจในการทดลองใช้ผลิตภัณฑ์เจลระงับเชื้อเตรียมจากเปลือกทุเรียนและ tea tree oil

ชื่อ-สกุล..... อายุ.....ปี เพศ.....

1. ท่านเคยใช้เจลล้างมือในการทำความสะอาดหรือไม่

เคย ไม่เคย

2. โดยปกติท่านใช้ผลิตภัณฑ์ทำความสะอาดในรูปแบบไหน

แบบล้างน้ำ
 แบบไม่ต้องล้างน้ำ

3. ความพอใจของผลิตภัณฑ์ตัวอย่าง

3.1 ลักษณะเนื้อเจลก่อนใช้ (ระดับคะแนน 1= พอใจน้อยสุด, 2= พอใจน้อย, 3= พอใจ, 4= พอใจมาก, 5= พอใจมากที่สุด)

หัวข้อ	1	2	3	4	5
สี					
กลิ่น					
ความหนืดของเนื้อเจล					
ความเนียนของเนื้อเจล					
ความแน่นของเนื้อเจล					
ความใสของเนื้อเจล					

3.2 ขณะใช้ทาผิวหนัง

หัวข้อ	1	2	3	4	5
ความเย็น					
การกระจายเนื้อสัมผัสไม่เป็นก้อน					
ความเหนียวเหนอะหนะระหว่างทา					
ทาแล้วแห้งเร็ว					
ความเหนียวเหนอะหนะหลังทาแห้งแล้ว					
คราบที่หลงเหลือบริเวณมือ					
ความรู้สึกชุ่มชื้นผิวหลังทา					
ความพึงพอใจโดยรวมหลังการใช้					

4. หากมีการพัฒนารูปแบบผลิตภัณฑ์ท่านสนใจการใช้ผลิตภัณฑ์เงาระดับเชื้อที่เตรียมจากผลิตภัณฑ์ธรรมชาติหรือไม่

สนใจ

ไม่สนใจ

แบบสอบถาม

ความพึงพอใจในการทดลองใช้ผลิตภัณฑ์เจลระดับเชื้อเตรียมจากเปลือกทุเรียนและ tea tree oil และ betel oil

ชื่อ-สกุล..... อายุปี เพศ.....

1. ท่านเคยใช้เจลล้างมือในการทำความสะอาดหรือไม่

เคย ไม่เคย

2. โดยปกติท่านใช้ผลิตภัณฑ์ทำความสะอาดในรูปแบบไหน

แบบล้างน้ำ

แบบไม่ต้องล้างน้ำ

3. ความพอใจของผลิตภัณฑ์ตัวอย่าง

3.1 ลักษณะเนื้อเจลก่อนใช้ (ระดับคะแนน 1= พอใจน้อยสุด, 2= พอใจน้อย, 3= พอใจ, 4= พอใจมาก, 5= พอใจมากที่สุด)

หัวข้อ	1	2	3	4	5
สี					
กลิ่น					
ความหนืดของเนื้อเจล					
ความเนียนของเนื้อเจล					
ความแน่นของเนื้อเจล					
ความใสของเนื้อเจล					

3.3 ขณะใช้ทาผิวหนัง

หัวข้อ	1	2	3	4	5
ความเย็น					
การกระจายเนื้อสม่าเสมอไม่เป็นก้อน					
ความเหนียวเหนอะหนะระหว่างทา					
ทาแล้วแห้งเร็ว					
ความเหนียวเหนอะหนะหลังทาแห้งแล้ว					
คราบที่หลงเหลือบริเวณมือ					
ความรู้สึกชุ่มชื้นผิวหลังทา					
ความพึงพอใจโดยรวมหลังการใช้					

4. หากมีการพัฒนารูปแบบผลิตภัณฑ์ท่านสนใจการใช้ผลิตภัณฑ์เจลระงับเชื้อที่เตรียมจากผลิตภัณฑ์ธรรมชาติหรือไม่

สนใจ

ไม่สนใจ

VITA

Miss Unchulee Pongwiwatana was born on December 9, 1978 in Nakhon Ratchasima, Thailand. She graduated Diploma in Analytical Chemistry in 2000 from Institute of Analytical Chemistry Training, Chulalongkorn University, Thailand. Bachelor's Degree of science in 2002 from Department of Biochemistry, Faculty of Science, Chulalongkorn University.

