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APPENDICES

APPENDIX A

Table A1. The pH profiles of polysaccharide gel (PG) at different concentrations

%PG	Polysaccharide gel solution			Average pH±SD
	I	II	III	
1	2.33	2.34	2.42	2.36±0.05
2	2.29	2.32	2.31	2.31±0.02
3	2.28	2.27	2.26	2.27±0.01
4	2.17	2.22	2.18	2.19±0.03
5	2.07	2.15	2.10	2.11±0.04
6	2.05	2.06	2.04	2.05±0.01

Table A2. The viscosity profiles of polysaccharide gel (PG) at different Concentrations

%PG	Polysaccharide gel solution			Average viscosity±SD
	I	II	III	
1	82	81.6	79.8	81.13±1.17
2	181.5	184.3	182	182.60±1.49
3	440	439	440	439.67±0.58
4	949.2	948	950	949.07±1.01
5	4755	4758	4760	4757.67±2.52
6	9841	9843	9845	9843.00±2.00

Table A3. Effect of acid (HCl) and base (NaOH) on the viscosity of polysaccharide gel (PG).

pH	Average viscosity±SD
1.04	534.47±1.94
1.99	542.26±1.04
2.17	439.56±0.51
3.02	350.63±1.03
4.08	327.72±0.98
5.01	283.57±1.14
6.04	254.80±1.56
7.13	206.60±1.12
8.07	185.32±0.59
9.16	172.37±0.78
10.16	94.51±1.08

Table A4. Effect of electrolytes on the viscosity of polysaccharide gel (PG)

Electrolytes	Concentrations (M)	pH	Average viscosity±SD
$CaCl_2$	0.02	2.08	1763.67±5.69
	0.04	1.96	2047.67±4.73
	0.06	1.86	2676.33±6.51
	0.08	1.77	2706.00±8.00
	0.10	1.75	3271.00±7.55
$MgCl_2$	0.02	2.11	621.70±7.35
	0.04	2.10	819.43±5.66
	0.06	1.96	851.97±4.95
	0.08	1.93	1095.33±8.33
	0.10	1.92	1362.67±6.03
$FeSO_4$	0.02	1.97	565.60±6.50
	0.04	1.97	1625.33±8.02
	0.06	1.99	2260.00±3.61
	0.08	2.00	3447.67±4.93
	0.10	2.01	9012.33±5.86
$ZnSO_4$	0.02	1.88	1306.00±4.00
	0.04	1.89	4660.33±8.50
	0.06	1.90	7670.67±3.06
	0.08	1.92	8750.33±2.52
	0.10	1.95	9953.67±5.69

Table A5. Effect of solvents on the viscosity of polysaccharide gel (PG)

Solvents	Concentrations (%)	pH	Average viscosity±SD
Ethyl alcohol	0	2.27	439.67±0.58
	5	2.37	445.17±0.76
	10	2.40	633.00±2.00
	15	2.42	1348.67±2.08
	20	2.42	4780.33±1.53
	25	2.40	8119.67±1.53
	30	2.44	9830.00±2.00
Isopropyl alcohol	0	2.27	439.67±0.58
	5	2.33	723.40±1.83
	10	2.33	865.40±1.64
	15	2.36	1520.67±2.08
	20	2.40	2816.00±1.00
	25	2.41	5432.67±2.08
	30	2.44	9840.33±1.53

Table A6. Effect of humectants on the viscosity of polysaccharide gel (PG)

Humectants	Concentrations (%)	pH	Average viscosity±SD
Propylene glycol	0	2.27	439.67±0.58
	5	2.34	648.17±1.26
	10	2.35	764.50±1.80
	15	2.35	1139.00±1.00
	20	2.36	1519.67±1.53
	25	2.38	1698.67±2.08
	30	2.38	2697.67±1.53
Glycerin	0	2.27	439.67±0.58
	5	2.27	468.43±1.56
	10	2.28	510.23±1.96
	15	2.29	609.70±1.95
	20	2.29	749.43±1.69
	25	2.30	923.33±1.53
	30	2.30	1041.33±2.08
Sorbitol	0	2.27	439.67±0.58
	5	2.26	465.77±1.97
	10	2.26	488.50±1.32
	15	2.24	495.80±1.66
	20	2.22	669.73±1.25
	25	2.21	815.33±1.53
	30	2.21	931.97±2.05

Table A7. Effect of amerchol L101 on the viscosity of polysaccharide gel (PG)

%Amerchol L101	pH	Average viscosity±SD
0	2.27	439.67±0.58
5	2.28	532.27±2.05
10	2.32	557.77±1.10
15	2.34	645.33±1.53
20	2.34	1114.00±2.00
25	2.33	1740.33±1.53
30	2.37	1774.00±2.00

Table A8. Effect of paraben concentrate on the viscosity of polysaccharide gel (PG)

%Paraben concentrate	pH	Average viscosity±SD
0	2.27	439.67±0.58
0.2	2.29	441.40±0.78
0.4	2.30	444.97±0.15
0.6	2.31	449.37±0.71
0.8	2.32	453.13±0.40
1	2.31	456.80±0.69
2	2.33	460.17±0.96
3	2.34	463.27±0.74
4	2.35	466.37±0.57
5	2.36	474.73±0.64

Table A9. Effect of buffers on the viscosity of polysaccharide gel (PG)

Buffers	pH	Average viscosity±SD
Citrate buffer	4	357.40±2.05
	4.5	293.70±1.49
	5	275.60±0.75
	5.5	250.57±1.88
	6	210.83±1.72
Phosphate buffer	5.5	910.57±1.86
	6	1162.33±153
	6.5	7590.00±2.00
	7	7850.33±1.53
	7.5	9839.33±2.08

APPENDIX B

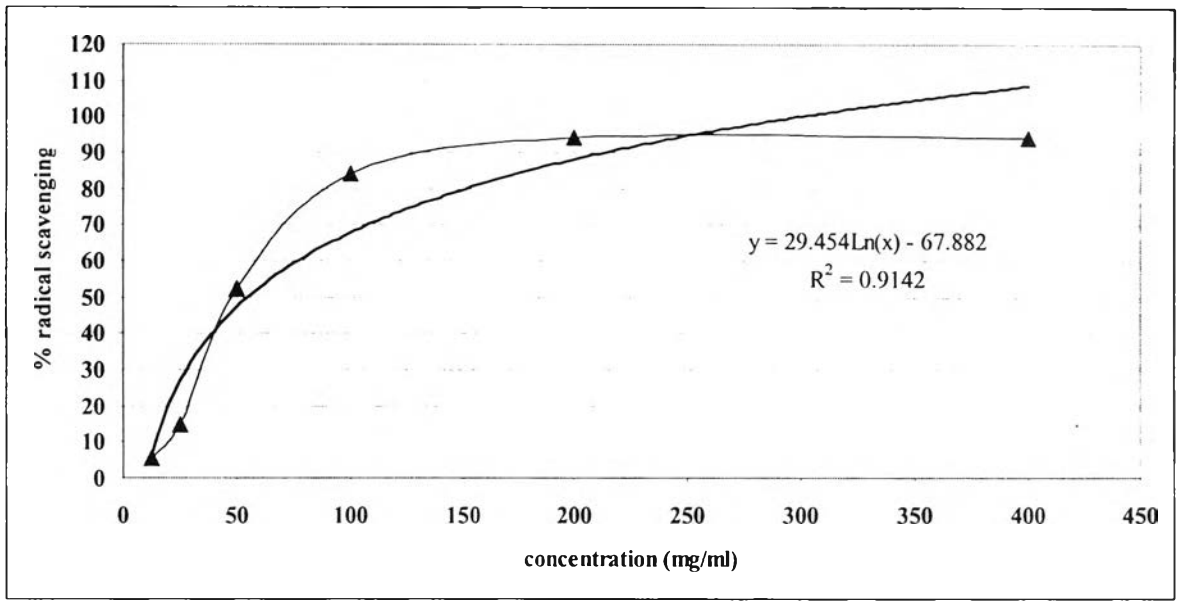


Figure B1. A logarithmic regression curve of radical scavenging activity of betel vine oil

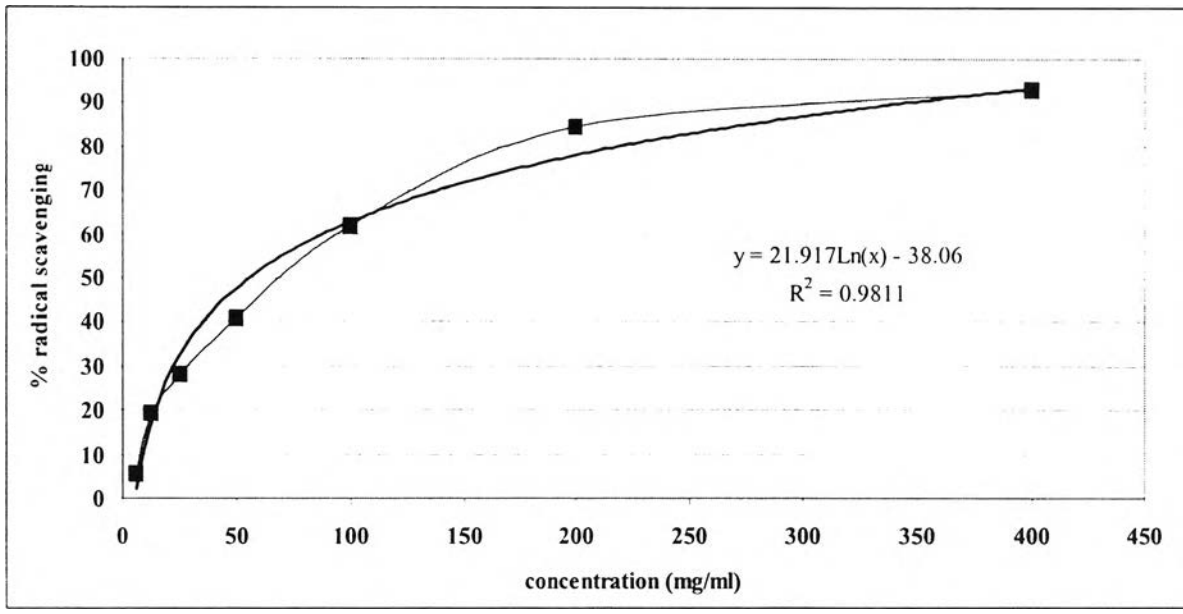


Figure B2. A logarithmic regression curve of radical scavenging activity of oleoresin

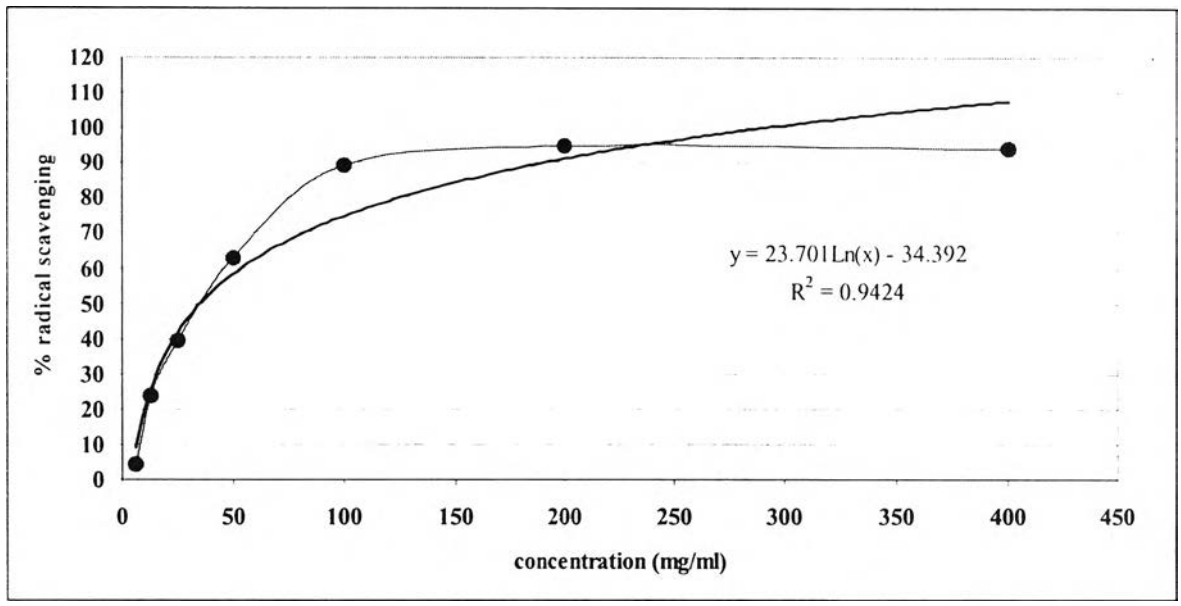


Figure B3. A logarithmic regression curve of radical scavenging activity of curcuminoid

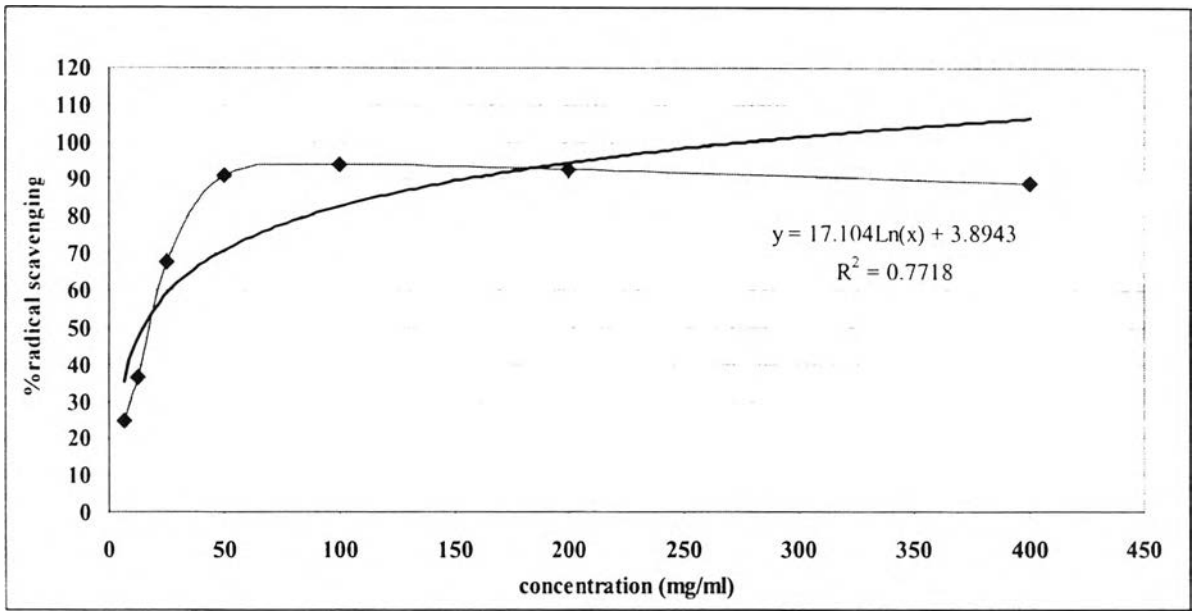


Figure B4. A logarithmic regression curve of radical scavenging activity of curcuminoid (TCFF)

APPENDIX C

Table C1. Formulation of PG gel base

Formulation No.	Ingredients (%w/w)						
	PG	Propylene glycol	Glycerin	Amerchol L101	Cremorphor RH-40	Paraben concentrate	Description of PG gel base preparation After prepared
1	2.5	5	5	0.25	5	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 524 cps pH: 2.23

Table C2. Formulation of PG gel contained betel vine oil

Formulation No.	Ingredients (%w/w)										
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	HCO-40	Tween 80	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
2	2.5	5	5	1	1	5	-	-	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 520 cps pH: 2.36
3	2.5	5	5	1	1	-	5	-	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 585.6 cps pH: 2.40
4	2.5	5	5	1	1	-	-	5	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 675 cps pH: 2.45

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)										
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	HCO-40	Tween 80	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
5	2.5	5	5	1	1	10	-	-	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 592 cps pH: 2.39
6	2.5	5	5	1	1	-	10	-	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 446.7 cps pH: 2.45
7	2.5	5	5	1	1	-	-	10	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 766 cps pH: 2.55

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)										
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	HCO-40	Tween 80	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
8	2.5	5	5	1	1	5	-	-	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 620 cps pH: 2.48
9	2.5	5	5	1	1	-	5	-	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 710 cps pH: 2.45
10	2.5	5	5	1	1	-	-	5	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 796 cps pH: 2.48

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)										
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	HCO-40	Tween 80	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
11	2.5	5	5	1	1	10	-	-	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 824 cps pH: 2.61
12	2.5	5	5	1	1	-	10	-	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 747 cps pH: 2.59
13	2.5	5	5	1	1	-	-	10	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 1068 cps pH: 2.50

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)										
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	HCO-40	Tween 80	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
14	2.5	5	5	1	0.5	5	-	-	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 445.2 cps pH: 2.40
15	2.5	5	5	1	0.5	-	5	-	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 473 cps pH: 2.42
16	2.5	5	5	1	0.5	-	-	5	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 598 cps pH: 2.45

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)										
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	HCO-40	Tween 80	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
17	2.5	5	5	1	0.5	10	-	-	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 617 cps pH: 2.52
18	2.5	5	5	1	0.5	-	10	-	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 450 cps pH: 2.45
19	2.5	5	5	1	0.5	-	-	10	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 672 cps pH: 2.57

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)										
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	HCO-40	Tween 80	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
20	2.5	5	5	1	0.5	5	-	-	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 833 cps pH: 2.58
21	2.5	5	5	1	0.5	-	5	-	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 721 cps pH: 2.52
22	2.5	5	5	1	0.5	-	-	5	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 992 cps pH: 2.55

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)										
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	HCO-40	Tween 80	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
23	2.5	5	5	1	0.5	10	-	-	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 1586 cps pH: 2.59
24	2.5	5	5	1	0.5	-	10	-	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 801 cps pH: 2.60
25	2.5	5	5	1	0.5	-	-	10	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 1795 cps pH: 2.61

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)										
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	HCO-40	Tween 80	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
26	2.5	5	5	1	0.25	5	-	-	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 600.8 cps pH: 2.21
27	2.5	5	5	1	0.25	-	5	-	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 121.4 cps pH: 2.34
28	2.5	5	5	1	0.25	-	-	5	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 136.2 cps pH: 2.36

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)										
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	HCO-40	Tween 80	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
29	2.5	5	5	1	0.25	10	-	-	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 191.3 cps pH: 2.33
30	2.5	5	5	1	0.25	-	10	-	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 112.2 cps pH: 2.32
31	2.5	5	5	1	0.25	-	-	10	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 117.8 cps pH: 2.38

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)										
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	HCO-40	Tween 80	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
32	2.5	5	5	1	0.25	5	-	-	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 788 cps pH: 2.54
33	2.5	5	5	1	0.25	-	5	-	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 966 cps pH: 2.66
34	2.5	5	5	1	0.25	-	-	5	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 439 cps pH: 2.56

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)										
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	HCO-40	Tween 80	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
35	2.5	5	5	1	0.25	10	-	-	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 2064 cps pH: 2.63
36	2.5	5	5	1	0.25	-	10	-	0.1	1	Appearance: homogenous Flow: easy Air bubbles: less Color: pale brown Viscosity: 3545 cps pH: 2.56
37	2.5	5	5	1	0.25	-	-	10	0.1	1	Appearance: homogenous Flow: not easy Air bubbles: less Color: pale brown Viscosity: >10000 cps pH: 2.61

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)									
	PG	Propylene glycol	Glycerin	Sorbitol	Betel vine oil	Amerchol L101	Cremorphor RH-40	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
38	2.5	5	5	5	1	0.25	5	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 440 cps pH: 2.51
39	2.5	5	5	10	1	0.25	5	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 443.4 cps pH: 2.54
40	2.5	5	5	5	1	0.25	5	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 627 cps pH: 2.63
41	2.5	5	5	10	1	0.25	5	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 745 cps pH: 2.60

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)								
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
42	2.5	5	5	2	0.25	5	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 457 cps pH: 2.26
43	2.5	5	5	2	0.25	10	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 462 cps pH: 2.30
44	2.5	5	5	2	0.25	5	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 489 cps pH: 2.51
45	2.5	5	5	2	0.25	10	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 533.5 cps pH: 2.57

Table C2. Formulation of PG gel contained betel vine oil (continued)

Formulation No.	Ingredients (%w/w)								
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	Triethanolamine	Paraben concentrate	Description of antimicrobial PG preparation After prepared
46	2.5	5	5	3	0.25	5	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 483 cps pH: 2.25
47	2.5	5	5	3	0.25	10	-	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 501 cps pH: 2.32
48	2.5	5	5	3	0.25	5	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 523.4 cps pH: 2.54
49	2.5	5	5	3	0.25	10	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 547.9 cps pH: 2.55

Table C3. Formulation of PG gel contained acid ingredient (lactic acid)

Formulation No.	Ingredients (%w/w)								
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	Lactic acid	Paraben concentrate	Description of antimicrobial PG preparation After prepared
50	2.5	5	5	1	0.25	5	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 624 cps pH: 2.21
51	2.5	5	5	1	0.25	5	0.2	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 625.5 cps pH: 2.15
52	2.5	5	5	1	0.25	5	0.3	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 619.5 cps pH: 2.14

Table C3. Formulation of PG gel contained acid ingredient (lactic acid) (continued)

Formulation No.	Ingredients (%w/w)								
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	Lactic acid	Paraben concentrate	Description of antimicrobial PG preparation After prepared
53	2.5	5	5	1	0.25	5	0.4	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 660 cps pH: 2.12
54	2.5	5	5	1	0.25	5	0.5	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 559.6 cps pH: 2.24
55	2.5	5	5	1	0.25	5	1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 490.6 cps pH: 2.16

Table C4. Formulation of PG gel contained acid ingredient (salicylic acid)

Formulation No.	Ingredients (%w/w)								
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	Salicylic acid	Paraben concentrate	Description of antimicrobial PG preparation After prepared
56	2.5	5	5	1	0.25	5	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 618 cps pH: 2.29
57	2.5	5	5	1	0.25	5	0.2	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 601.5 cps pH: 2.27
58	2.5	5	5	1	0.25	5	0.3	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 498 cps pH: 2.26

able C4. Formulation of PG gel contained acid ingredient (salicylic acid) (continued)

Formulation No.	Ingredients (%w/w)								
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	Salicylic acid	Paraben concentrate	Description of antimicrobial PG preparation After prepared
59	2.5	5	5	1	0.25	5	0.4	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 490.8 cps pH: 2.23
60	2.5	5	5	1	0.25	5	0.5	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 457.2 cps pH: 2.26
61	2.5	5	5	1	0.25	5	1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 441.6 cps pH: 2.21

Table C5. Formulation of PG gel contained insoluble antibacterial agent (precipitated sulphur)

Formulation No.	Ingredients (%w/w)								
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	Precipitate sulphur	Paraben concentrate	Description of antimicrobial PG preparation After prepared
62	2.5	5	5	1	0.25	5	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: yellow suspension Viscosity: 900 cps pH: 2.29
63	2.5	5	5	1	0.25	5	0.2	1	Appearance: homogenous Flow: easy Air bubbles: non Color: yellow suspension Viscosity: 735 cps pH: 2.28
64	2.5	5	5	1	0.25	5	0.3	1	Appearance: homogenous Flow: easy Air bubbles: non Color: yellow suspension Viscosity: 644.4 cps pH: 2.26

Table C5. Formulation of PG gel contained insoluble antibacterial agent (precipitated sulphur) (continued)

Formulation No.	Ingredients (%w/w)								
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	Precipitate sulphur	Paraben concentrate	Description of antimicrobial PG preparation After prepared
65	2.5	5	5	1	0.25	5	0.4	1	Appearance: homogenous Flow: easy Air bubbles: non Color: yellow suspension Viscosity: 642 cps pH: 2.26
66	2.5	5	5	1	0.25	5	0.5	1	Appearance: homogenous Flow: easy Air bubbles: non Color: yellow suspension Viscosity: 494.5 cps pH: 2.25
67	2.5	5	5	1	0.25	5	1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: yellow suspension Viscosity: 424 cps pH: 2.27

Table C6. Formulation of PG gel contained zinc oxide

Formulation No.	Ingredients (%w/w)								
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	Zinc oxide	Paraben concentrate	Description of antimicrobial PG preparation After prepared
68	2.5	5	5	1	0.25	5	0.1	1	Appearance: homogenous Flow: not easy Air bubbles: non Color: white suspension Viscosity: >10000 cps pH: 5.00
69	2.5	5	5	1	0.25	5	0.2	1	Appearance: homogenous Flow: not easy Air bubbles: non Color: white suspension Viscosity: >10000 cps pH: 5.32
70	2.5	5	5	1	0.25	5	0.3	1	Appearance: homogenous Flow: not easy Air bubbles: less Color: white suspension Viscosity: >10000 cps pH: 5.36

Table C6. Formulation of PG gel contained zinc oxide (continued)

Formulation No.	Ingredients (%w/w)								
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	Zinc oxide	Paraben concentrate	Description of antimicrobial PG preparation After prepared
71	2.5	5	5	1	0.25	5	0.4	1	Appearance: homogenous Flow: not easy Air bubbles: less Color: white suspension Viscosity: >10000 cps pH: 5.47
72	2.5	5	5	1	0.25	5	0.5	1	Appearance: homogenous Flow: not easy Air bubbles: less Color: white suspension Viscosity: >10000 cps pH: 5.50
73	2.5	5	5	1	0.25	5	1	1	Appearance: homogenous Flow: not easy Air bubbles: less Color: white suspension Viscosity: >10000 cps pH: 5.71

Table C7. Formulation of PG gel contained insoluble antimicrobial agents and HPMC 4000

Formulation No.	Ingredients (%w/w)										
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	Zinc oxide	Precipitate sulphur	HPMC 4000	Paraben concentrate	Description of antimicrobial PG preparation After prepared
74	2.5	5	5	1	0.25	5	0.5	0.5	0.5	1	Appearance: homogenous Flow: easy Air bubbles: non Color: white suspension Viscosity: 489 cps pH: 2.51
75	2.5	5	5	1	0.25	10	0.5	0.5	1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: white suspension Viscosity: 533.5 cps pH: 2.57

Table C8. Formulation of PG gel contained organic acid

Formulation No.	Ingredients (%w/w)									
	PG	Propylene glycol	Glycerin	Betel vine oil	Amerchol L101	Cremorphor RH-40	Lactic acid	Salicylic acid	Paraben concentrate	Description of antimicrobial PG preparation After prepared
76	2.5	5	5	1	0.25	5	0.1	0.1	1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 476 cps pH: 2.32

APPENDIX D

Assessment of formulation of polysaccharide gel (PG) and acne lotion of PG

Table D1. Preparation of PG gel base

Formulation No.	Description of formulation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
1	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 524 cps pH: 2.23	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 4592 cps pH: 2.17	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 4862 cps pH: 2.17

Table D2. Preparation of PG gel contained betel vine oil

Formulation No.	Description of formulations		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
2	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 520 cps pH: 2.36	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5592 cps pH: 2.17	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6218 cps pH: 2.17
3	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 585.6 cps pH: 2.40	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6259 cps pH: 2.17	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6613 cps pH: 2.17
4	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 675 cps pH: 2.45	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6162 cps pH: 2.17	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6574 cps pH: 2.17

Table D2. Preparation of PG gel contained betel vine oil (continued)

Formulation No.	Description of formulation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
5	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 592 cps pH: 2.39	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6352 cps pH: 2.43	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6517 cps pH: 2.42
6	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 446.7 cps pH: 2.45	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5716 cps pH: 2.13	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6456 cps pH: 2.12
7	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 766 cps pH: 2.55	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6128 cps pH: 2.11	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6643 cps pH: 2.10
8	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 620 cps pH: 2.48	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 7385 cps pH: 2.26	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8395 cps pH: 2.23
9	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 710 cps pH: 2.45	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 7925 cps pH: 2.17	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8628 cps pH: 2.16
10	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 796 cps pH: 2.48	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8053 cps pH: 2.43	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8960 cps pH: 2.42

Table D2. Preparation of PG gel contained betel vine oil (continued)

Formulation No.	Description of formulation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
11	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 824 cps pH: 2.61	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8467 cps pH: 2.13	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8258 cps pH: 2.12
12	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 747 cps pH: 2.59	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9081 cps pH: 2.11	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9259 cps pH: 2.10
13	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 1068 cps pH: 2.50	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9185 cps pH: 2.26	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9533 cps pH: 2.23
14	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 445.2 cps pH: 2.40	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5592 cps pH: 2.17	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6218 cps pH: 2.17
15	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 473 cps pH: 2.42	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5320 cps pH: 2.43	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6055 cps pH: 2.42
16	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 598 cps pH: 2.45	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 4670 cps pH: 2.13	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5628 cps pH: 2.12

Table D2. Preparation of PG gel contained betel vine oil (continued)

Formulation No.	Description of formulation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
17	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 617 cps pH: 2.52	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6810 cps pH: 2.11	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6995 cps pH: 2.10
18	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 450 cps pH: 2.45	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6580 cps pH: 2.26	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6930 cps pH: 2.23
19	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 672 cps pH: 2.57	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5920 cps pH: 2.17	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6820 cps pH: 2.17
20	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 833 cps pH: 2.58	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 7320 cps pH: 2.43	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8055 cps pH: 2.42
21	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 721 cps pH: 2.52	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 7670 cps pH: 2.13	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8528 cps pH: 2.12
22	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 992 cps pH: 2.55	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 7120 cps pH: 2.11	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8990 cps pH: 2.10

Table D2. Preparation of PG gel contained betel vine oil (continued)

Formulation No.	Description of formulation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
23	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 1586 cps pH: 2.59	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8560 cps pH: 2.26	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9530 cps pH: 2.23
24	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 801 cps pH: 2.60	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8592 cps pH: 2.17	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9620 cps pH: 2.17
25	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 1795 cps pH: 2.61	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8230 cps pH: 2.43	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9655 cps pH: 2.42
26	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 600.8 cps pH: 2.21	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 4075 cps pH: 2.28	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 4720 cps pH: 2.20
27	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 121.4 cps pH: 2.34	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 4120 cps pH: 2.11	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5090 cps pH: 2.10
28	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 136.2 cps pH: 2.36	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 4563 cps pH: 2.26	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5532 cps pH: 2.23

Table D2. Preparation of PG gel contained betel vine oil (continued)

Formulation No.	Description of formulation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
29	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 191.3 cps pH: 2.33	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 7590 cps pH: 2.17	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8210 cps pH: 2.17
30	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 112.2 cps pH: 2.32	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 7350 cps pH: 2.43	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8600 cps pH: 2.42
31	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 117.8 cps pH: 2.38	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8460 cps pH: 2.13	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8520 cps pH: 2.12
32	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 788 cps pH: 2.54	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8620 cps pH: 2.11	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9150 cps pH: 2.10
33	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 966 cps pH: 2.66	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8563 cps pH: 2.26	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9532 cps pH: 2.23
34	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 439 cps pH: 2.56	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8570 cps pH: 2.17	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9210 cps pH: 2.17

Table D2. Preparation of PG gel contained betel vine oil (continued)

Formulation No.	Description of formulation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
35	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 2064 cps pH: 2.63	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9320 cps pH: 2.43	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9655 cps pH: 2.42
36	Appearance: homogenous Flow: easy Air bubbles: less Color: pale brown Viscosity: 3545 cps pH: 2.56	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9460 cps pH: 2.13	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9528 cps pH: 2.12
37	Appearance: homogenous Flow: not easy Air bubbles: less Color: pale brown Viscosity: >10000 cps pH: 2.61	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: >10000 cps pH: 2.11	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: >10000 cps pH: 2.10
38	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 440 cps pH: 2.51	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 4670 cps pH: 2.26	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5628 cps pH: 2.23
39	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 443.4 cps pH: 2.54	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5592 cps pH: 2.17	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6218 cps pH: 2.17
40	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 627 cps pH: 2.63	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8563 cps pH: 2.13	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9530 cps pH: 2.12

Table D2. Preparation of PG gel contained betel vine oil (continued)

Formulation No.	Description of formulation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
41	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 745 cps pH: 2.60	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8670 cps pH: 2.13	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8720 cps pH: 2.12
42	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 457 cps pH: 2.26	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5592 cps pH: 2.17	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6218 cps pH: 2.17
43	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 462 cps pH: 2.30	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5320 cps pH: 2.43	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6055 cps pH: 2.42
44	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 489 cps pH: 2.51	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 4670 cps pH: 2.13	Appearance: homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5628 cps pH: 2.12
45	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 533.5 cps pH: 2.57	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 6193 cps pH: 2.12	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 7024 cps pH: 2.15

Table D2. Preparation of PG gel contained betel vine oil (continued)

Formulation No.	Description of formulation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
46	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 483 cps pH: 2.25	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5487 cps pH: 2.23	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6105 cps pH: 2.26
47	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 501 cps pH: 2.32	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 5963 cps pH: 2.30	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 6495cps pH: 2.35
48	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 523.4 cps pH: 2.54	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8220 cps pH: 2.52	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8660 cps pH: 2.56
49	Appearance: homogenous Flow: easy Air bubbles: non Color: cloudy Viscosity: 547.9 cps pH: 2.55	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 8821 cps pH: 2.56	Appearance: non homogenous Flow: not easy Air bubbles: non Color: cloudy Viscosity: 9893 cps pH: 2.57

Table D3. Preparation of PG gel contained acid ingredient (lactic acid)

Formulation No.	Description of formulation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
50	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 624 cps pH: 2.21	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 5592 cps pH: 2.17	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 6218 cps pH: 2.17
51	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 625.5 cps pH: 2.15	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 5320 cps pH: 2.13	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 6055 cps pH: 2.12
52	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 619.5 cps pH: 2.14	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 5070 cps pH: 2.13	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 5628 cps pH: 2.12
53	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 660 cps pH: 2.12	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 5620 cps pH: 2.11	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 6950 cps pH: 2.13
54	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 559.6 cps pH: 2.14	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 5012 cps pH: 2.16	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 6856 cps pH: 2.15
55	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 490.6 cps pH: 2.16	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 5140 cps pH: 2.16	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 5985 cps pH: 2.15

Table D4. Preparation of PG gel contained acid ingredient (salicylic acid)

Formulation No.	Description of formulation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
56	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 618 cps pH: 2.29	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 5380 cps pH: 2.28	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 6730 cps pH: 2.30
57	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 601.5 cps pH: 2.27	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 5845 cps pH: 2.31	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 6493 cps pH: 2.32
58	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 498 cps pH: 2.26	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 6975 cps pH: 2.31	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 7379cps pH: 2.30
59	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 490.8 cps pH: 2.23	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 7337 cps pH: 2.27	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 8980 cps pH: 2.27
60	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 457.2 cps pH: 2.26	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 7457 cps pH: 2.27	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 8879 cps pH: 2.28
61	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 441.6 cps pH: 2.21	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 7318 cps pH: 2.27	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 8902 cps pH: 2.28

Table D5. Preparation of PG gel contained insoluble antibacterial agent (precipitated sulphur)

Formulation No.	Description of formulation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
62	Appearance: homogenous Flow: easy Air bubbles: non Color: yellow suspension Viscosity: 900 cps pH: 2.29	Appearance: non homogeneous Flow: not easy Air bubbles: non Color yellow suspension Viscosity: 8085 cps pH: 2.20	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: yellow suspension Viscosity: 8550 cps pH: 2.18
63	Appearance: homogenous Flow: easy Air bubbles: non Color: yellow suspension Viscosity: 735 cps pH: 2.28	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: yellow suspension Viscosity: 8410 cps pH: 2.20	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: yellow suspension Viscosity: 8735 cps pH: 2.16
64	Appearance: homogenous Flow: easy Air bubbles: non Color: yellow suspension Viscosity: 644.4 cps pH: 2.26	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: yellow suspension Viscosity: 8460 cps pH: 2.22	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: yellow suspension Viscosity: 9299 cps pH: 2.20
65	Appearance: homogenous Flow: easy Air bubbles: non Color: yellow suspension Viscosity: 642 cps pH: 2.26	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: yellow suspension Viscosity: 8642 cps pH: 2.21	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: yellow suspension Viscosity: 8789 cps pH: 2.19
66	Appearance: homogenous Flow: easy Air bubbles: non Color: yellow suspension Viscosity: 494.5 cps pH: 2.25	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: yellow suspension Viscosity: 8045 cps pH: 2.23	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: yellow suspension Viscosity: 8494 cps pH: 2.22
67	Appearance: homogenous Flow: easy Air bubbles: non Color: yellow suspension Viscosity: 424 cps pH: 2.27	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: yellow suspension Viscosity: 7494 cps pH: 2.23	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: yellow suspension Viscosity: 8035 cps pH: 2.22

Table D6. Preparation of PG gel contained zinc oxide

Formulation No.	Description of formulation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
68	Appearance: homogenous Flow: not easy Air bubbles: non Color: white suspension Viscosity: >10000 cps pH: 5.00	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 5.07	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 5.34
69	Appearance: homogenous Flow: not easy Air bubbles: non Color: white suspension Viscosity: >10000 cps pH: 5.32	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 5.57	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 5.76
70	Appearance: homogenous Flow: not easy Air bubbles: less Color: white suspension Viscosity: >10000 cps pH: 5.36	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 5.81	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 5.87
71	Appearance: homogenous Flow: not easy Air bubbles: less Color: white suspension Viscosity: >10000 cps pH: 5.47	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 5.89	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 5.95
72	Appearance: homogenous Flow: not easy Air bubbles: less Color: white suspension Viscosity: >10000 cps pH: 5.50	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 5.94	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 5.97
73	Appearance: homogenous Flow: not easy Air bubbles: less Color: white suspension Viscosity: >10000 cps pH: 5.71	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 5.93	Appearance: non homogeneous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 5.98

Table D7. Preparation of PG gel contained insoluble antimicrobial agents and HPMC 4000

Formulation No.	Description of gel preparations		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
74	Appearance: homogenous Flow: easy Air bubbles: non Color: white suspension Viscosity: 489 cps pH: 2.51	Appearance: non homogenous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 2.52	Appearance: non homogenous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 2.54
75	Appearance: homogenous Flow: easy Air bubbles: non Color: white suspension Viscosity: 533.5 cps pH: 2.57	Appearance: non homogenous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 2.56	Appearance: non homogenous Flow: not easy Air bubbles: non Color: gray suspension Viscosity: >10000 cps pH: 2.60

Table D8. Preparation of PG gel contained organic acid

Formulation No.	Description of gel preparation		
	After prepared	After 30 days stand at ambient temperature	After 6 freeze-thaw cycles
76	Appearance: homogenous Flow: easy Air bubbles: non Color: pale brown Viscosity: 476 cps pH: 2.32	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 6175 cps pH: 2.20	Appearance: homogenous Flow: not easy Air bubbles: non Color: pale brown Viscosity: 6342 cps pH: 2.22

APPENDIX E

Media

Brain heart infusion agar (BHIA)

Calf brains, infusion from	200	g
Beef heart, infusion from	250	g
Proteose or Gelysate (BBL) pancreatic		
Digest of gelatin	10	g
Glucose	2	g
Sodium chloride	5	g
Disodium phosphate	2.5	g
Agar	15	g
Distilled or Demineralized water	1	liter

Final pH 7.4

Dispense and autoclave at 121°C for 15 min.

Brain heart infusion broth (BHIB)

Calf brains, infusion from	200	g
Beef heart, infusion from	250	g
Proteose or Gelysate (BBL) pancreatic		
Digest of gelatin	10	g
Glucose	2	g
Sodium chloride	5	g
Disodium phosphate	2.5	g
Distilled or Demineralized water	1	liter

Final pH 7.4

Dispense and autoclave at 121°C for 15 min.

Mueller hinton agar (MHA)

Beef infusion, from	300	g
Acid hydrolysate of casein	17.5	g
Starch	1.5	g
Agar	17	g
Distilled water	1	liter

Dispense, and autoclave at 116 to 121°C for 15 min.

Mueller hinton broth (MHB)

Beef infusion, from	300	g
Acid hydrolysate of casein	17.5	g
Starch	1.5	g
Distilled water	1	liter

Dispense, and autoclave at 116 to 121°C for 15 min.

Sabouraud dextrose agar (SDA)

Glucose	40	g
Neopeptone or Polypeptone (BBL)	10	g
(Pancreatic digest of casein USP)	5	g
(Peptic digest of animal tissue USP)	5	g
Agar	20 to 15	g
Demineralized water	1	liter

Final pH 5.6

Heat to dissolve completely. Dispense into tubes (18 to 25 min in diameter), and autoclave at 121oC for 10 min

Sabouraud dextrose broth (SDB)

Glucose	40	g
Neopeptone or Polypeptone (BBL)	10	g
(Pancreatic digest of casein USP)	5	g
(Peptic digest of animal tissue USP)	5	g
Demineralized water	1	liter

Final pH 5.6

Heat to dissolve completely. Dispense into tubes (18 to 25 min in diameter), and autoclave at 121oC for 10 min

Tryptic soy agar (TSA)

Peptone from casein	17.0	g
Peptone from soymeal	3.0	g
Sodium chloride	5.0	g
Agar	15.0	g

pH 7.3±0.2

APPENDIX F

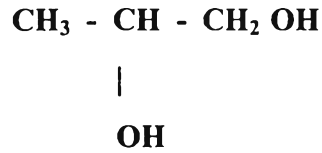
Physicochemical properties of substances

1. Humectant

1.1 Propylene Glycol (American Pharmaceutical Association and the Pharmaceutical Society of Great Britain, 1986 ; John, 1990 ; Reynolds, 1993)

Chemical name: (±) – Propane – 1, 2 - diol

Structure formula of propylene glycol



The empirical structure is CH_3. CHOH. CH_2OH with molecular weight 76.10. Propylene glycol is clear, colorless, viscous 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.

Application: Propylene glycol is a solvent or co – solvent used in solutions, parenterals, topical preparations and aerosol solutions and used as humectant in topical preparations.

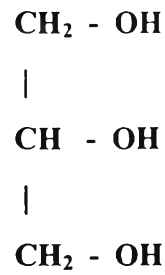
Incompatibility: It is incompatible with oxidizing reagents such as potassium permanganate.

Stability and storage condition: It is stable in wellclosed 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 be stored in wellclosed container and protected from light.

1.2 Glycerin (John, 1990 ; Reynolds, 1993)

Chemical name: Propane – 1, 2, 3 – triol

Structure formula of glycerin



The empirical structure is $C_3H_8O_3$ with molecular weight 92.09. Glycerin is a clear, colorless, ordorless, viscous, hygroscopic liquid; it has a sweet taste approximately 0.6 times as sweet as sucrose. It has melting point at 17.8 °C. It is miscible with ethanol, methanol, water and practically insoluble with benzene, chloroform and oils.

Application: Glycerin is used in a wide variety of pharmaceutical formulations including oral, ophthalmic, topical and parenteral preparations. It is also used in Cosmetic, food additive and as a plasticizer of gelatin in the production of soft gelatin capsules and gelatin suppositories.

Incompatibility: Glycerin may explode if mixed with strong oxidizing agents, such as chromium trioxide, potassium chlorate or potassium permanganate.

Stability and storage condition: It is hygroscopic. Pure glycerin is not prone to oxidation by the atmosphere under ordinary storage conditions, but decomposes on heating, with the evaluation of toxic acrolene.

1.3 Sorbitol

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.

Application: Sorbitol is a polyhydric alcohol with half the sweetening power of sucrose. 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 humectant and stabilizing properties and is used in various pharmaceutical and cosmetic products including toothpaste. Sorbitol may also be used analytically as a marker for assessing liver blood flow.

Incompatibility: Sorbitol will form water-soluble chelates with many divalent and trivalent metal ions in strongly acidic and alkaline conditions. Additon of liquid polyethylene glycols to sorbitol solution, with vigorous agitation, produces a waxy,

water-soluble gel with melting point of 35-40°C. Sorbitol solutions also react with iron oxide to become discolored.

Stability and storage condition: It is slightly hygroscopic. Sorbitol shall be kept in tightly closed containers. Sorbitol does not darken or decompose at elevated temperatures or in the presence of amines. It is nonflammable, noncorrosive, and nonvolatile. Sorbitol may be stored in glass, plastic, aluminum, and stainless steel containers.

2. Surfactant

2.1 Cremorphor RH 40

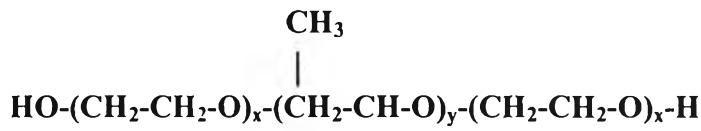
Chemical name: Polyethoxylated castor oil

Appearance: Cremophor RH 40 is a white to yellowish thin paste at 20 °C. The HLB value lies between14 and 16. Particular features are that it has very little odour and in aqueous solutions is almost tasteless.

Application: Cremophor RH 40 is a nonioinic 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.

2.2 Poloxamer 188 (Pluronic F-68)

Structure formula of propylene glycol



Solubility: Readily soluble in ethanol, dissolves readily in water to give an opalescent solution, and is insoluble in diethyl ether, paraffin and fatty oils.

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.

Stability and storage condition: Meets specification after at least 2 years stored in the unopened original containers at room temperature.

2.3 Tween 80

Chemical name: Polyoxyethylene 20 sorbitan monooleate

Molecular weight: 1310

Application: Polyoxyethylene sorbitan fatty acid esters (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 used widely as emulsifying agents in the preparation of pharmaceutical emulsions.

Incompatibilities: Discoloration and/or precipitation occurs with various substances, especially phenols, tannins, tars and/or tar-like materials. The antimicrobial acitivity of paraben preservatives is reduced in the presence of polysorbates.

Stability and storage condition: 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.

Amerchol L-101

Chemical name: Mineral oil and Lanolin alcohols

Appearance: A pale yellow-colored, oily liquid with a faint characteristic sterol odor.

Application: Mineral oil and lanolin alcohols is used as a primary emulsifier in the preparation of water-in-oil creams and lotions and as an auxiliary emulsifier and stabilizing agent in oil-in-water creams and lotion. It is generally regarded as an essentially nontoxic and nonirritant material.

Incompatibility: Lanolin alcohols is incompatible with coal tar, ichthammol, phenol and resorcinol.

Stability and storage condition: Mineral oil and lanolin alcohols is stable and should be stored in a well-closed container in a cool, dry, place.

Hydroxypropyl Methylcellulose (HPMC)

Chemical name: Cellulose, 2-Hydroxypropyl methyl ether

Molecular formulation: $C_8H_{15}O_6$-$(C_{10}H_{18}O_6)_n$- $C_8H_{15}O_5$

Molecular weight: 10,000-1,500,000

Appearance: White, yellowish white or grayish white powder or granules, odorless and tasteless.

Solubility: Soluble in cold water, forming a viscous colloidal solution, insoluble in absolute ethanol, acetone, ether, toluene, chloroform, but soluble in mixtures of methyl alcohol and methylene chloride.

Application: 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 a nontoxic and nonirritant material although excessive oral comsumption may have a laxative effect.

Stability and storage condition: Hypromellose shall be kept in well-closed containers.

Parabens

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. 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. The utility of parabens is often limited by their low water solubility. 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.

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

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%)

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

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).

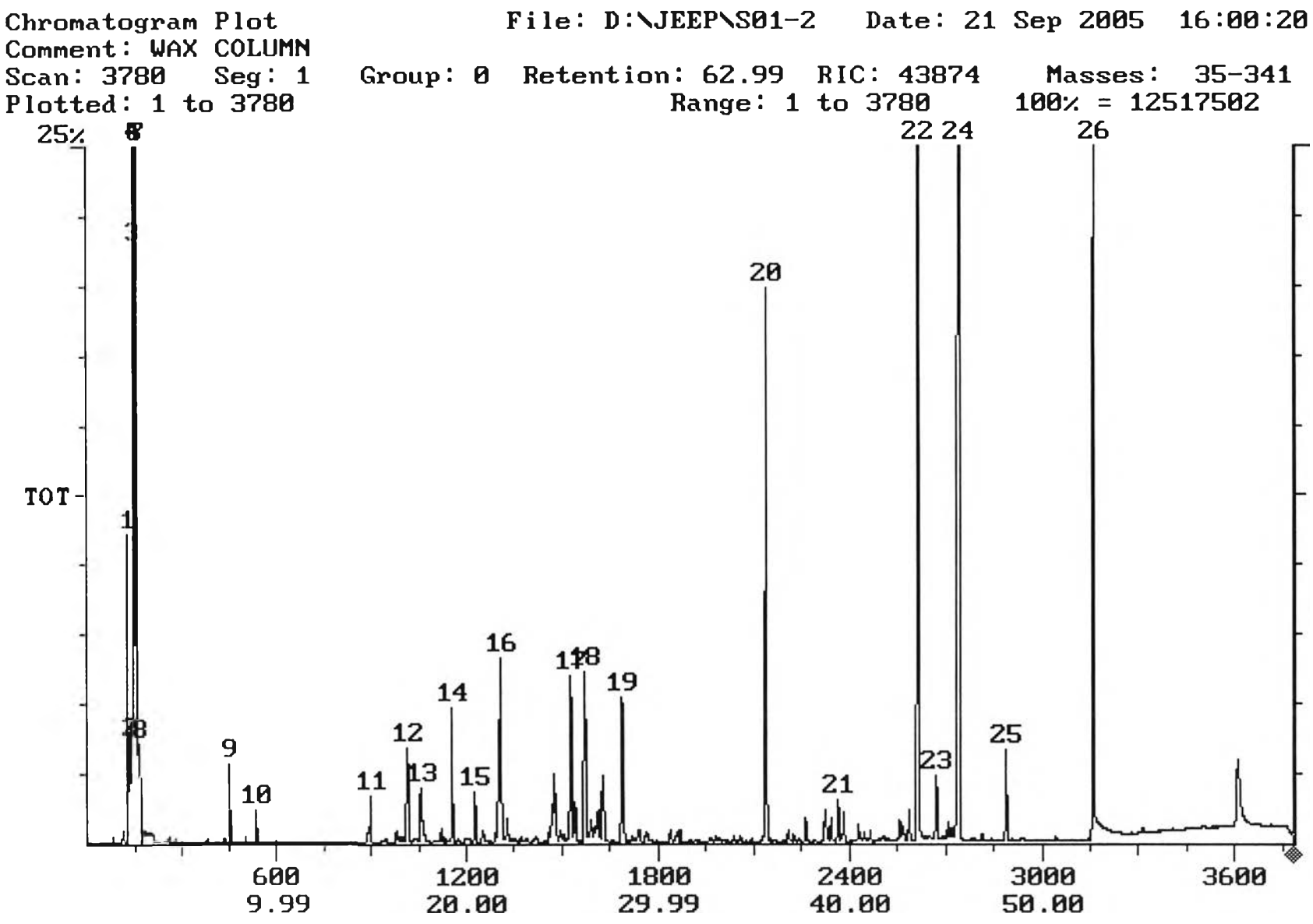
APPENDIX G

Gas chromatography-mass spectrometry

For identification of the composition of betel vine oil, a gas chromatography coupled with a mass spectrometer (GC-MS) was used. The betel vine oil was diluted to 1:1000 in methanol before being injected into GC-MS system. The condition of GC-MS was described below. Gas chromatography-mass spectrometry is illustrated on page 204.

GC-MS Condition

Instrument	: GC-MS Varian Saturn 4D
Column	: Stabil wax, PEG 30 m, 0.25 mm (i.d.)
Temperature program	: Oven temperature program
Initial temperature	: 60 deg, hold for 3 min
Ramp 1	: 3 deg/min to 200 deg
Ramp 2	: 5 deg/min to 240 deg
Ramp 3	: 240 deg, hold for 5 min
Injector	: 250 °C
Xfer line	: 220 °C
Injection volume	: 0.5 µl
Carrier gas	: Helium
Pressure	: 1 ml/min
Total time	: 63 min
Mass range	: 35 to 350 m/z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Plotted: 1 to 3780
Range: 1 to 3780
100% = 12517502
25%
TOT
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
600
9.99
1200
20.00
1800
29.99
2400
40.00
3000
50.00
3600

Table G1. Essential oil composition of *Piper betle* leaves

Number of peak	Compound	Retention time (min)	% Area
9	Eucalyptol	7.54	0.72
10	3-Carene	8.95	0.31
11	Menthone	14.98	0.14
12	Copaene	16.93	1.78
13	α-cubebene	17.61	0.95
14	1,8-cineole	19.28	0.88
15	Linalool	20.44	0.63
16	Caryophyllene	21.80	1.92
17	τ-Cadinene	25.46	3.38
18	Germacrene D	26.18	3.20
19	δ-Cadinene	28.14	2.70
20	Chavicol	35.65	7.73
21	Allo-Aromadendrene	39.42	0.56
22	Eugenol	43.59	25.34
23	δ-Cadinol	44.53	0.83
24	Isoeugenol	45.74	47.60
25	α-humulene	48.15	1.33
26	γ-muurolene	52.69	11.46

VITA

Miss Naruphat Paphattarapong was born on June 27, 1977 in Bangkok, Thailand. She graduated with Bachelor Degree of Science in 1999 from Department of Biotechnology, Faculty of Science, Mahidol University.