

Effects of Additives on the Oxidative Stability of Botanical Emollients

Presented by:

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SCC Ontario Chapter - Education Day
September 10, 1998



Oxidative Stability

A basic criteria for cosmetic formulations.



The Cosmetic Industry

The Only Constant is Change

- ❖ **New Ingredients**
- ❖ **New Ingredient Combinations**



The Trend Toward Botanical Emollients

➔ **THE DRIVERS -**

Full Disclosure Labeling Laws

BSE (Mad Cow Disease)

Use of Renewable Resources

Use of Biodegradable Ingredients

Use “Non Animal” Products



Botanical Emollients

❖ Oils

- Almond
- Traditional Sunflower
- Hybrid Sunflower
- Macadamia
- Palm
- Sesame

❖ Esters

- Jojoba Esters 15
- Jojoba Esters 60

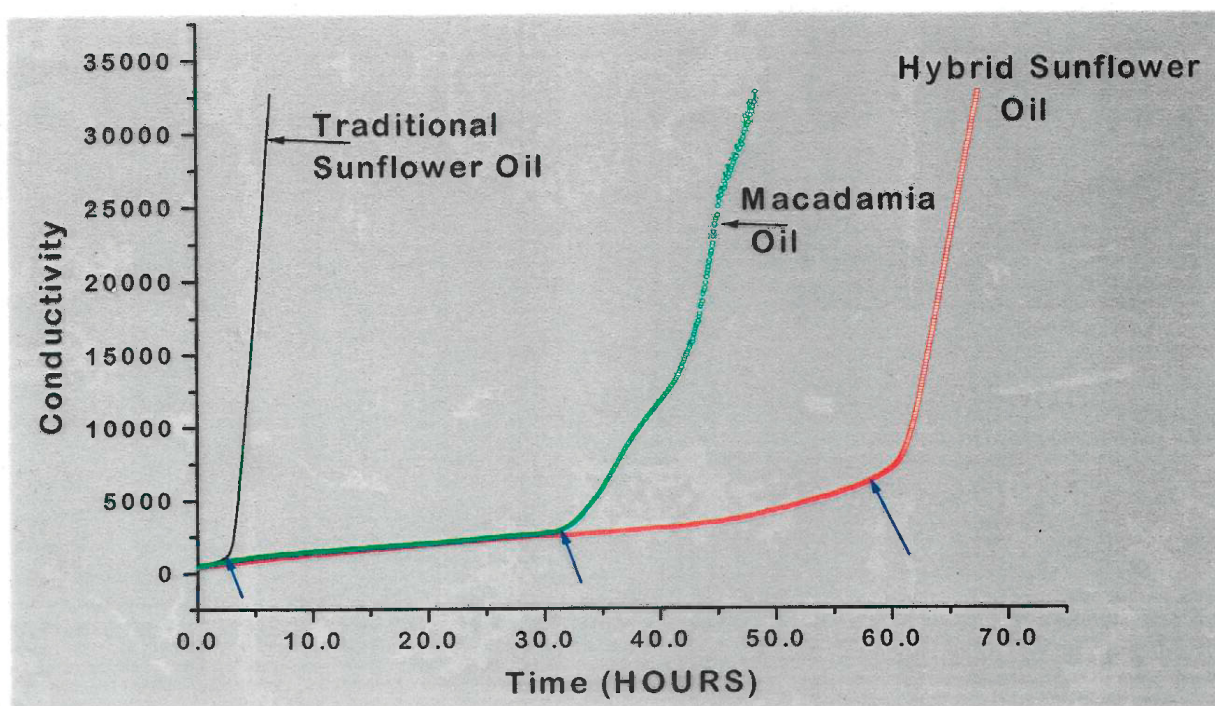


Determination of Oxidative Stability

TEST	AOCS Method
Peroxide Value	Cd 8-53
AOM (Active Oxygen Method)	Cd 12-57(93)
Rancimat	Cd 12b-92
OSI (Oxidative Stability Index)	Cd 12b-92
Oxidograph	

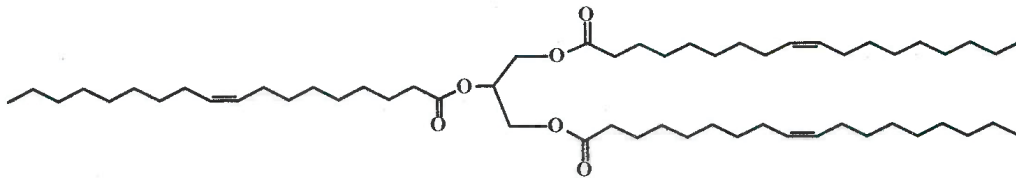


Oxidative Stability Determination

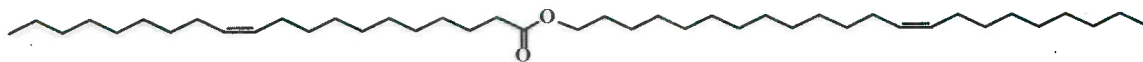


Botanical Emollients

Typical Structures



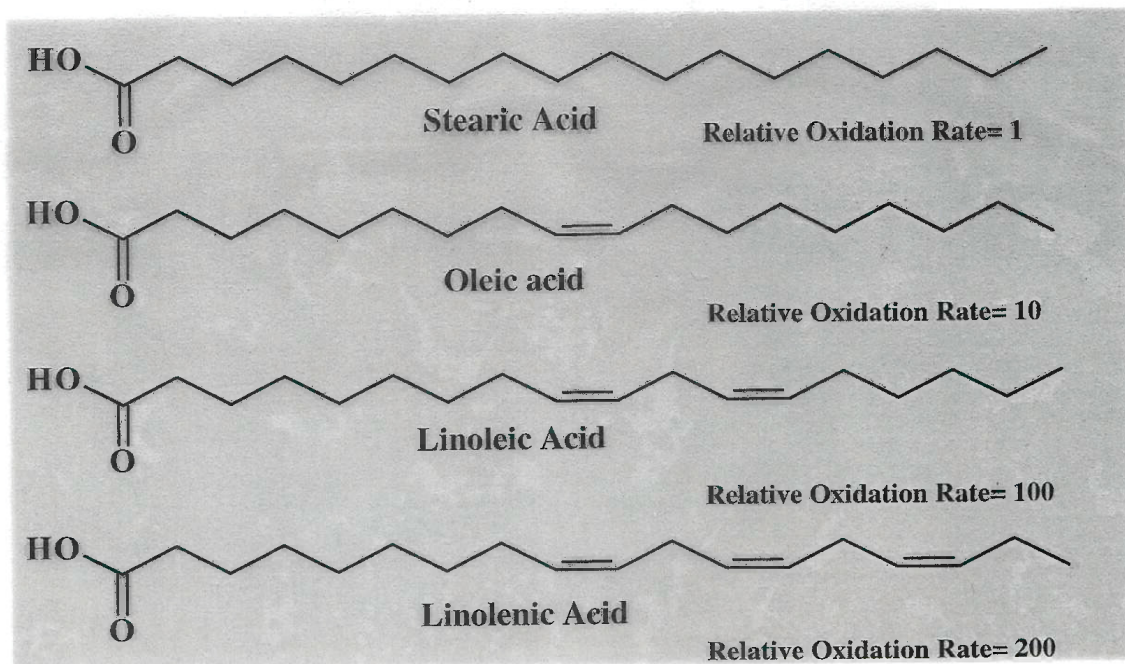
Triglyceride



Jojoba Wax-Ester



Relative Oxidation Rate of Common Fatty Acids



Composition of Botanically-Derived Emollients

<u>Oils</u>	<u>C-</u>	<u>12:0</u>	<u>14:0</u>	<u>16:0</u>	<u>16:1</u>	<u>18:0</u>	<u>18:1</u>	<u>18:2</u>	<u>18:3</u>	<u>Others</u>
Almond Oil		0.0	0.0	5.6	0.3	1.1	67.8	25.2	0.0	0.0
Macadamia Nut Oil		0.0	1.0	9.0	18.6	3.2	58.1	3.1	0.0	7.0
Palm Oil		3.1	2.0	44.5	0.0	3.5	38.9	8.0	0.0	0.0
Sesame Oil		0.0	0.0	10.7	0.2	4.9	39.3	43.4	0.4	1.1
Hybrid Sunflower Oil		0.0	0.0	3.1	0.1	3.2	88.5	3.2	0.1	1.8
Traditional Sunflower Oil		0.0	0.1	6.0	0.1	4.6	17.8	69.1	0.2	2.1

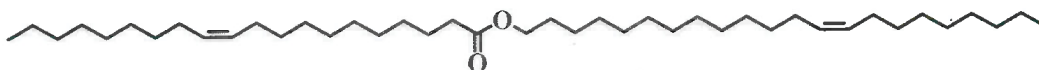


Composition of Botanically-Derived Emollients

Wax-Ester Composition

Chainlength	C ₃₆			C ₃₈			C ₄₀		
Double Bonds	0:0	0:1	1:1	0:0	0:1	1:1	0:0	0:1	1:1
Alcohol:Acid									
Acid:Alcohol									
Jojoba Esters 15		0.7	0.3		0.7	6.2		0.5	36.9
Jojoba Esters 60		0.4	0.4	2.0	3.5	1.6	9.8	18.8	9.2

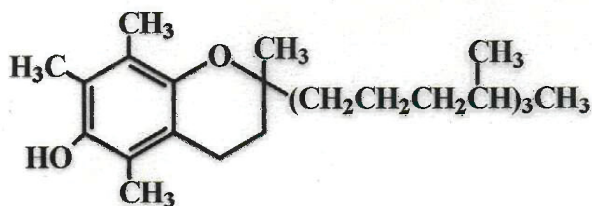
Chainlength	C ₄₂			C ₄₄			C ₄₆		
Double Bonds	0:0	0:1	1:1	0:0	0:1	1:1	0:0	0:1	1:1
Alcohol:Acid									
Acid:Alcohol									
Jojoba Esters 15		1.0	38.5		0.7	6.2		0.5	36.9
Jojoba Esters 60	10.1	19.5	9.7	3.3	6.5	3.2	0.5	1.0	0.5



Jojoba Wax-Esters

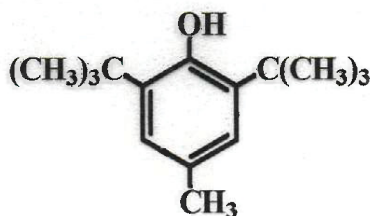


Antioxidants

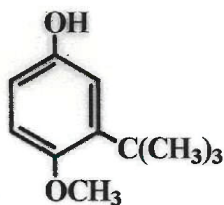
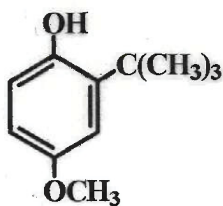


Vitamin E

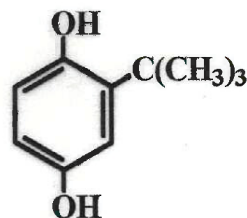
α - Tocopherol



Butylated Hydroxytoluene (BHT)



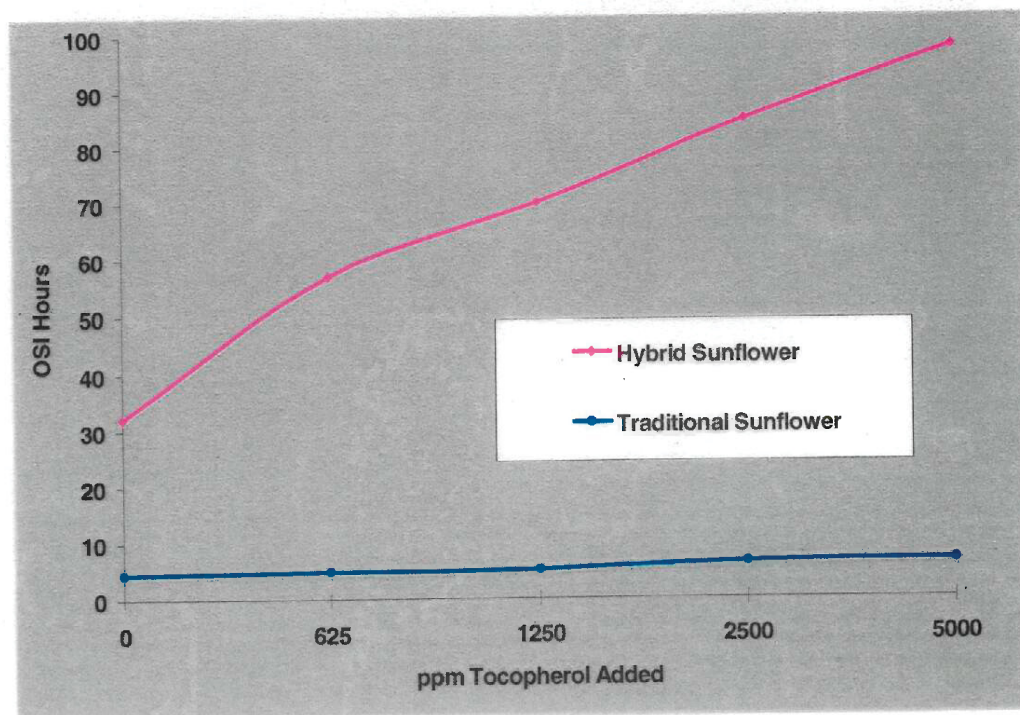
Butylated Hydroxyanisole (BHA)

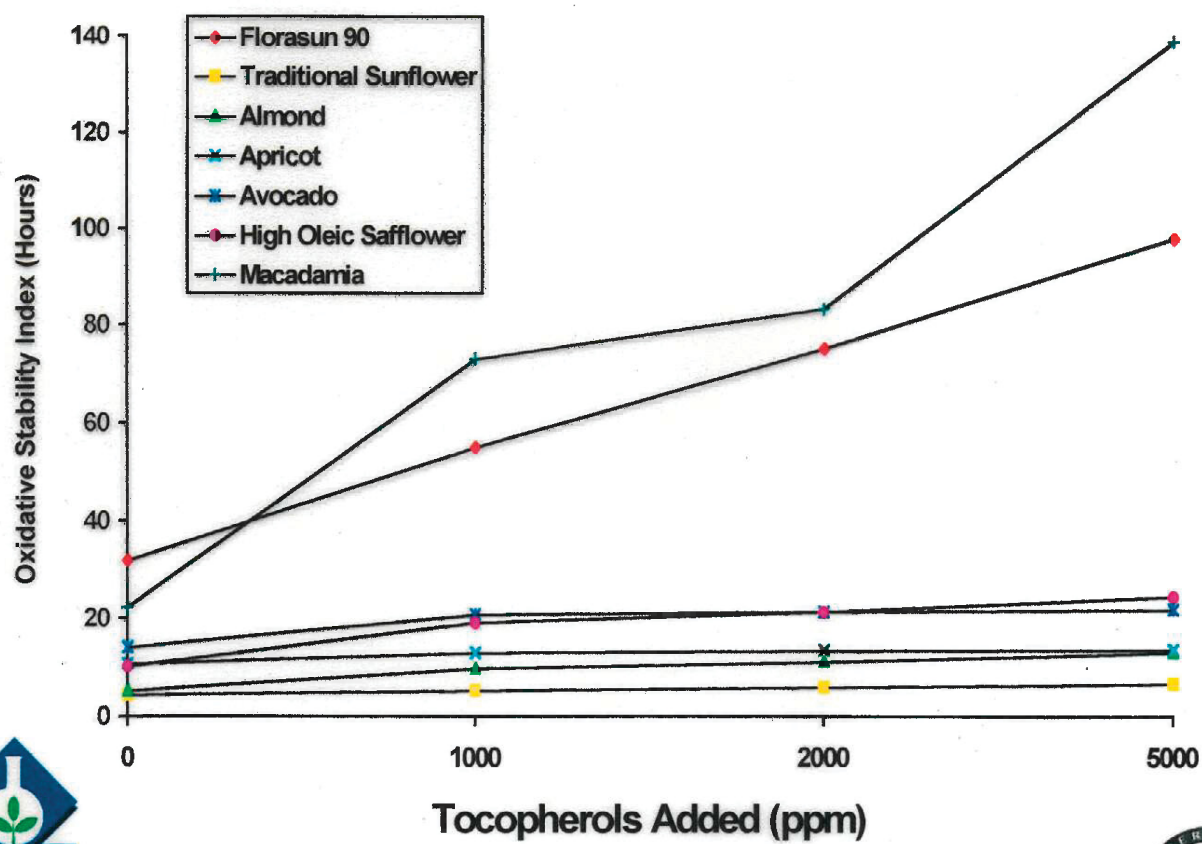


Tertiary Butylhydroquinone (TBHQ)

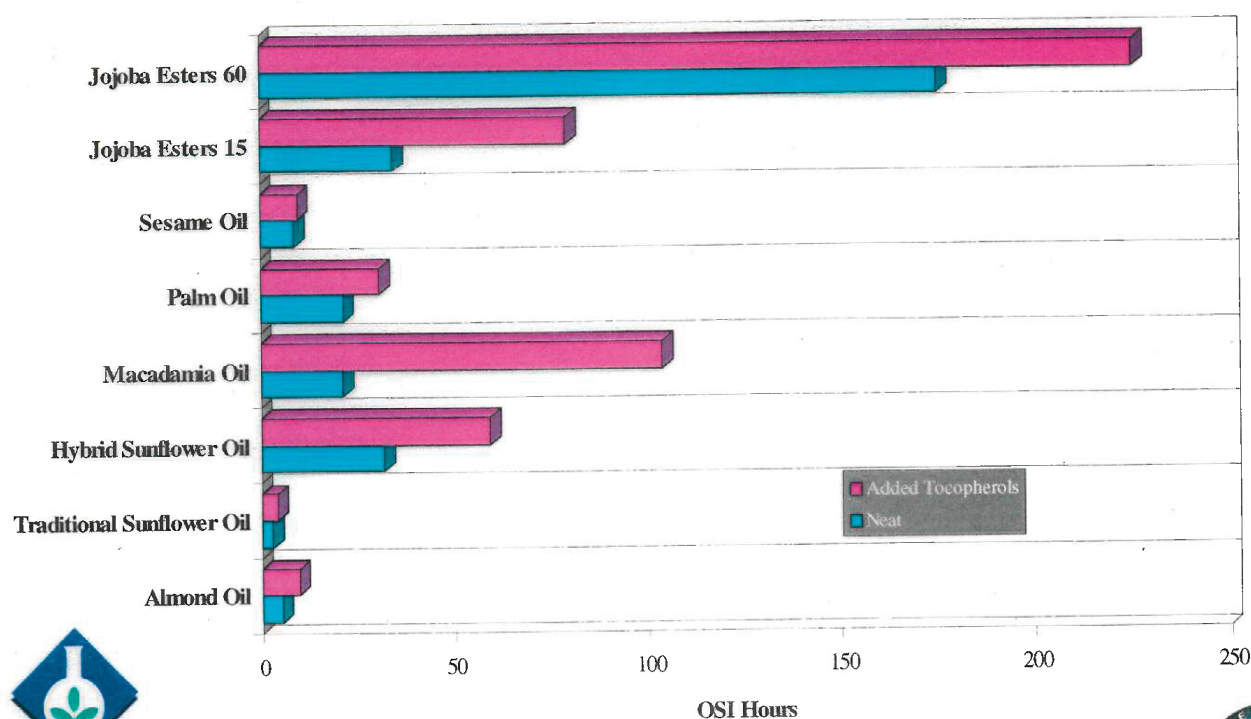


Hybrid Sunflower Oil vs Traditional Sunflower Oil





Selected Emollients With and Without Added Tocopherols (1000 ppm)



Shelf Life Guidelines for Lipids

OSI Value (hours) with <u>Peroxide Value < 2</u>	<u>Estimated Shelf Life</u>
0 - 5	no guarantee
6 - 12	6 months
12 - 20	1 year
20 +	2 years or more



Summary

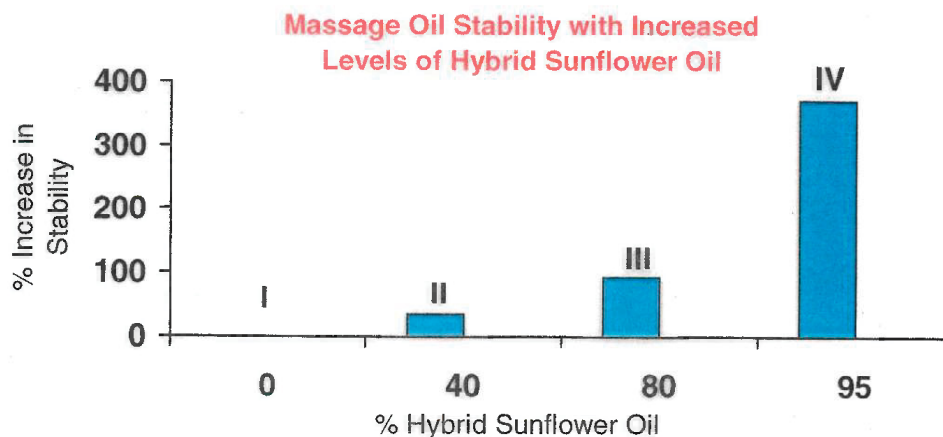
Tocopherols

- ❖ **Low levels improve the stability of inherently stable emollients.**
- ❖ **High levels do not significantly improve stability of inherently unstable emollients.**



Massage Oil Formulas Comparison Test

Ingredients	I	II	III	IV
Hybrid Sunflower Oil	-	40.00	80.00	95.00
High Oleic Safflower Oil	80.00	40.00	-	3.00
Grape Seed Oil	15.00	15.00	15.00	0.50
Joboba Oil	3.00	3.00	3.00	0.50
Sweet Almond Oil	1.30	1.30	1.30	0.50
Sesame Seed Oil	0.55	0.55	0.55	0.35
Propylparaben	0.15	0.15	0.15	0.15



Cosmetic Actives Tested

❖ Metal Oxides

❖ Skin Whiteners

- 1% Kojic Acid
- 7% Arbutin
- 3% Magnesium Ascorbyl Phosphate

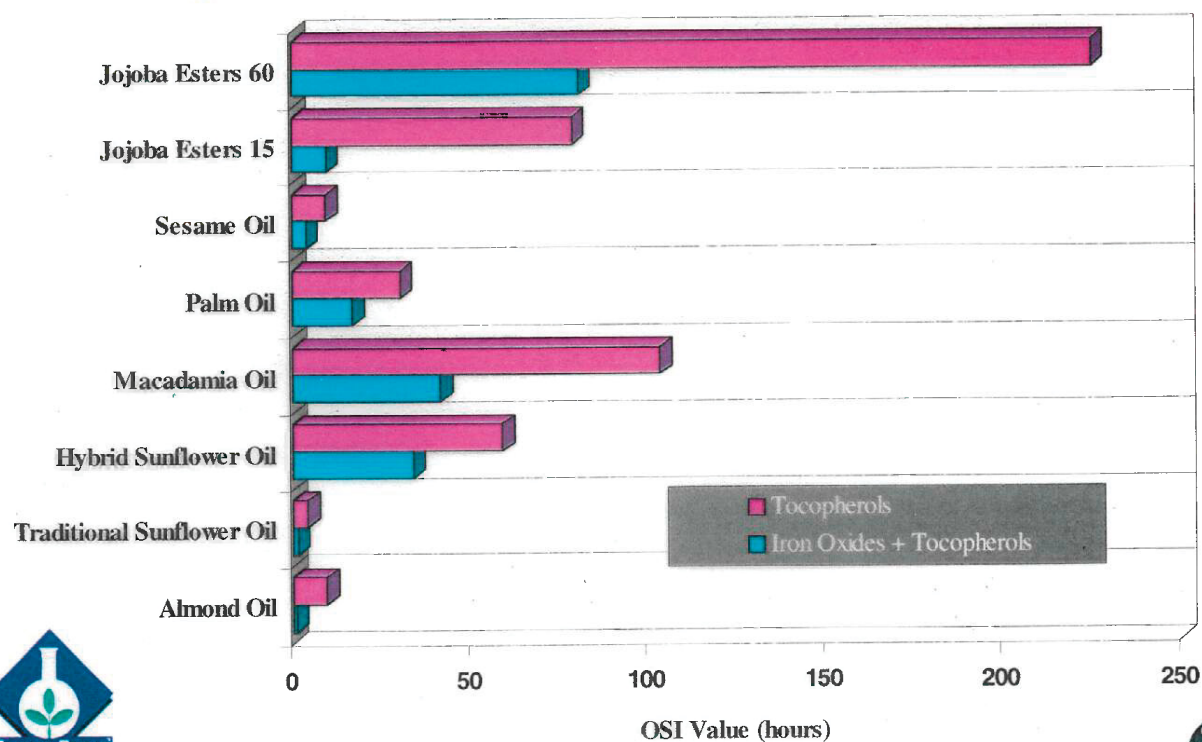
❖ Chemical Exfoliatives

- 5% Malic Acid
- 2% Salicylic Acid

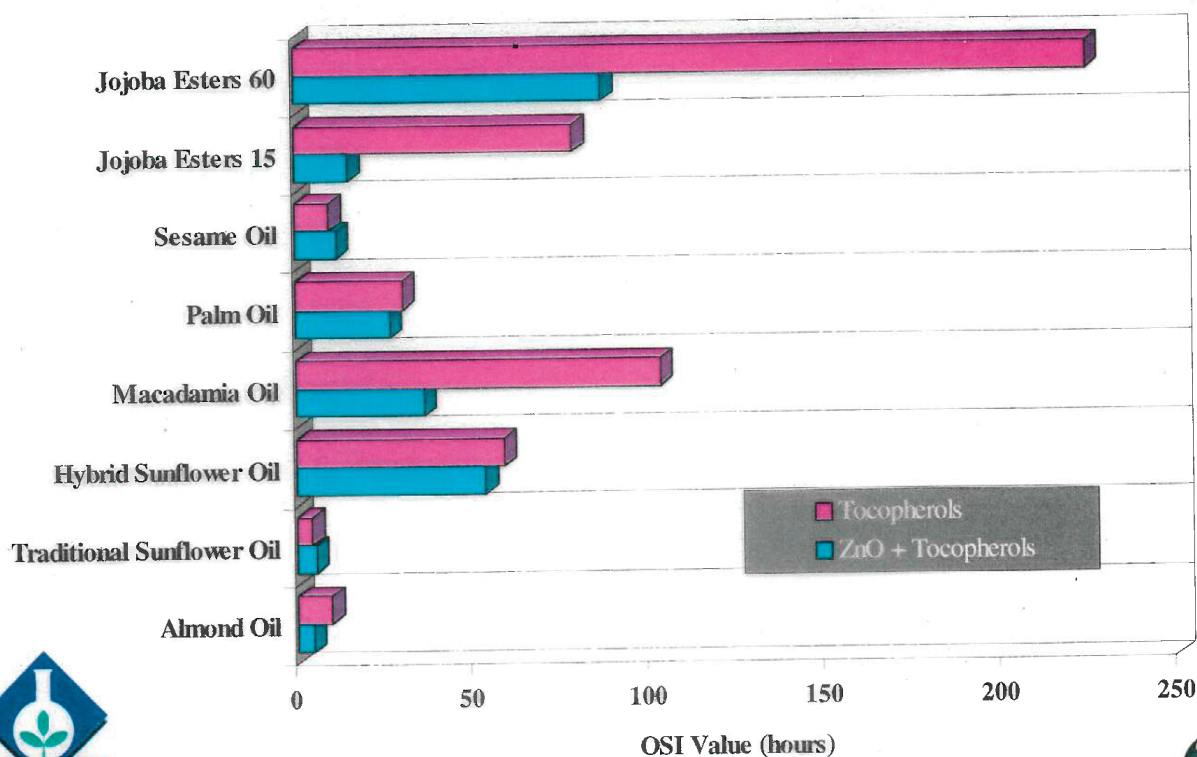
❖ Sunscreens



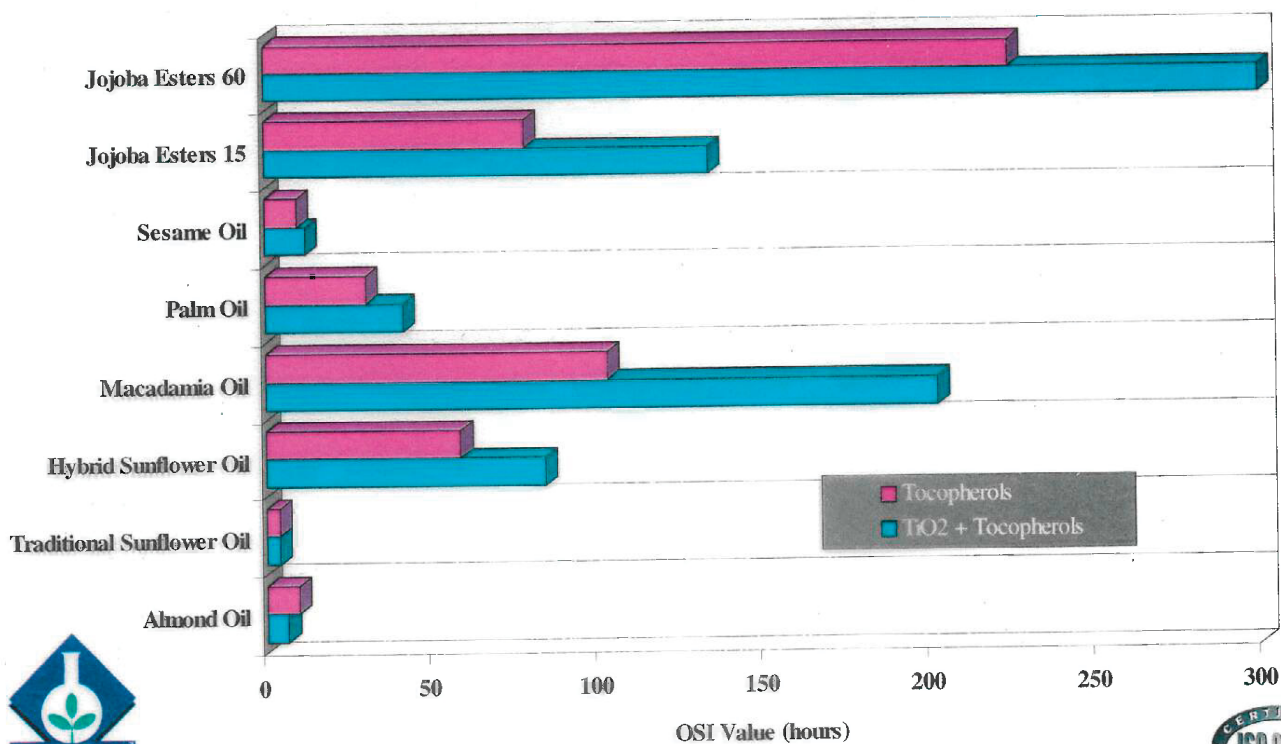
Oxidative Effect of Iron Oxides on Botanical Emollients



Oxidative Effect of Zinc Oxide on Botanical Emollients



Oxidative Effect of Titanium Dioxide on Botanical Emollients



Summary

**Iron Oxides (10%) -
degrades all emollients tested**

The Best Emollients Tested:

- ◆ **Jojoba Esters 60**
- ◆ **Macadamia Oil**



Summary

Zinc Oxide (10%)

The Best Emollients Tested:

- ◆ **Jojoba Ester 60**
- ◆ **Hybrid Sunflower Oil**



Summary

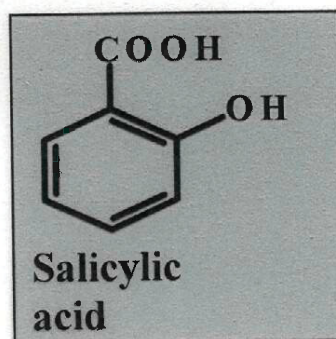
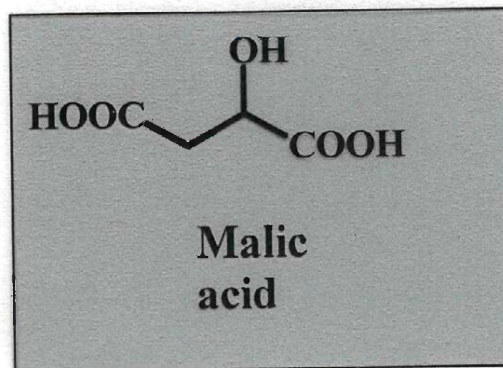
Titanium Dioxide (10%)

The Best Emollients Tested:

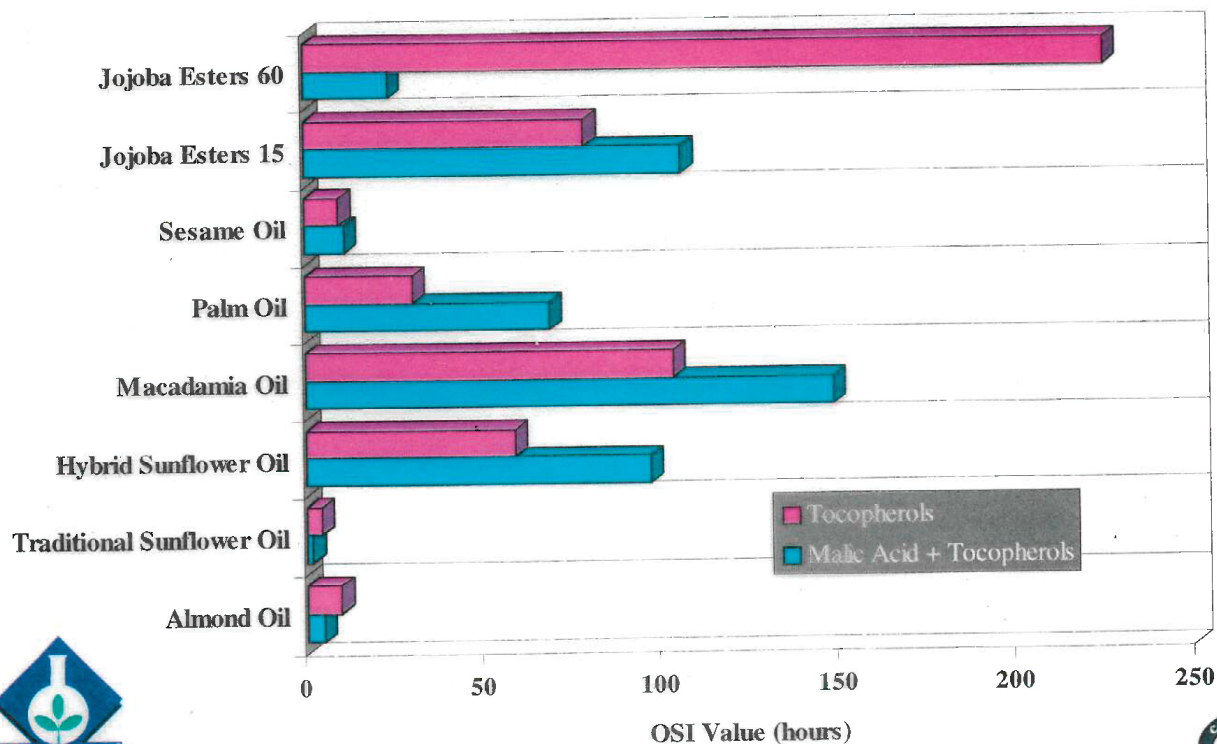
- ◆ Macadamia Oil
- ◆ Jojoba Esters 60



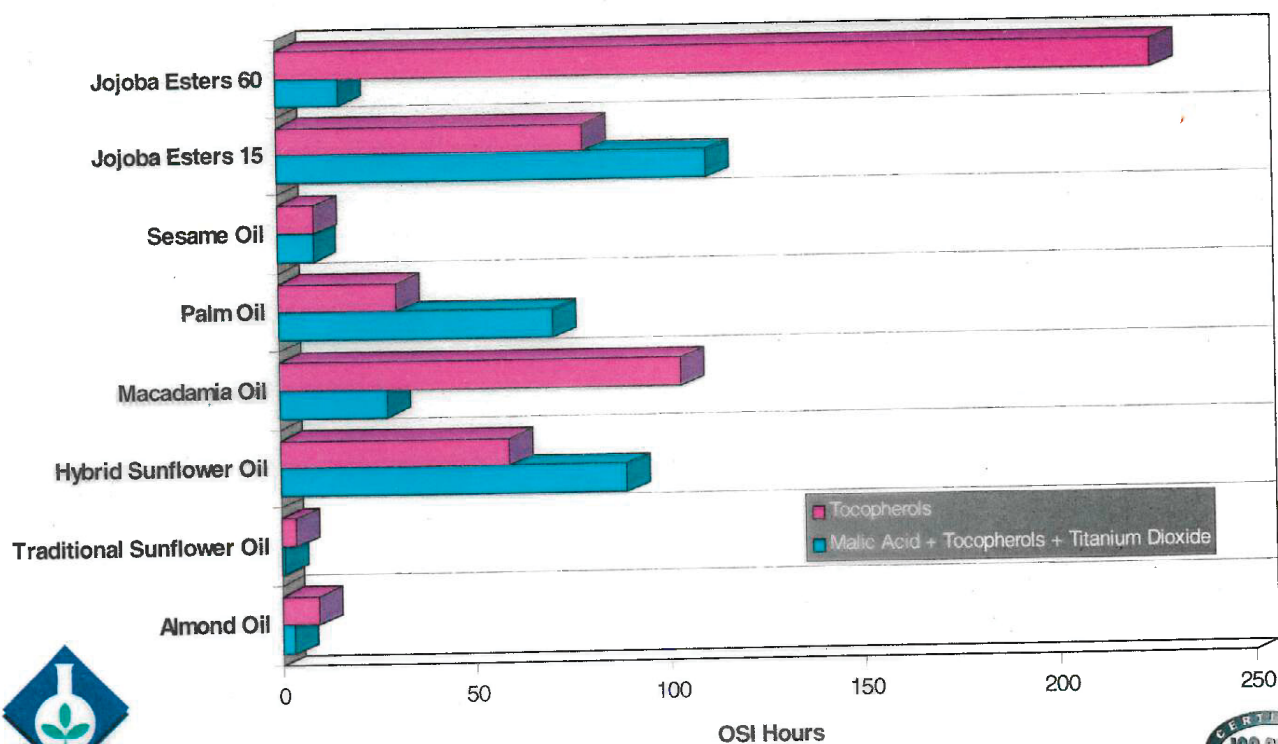
Exoliatives



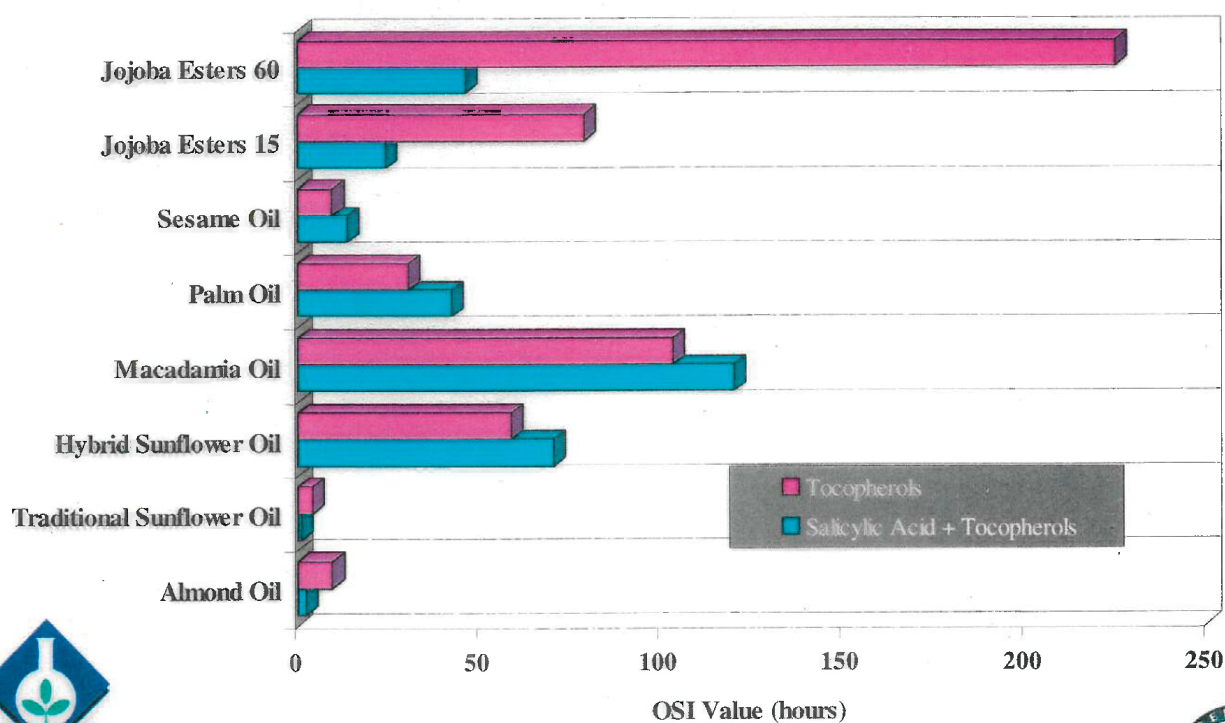
Oxidative Effect of Malic Acid on Botanical Emollients



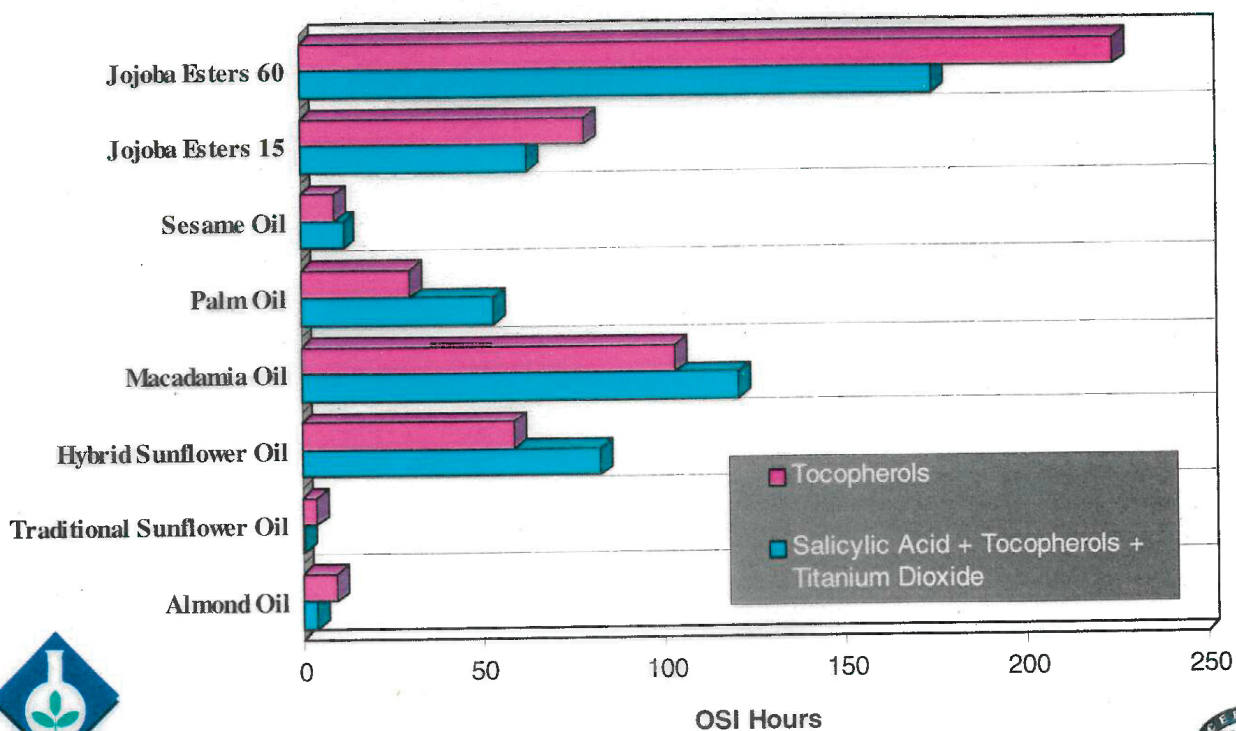
Oxidative Effect of Malic Acid and Titanium Dioxide on Botanical Emollients



Oxidative Effect of Salicylic Acid on Botanical Emollients



Oxidative Effect of Salicylic Acid and Titanium Dioxide on Botanical Emollients



Summary

Salicylic Acid (2%)

The Best Emollients Tested:

- ◆ Macadamia Oil
- ◆ Hybrid Sunflower Oil



Summary

Titanium Dioxide (10%) and Malic Acid

The Best Emollients Tested:

- ◆ **Jojoba Esters 15**
- ◆ **Hybrid Sunflower Oil**



Summary

Malic Acid (5%)

The Best Emollients Tested:

- ◆ Macadamia Oil
- ◆ Jojoba Ester 15



Summary

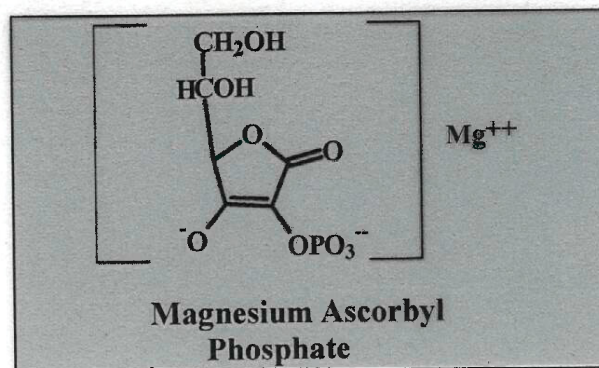
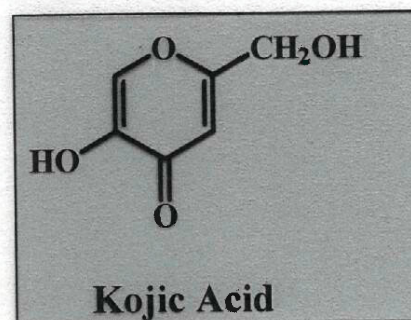
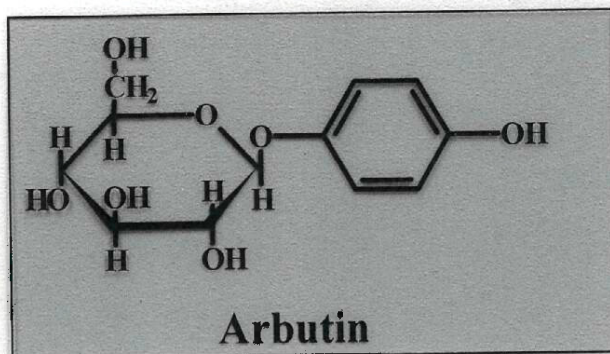
Titanium Dioxide (10%) and Salicylic Acid

The Best Emollients Tested:

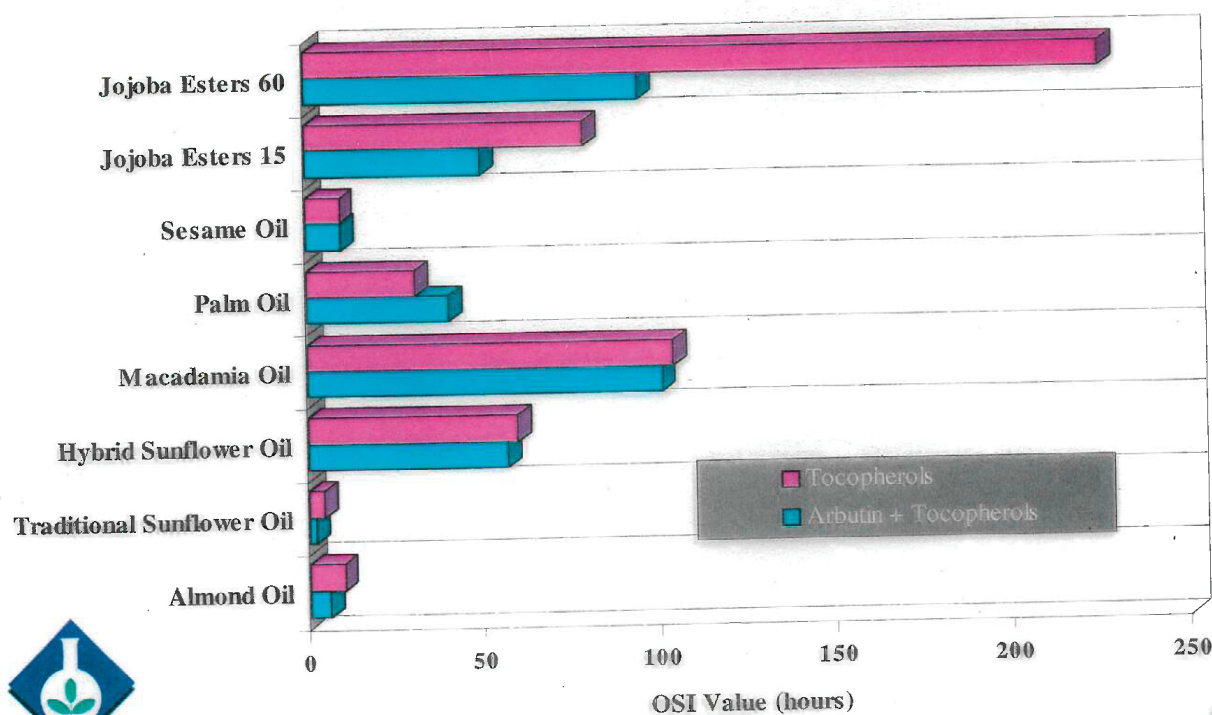
- ◆ **Jojoba Esters 60**
- ◆ **Macadamia Oil**



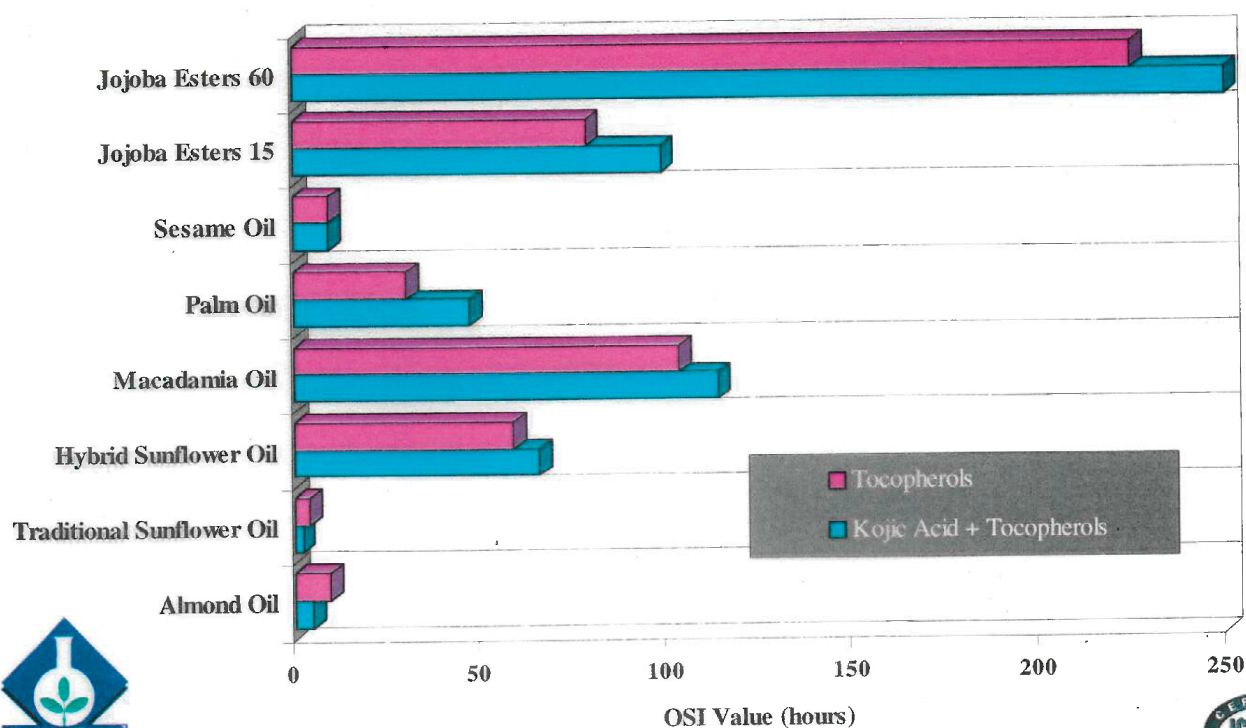
Skin Whiteners



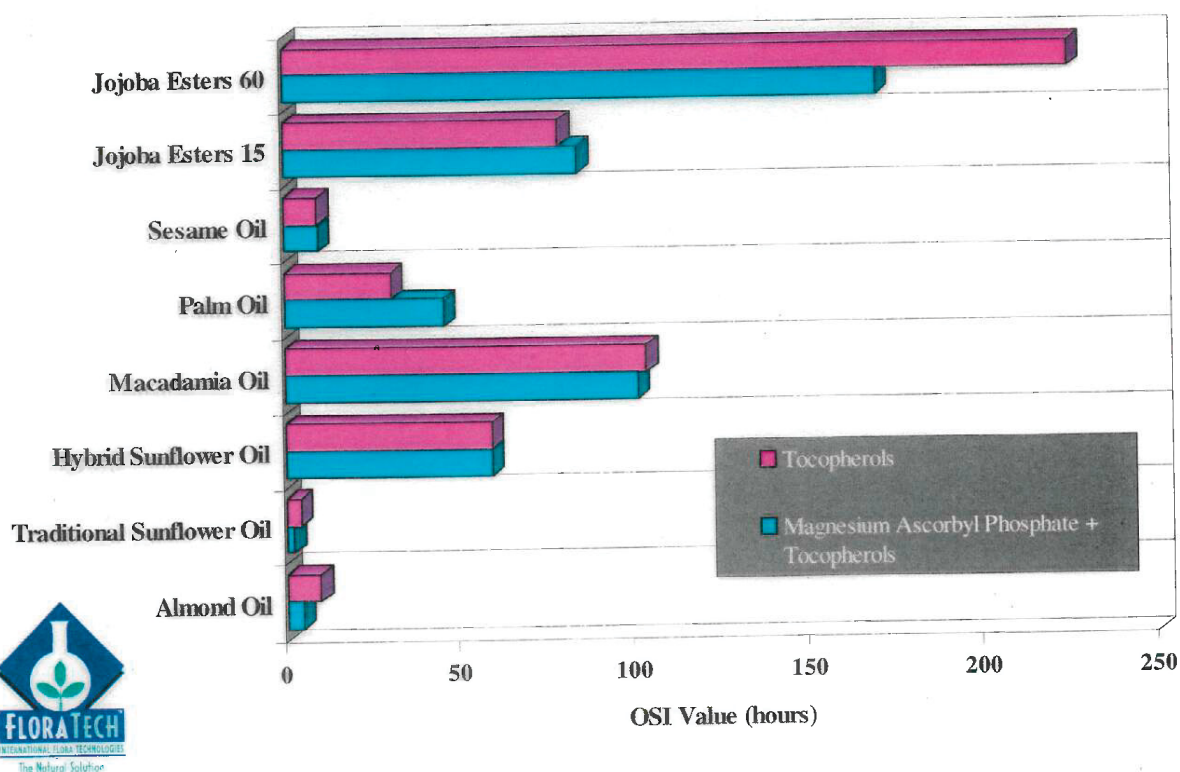
Oxidative Effect of Arbutin on Botanical Emollients



Oxidative Effect of Kojic Acid on Botanical Emollients



Oxidative Effect of Magnesium Ascorbyl Phosphate on Botanical Emollients



Summary

Arbutin (7%)

The Best Emollients Tested:

- ◆ **Jojoba Esters 60**
- ◆ **Macadamia Oil**



Summary

Kojic Acid (1%)

The Best Emollients Tested:

- ◆ **Jojoba Esters 60**
- ◆ **Macadamia Oil**



Summary

Magnesium Ascorbyl Phosphate (3%)

The Best Emollients Tested:

- ◆ Jojoba Esters 60
- ◆ Macadamia Oil



Summary

THE BEST PERFORMERS:



Jojoba Esters - 60

Jojoba Esters - 15

Hybrid Sunflower Oil

Macadamia Nut Oil



Summary

GOOD PERFORMANCE: 

Palm Oil



Summary

MARGINAL PERFORMANCE:

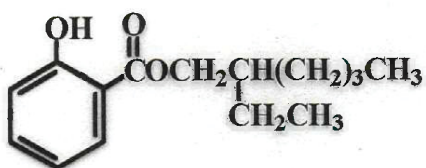
Sesame Oil

Almond Oil

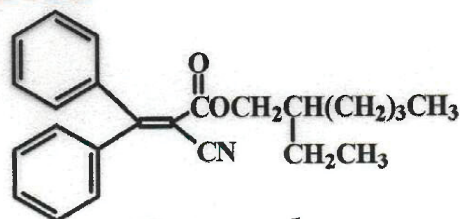
Traditional Sunflower Oil



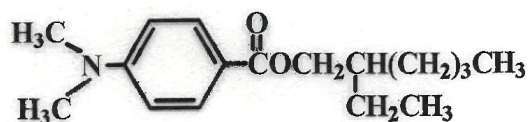
Sunscreens



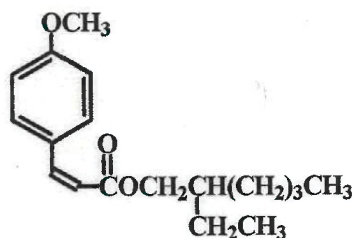
Octyl Salicylate



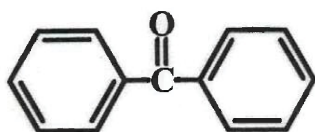
Octocrylene



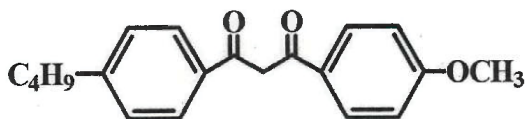
Octyl Dimethyl PABA



Octyl Methoxycinnamate



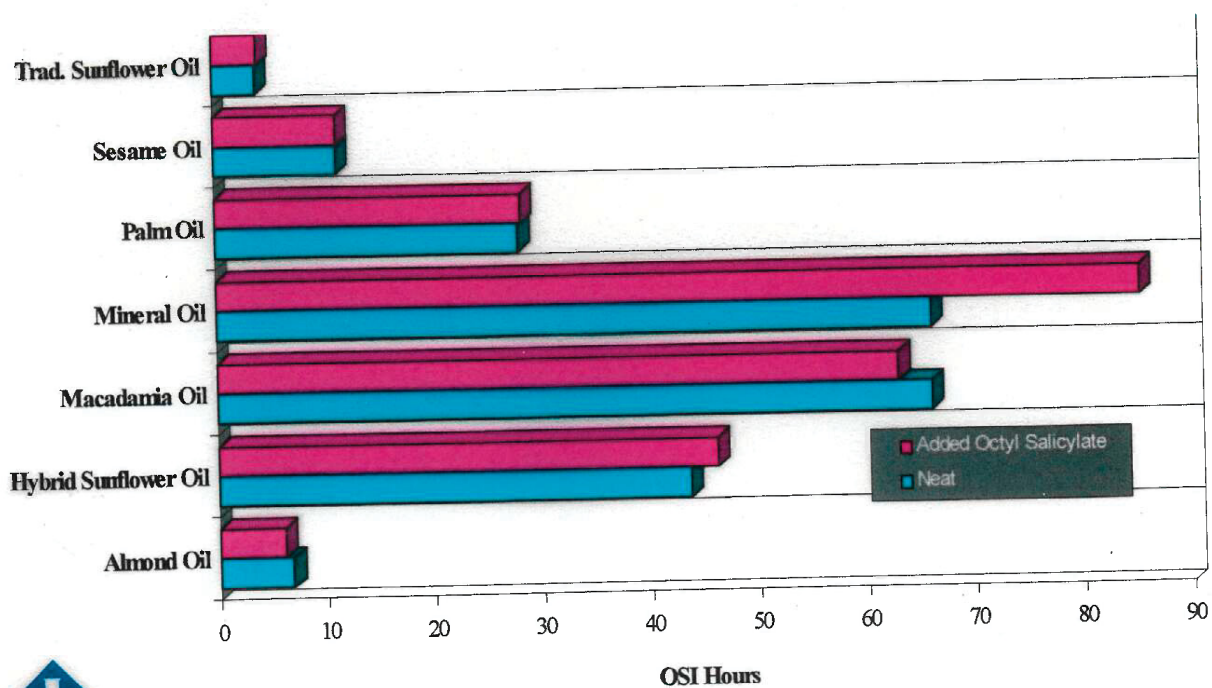
Benzophenone



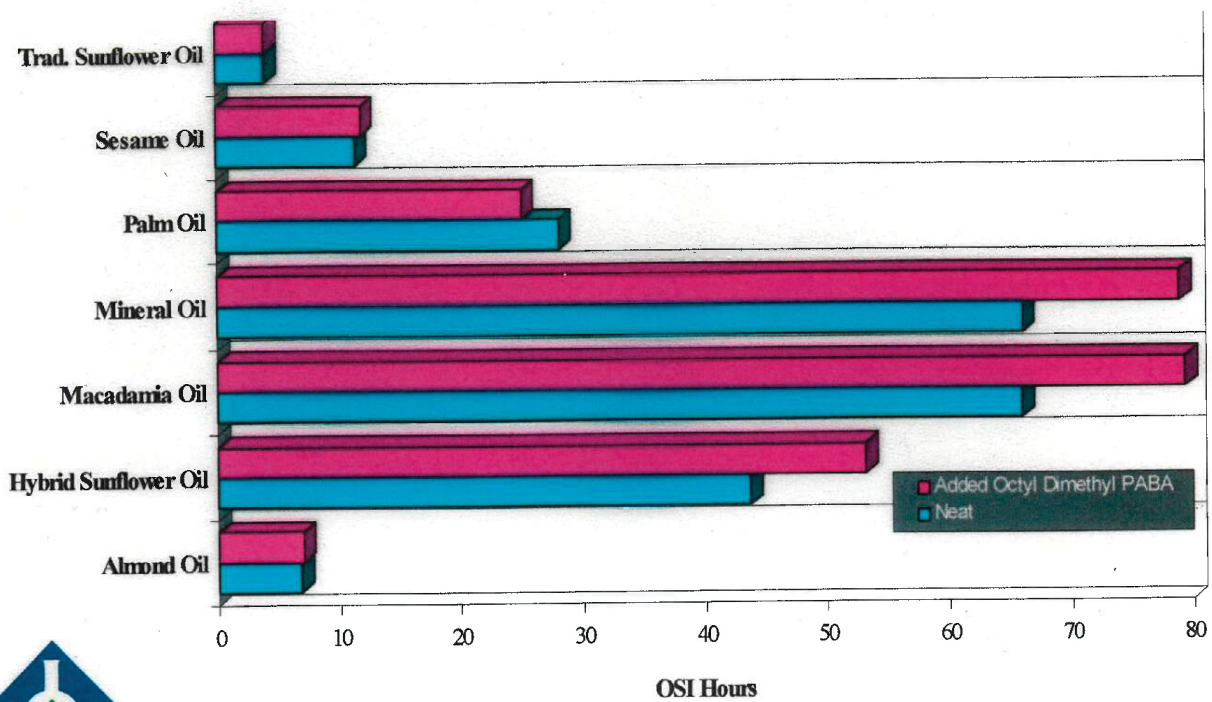
Parsol 1789



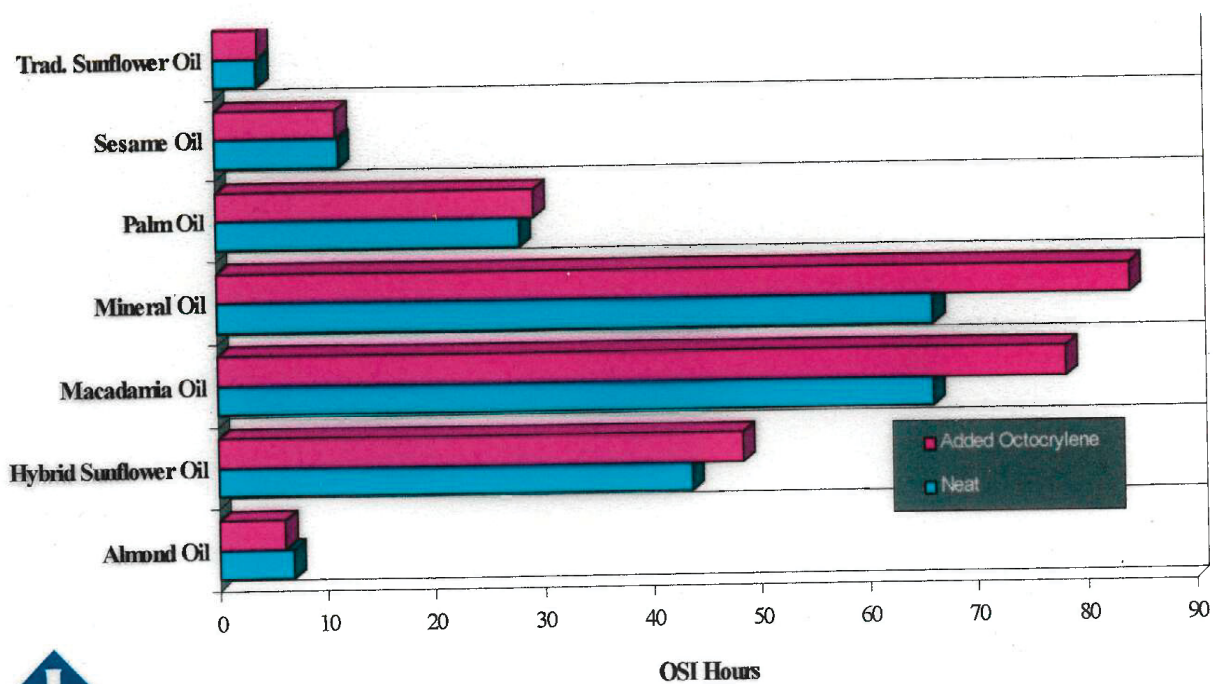
Octyl Salicylate



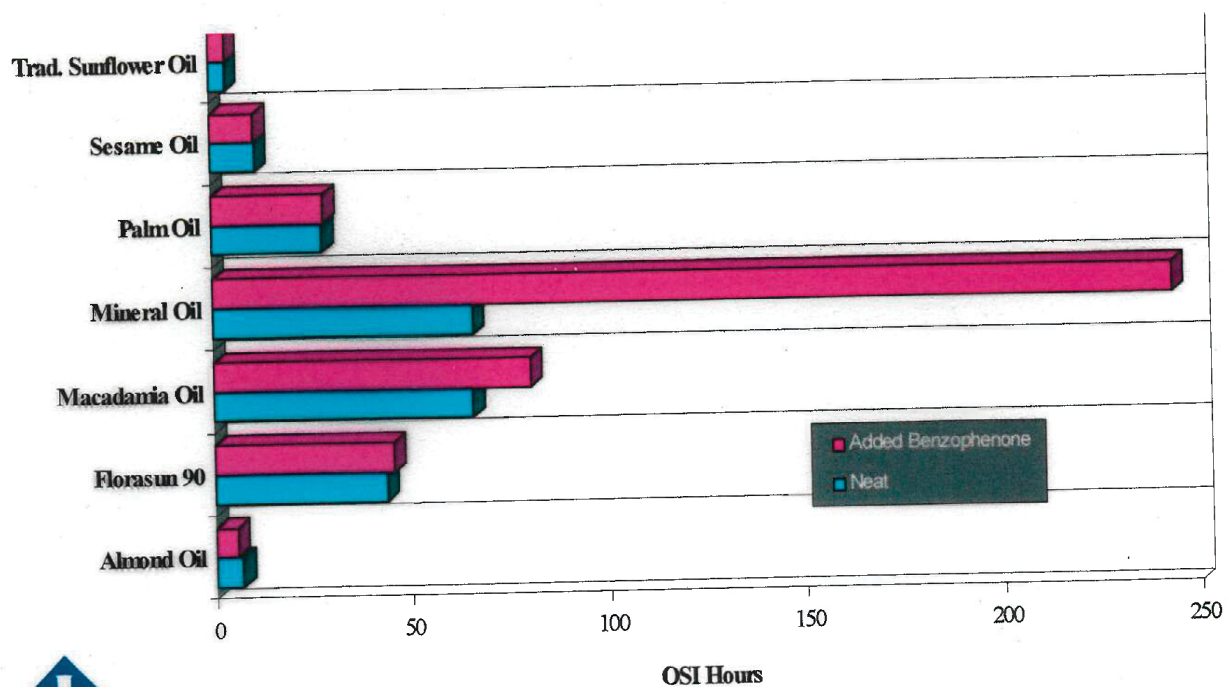
Octyl Dimethyl PABA



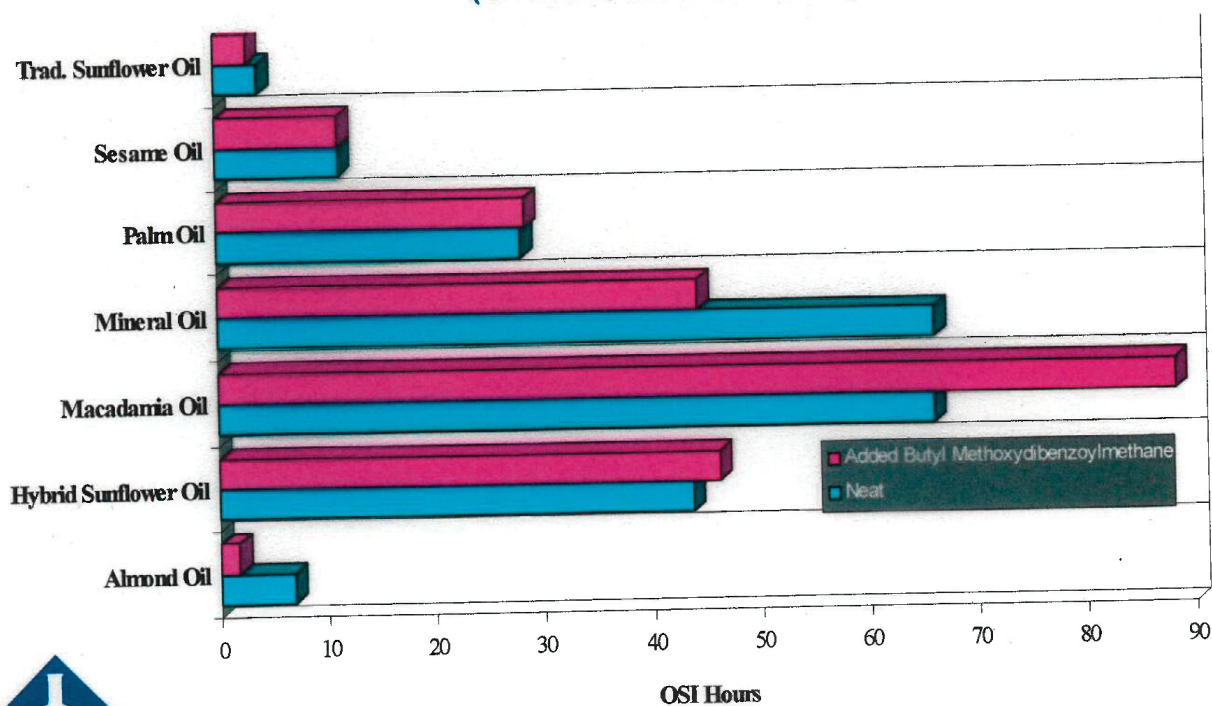
Octocrylene



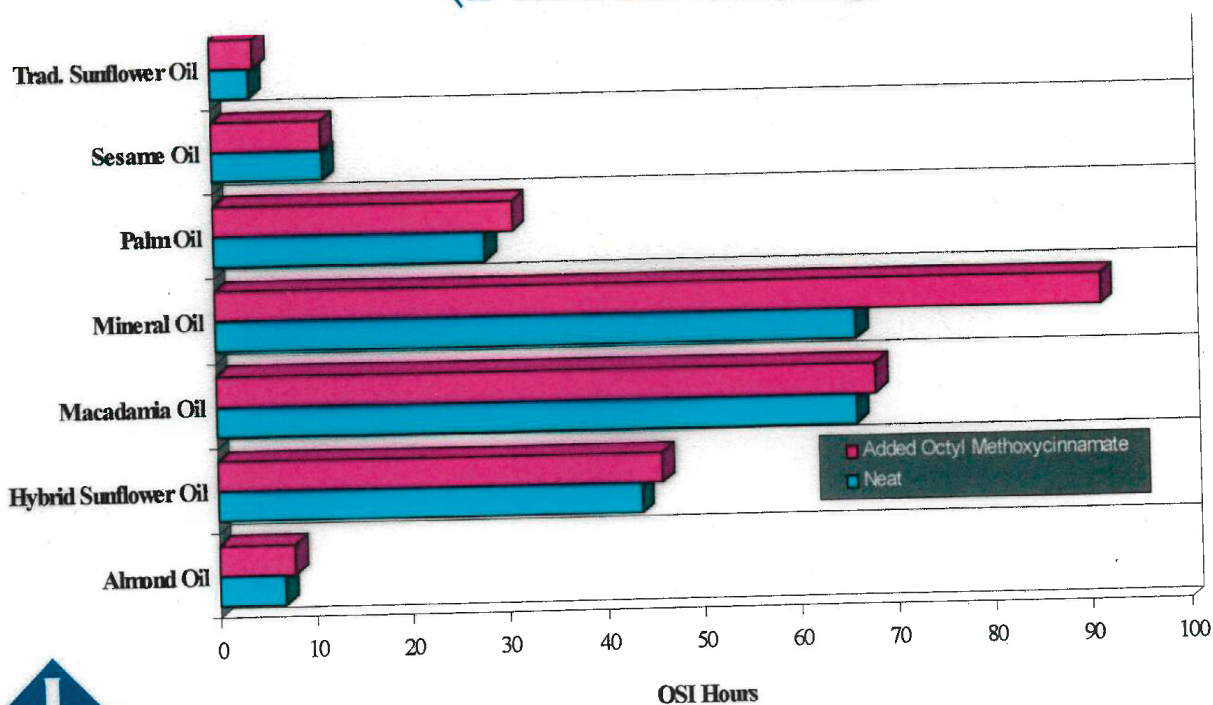
Benzophenone



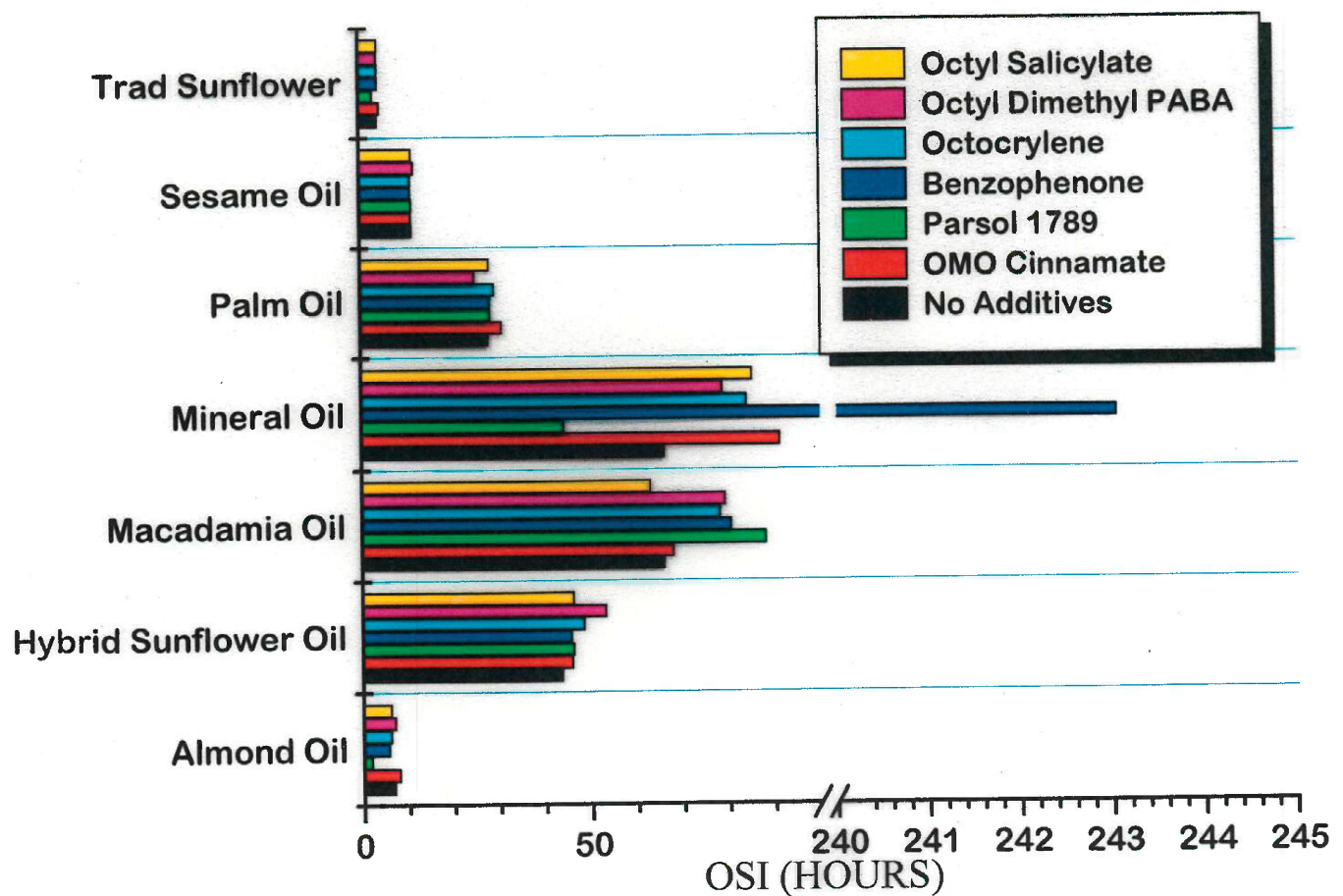
Butyl Methoxydibenzoylmethane (Parsol 1789)



Octyl Methoxycinnamate (Parsol MCX)



Effect of Sunscreens on OSI



OXIDATIVE STABILITY OF BOTANICAL EMOLLIENTS IN THE PRESENCE OF COSMETIC "ACTIVES"

ADDITIVES

1000ppm Tocopherols		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10% TiO ₂			✓								✓	✓
10% ZnO				✓								
10% Iron Oxides					✓							
1% Kojic Acid						✓						
7% Arbutin							✓					
2% Salicylic Acid								✓				✓
5% Malic Acid									✓		✓	
3% Mg Ascorbyl Phosphate										✓		

OSI HOURS

EMOLLIENTS

(Neat)

Almond Oil	5.2	9.6	6.5	4.4	0.9	4.8	5.5	2.3	4.8	4.5	3.3	4.3
Traditional Sunflower Oil	2.7	4.1	4.3	5.4	1.2	2.0	1.8	1.0	1.7	1.9	1.1	0.6
Hybrid Sunflower Oil	31.7	59.2	84.5	53.7	34.2	66.0	56.5	70.7	97.1	59.3	89.4	82.6
Macadamia Oil	21.0	103.6	203.1	36.5	41.9	114.2	100.5	120.2	148.6	101.2	28.1	120.9
Palm Oil	21.3	30.6	42.0	27.0	17.0	47.7	40.3	42.7	69.0	45.9	70.8	53.4
Sesame Seed Oil	8.6	9.6	12.2	11.6	3.9	9.5	9.7	13.7	11.3	9.7	9.4	12.1
Jojoba Esters 15	34.3	79.0	134.3	15.1	9.8	99.2	49.6	24.5	106.3	84.5	110.7	62.8
Jojoba Esters 60	175.0	225.1	300.0	87.3	80.8	250.0	94.5	46.5	23.9	170.3	16.3	175.2

Table 6

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SCC Ontario Chapter - Education Day
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