A world first **super ingredient** from
the unique New Zealand Tōtara Tree.

BIOACTIVE
TOTAROL™

A WORLD FIRST ORGANIC SUPER INGREDIENT

BIOACTIVE TOTAROL™

Bioactive Totarol™ is an aromatic diterpenoid with chemical formula $C_{20}H_{30}O$. **Bioactive Totarol™** is the next generation certified organic antioxidant and antibacterial super ingredient, helping human and animal health by harnessing the power of nature.

Bioactive Totarol™ is a naturally occurring plant extract that develops in the New Zealand Tōtara tree in large quantities after approximately 150 years of growth. This natural phenomenon protects the tree from bacterial attacks and environmental influences, allowing the tree to grow for thousands of years and making it impervious to rot, even after it has fallen.

The Tōtara derives from the Podocarpus tree family which dates back over 100 million years. Before New Zealand existed as a land mass, in the time of Gondwanaland stood the ancestors of the native Tōtara tree. About 80 million years ago as Aotearoa (New Zealand) started to take shape, so did the modern day



A WORLD FIRST ORGANIC SUPER INGREDIENT

BIOACTIVE TOTAROL™



Tōtara; and there it grew in abundance, only in New Zealand. Then arrived the indigenous Māori who instantly noticed the majestic tree's strength and long lasting nature. With it they created mighty wakas (canoes), whare (houses) and used the tree for medicinal purposes. The early colonial settlers then arrived and also noticing its robustness they built houses, fences and railway tracks from Tōtara, many still in existence today.

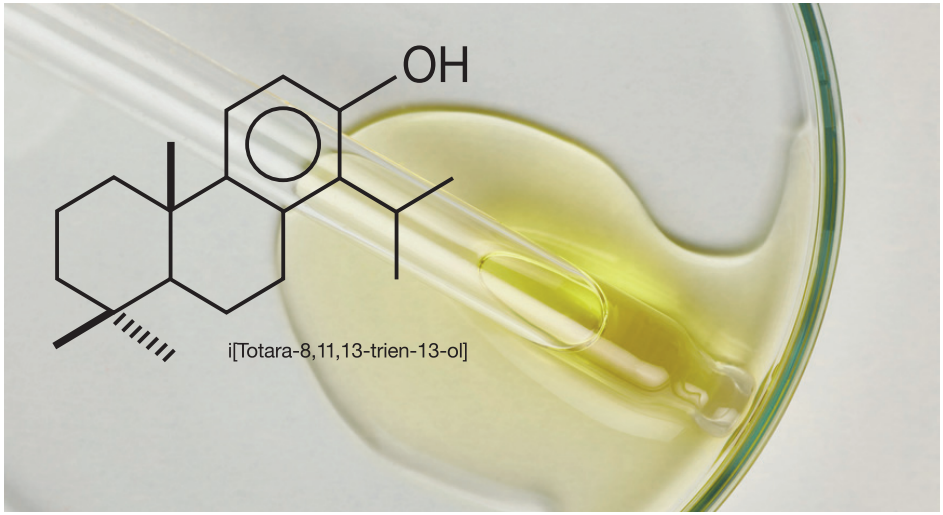
International and New Zealand scientists and researchers conducted research on the Tōtara tree in the 1990's.
This group were intrigued by the fact that Tōtara wood used for Māori carvings, canoes, and fortification, and by early European settlers in building material seemed to survive environmental attacks and degradation. The Tōtara wood had proved to be virtually unblemished after hundreds of years of use and after testing it was discovered that the Totarol™ located in the heartwood of the tree was the magic ingredient at play.

THE PROPERTIES OF BIOACTIVE TOTAROL™

Bioactive Totarol™ is an aromatic diterpenoid with chemical formula $C_{20}H_{30}O$. **Bioactive Totarol™** is a natural extract from heartwood of the Tōtara tree. Tōtara (Podocarpus Tōtara) is a Podocarpus species unique to New Zealand. The timber of Tōtara is renowned for its resilience against rotting.

Bioactive Totarol™ has selective antibacterial properties. It is active against *Staphylococcus aureus;* (including methicillin-resistant, epidemic, community and multi-drug-resistant strains), *Streptococcus mutans, Streptococcus pneumoniae* (penicillin-resistant), *Streptococcus pyogenes* (erythromycin-resistant), *Enterococcus faecalis* (high-level-gentamicin-resistant), *Enterococcus faecalis* (vancomycin-resistant), *Salmonella menston, Eschericia coli, Enterobacter aerogenes, Pseudomonas aeruginosa, Bacillus subtilis, Brevibacterium ammoniagenes* and *Cutibacterium acnes.*

Totarol™ provides anti-microbial efficacy against gram-positive and gram-negative bacteria by disrupting the bacteria cell, it creates an environment that starves bacteria of any environment for it to survive in, while not harming any of the other useful microorganisms, a natural mycobacterium.



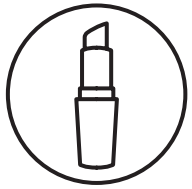
BIOACTIVE TOTAROL™ — A UNIQUE INGREDIENT FROM NEW ZEALAND:

1. A sustainably sourced organic and natural ingredient from the New Zealand Tōtara tree
2. No living trees harmed, only off cuts are used
3. A potent antioxidant – Totarol™ is 7 times more effective than vitamin E
4. Anti-microbial – Totarol™ possess potent anti-bacterial properties against pathogenic bacteria such as acne-causing bacteria
5. **Bioactive Totarol™** is able to penetrate harmful, pathogenic bacteria and destroy them
6. Highly effective Totarol™ is a multi-tasking and versatile ingredient for cosmetic formulations
7. Used successfully in formulations for the last 20 years
8. Available in powder and liquid formats, both food-grade and cosmetic grade
9. A powerful ingredient story to add to your product marketing
10. Microbiome friendly - targets pathogenic bacteria such as Staph, Strep and C. Acnes that cause skin, gum and tooth infections



THE APPLICATIONS OF BIOACTIVE TOTAROL™

Bioactive Totarol™ has a series of bioactive compounds and associated technologies allowing it to be a multi-functional active ingredient in a wide range of applications, including but not limited to:



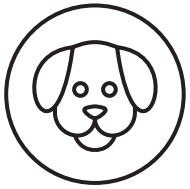
COSMETICS

Skin Care
Make Up
Anti-Acne
Anti-Aging



PERSONAL CARE/ ORAL CARE

Toothpaste & Mouthwash
Hand Protection
Deodorant
Throat Lozenges
Baby care
Hair Care
Supplements



ANIMAL CARE

Dog Shampoo
Skin Care Treatments
Oral Care
Wound Healing
Infection Protection



PHARMACEUTICAL

Wound Care
Wound Healing
Infection Protection

NB: These are examples of where Bioactive Totarol™ is being or could be applied to.

PROPERTIES OF TOTAROL



1. Non-irritating to skin*
2. Non-sensitizing to skin*
3. Sustainably and responsibly produced
4. Strengthens the microbiome
5. Anti-oxidant and anti-aging properties

*at use concentration

TOTAROL™ VARIANTS AND USE LEVELS

	TOTAROL™ T8 FOOD GRADE	TOTAROL™ T9 COSMETIC	TOTAROL™ PDR
INCI	Totarol™, Helianthus Annuus (Sunflower) Seed Oil, Polysorbate 60	Totarol™, Helianthus Annuus (Sunflower) Seed Oil, Polysorbate 60, Caprylhydroxamic Acid, Glyceryl Caprylate, Glycerin	Totarol™
Use levels	0.1 – 3%	0.1 – 3%	0.05 – 0.1%
Oral Care	0.1 – 0.3%	0.1 – 0.3%	0.05 – 0.15%
Acne care	0.75 – 1.5%	1.5 – 3.0%	0.25 – 0.50%
Anti-aging	0.25% - 2%	0.25 – 2%	0.1 – 0.75%
Skincare	0.25 – 2%	0.25-2%	0.10 – 0.25%
Petcare	1.0-3.0%	1.0-3.0%	0.25 – 1.0%
Rinse-off products	0.5 – 2.0%	0.5 – 2.0%	0.2 – 0.75%

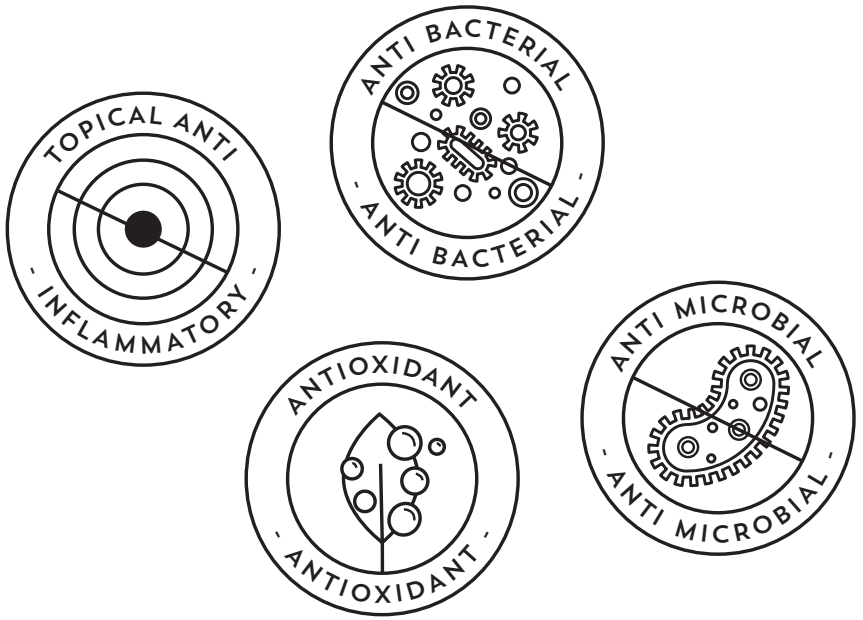
BIOACTIVE TOTAROL™

MOTHER NATURE'S SECRET WEAPON AGAINST DISEASES

The potency of **Bioactive Totarol™** is such that efficacy can be achieved with low doses, when formulated as an active ingredient. Totarol™ itself has no taste and minimal aroma – a perfect organic partner to enhance a product formula.

Bioactive Totarol™ is a potent anti-oxidant and strongly inhibits lipid peroxidation and scavenges ROS (reactive oxygen species). It also has good antioxidant preservative activity in lipid or emulsion based systems.

Its high antioxidant properties have been tested and proven to be seven times more effective than Vitamin E.
(Bai. Y., 2002) and 4 times more potent than Enzogenol (Bai. Y., 2002).



ANTIBACTERIAL BENEFITS

BIOACTIVE TOTAROL™

Report study for Mende Biotech Ltd. to determine the minimum concentration of Totarol™ required to inhibit the growth of staphylococcus aureus (bacteria that can cause boils, blisters, and redness on skin) in broth cultures.

The testing was done with Totarol™ dissolved at 320mg/ml, 160MG/ml and 80ml/ml solutions of DMF (dimethylsulfoxide)..

Totarol™ was a very potent inhibitor at the higher concentration tested. From a concentration of 5% to a 0.005% there was >97% kill of the bacteria after 16h incubation and complete inhibition after further 8 hours.

BIOCHEMISTRY – VOLUME 46, NO. 12, APRIL 2007.

Totarol™ Inhibits Bacterial Cytokinesis by Perturbing the Assembly Dynamics of FtsZ†

(Richa Jaiswal, Tushar K. Beuria, Renu Mohan, Suresh K. Mahajan, and Dulal Panda, School of Biosciences and Bioengineering, Indian Institute of Technology, Bombay, India, and Institute of Science, India, 2006; Revised 2007)

Totarol™ has been shown to inhibit the proliferation of several pathogenic Gram-positive bacteria including Mycobacterium tuberculosis.

Since Totarol™ was shown to inhibit the proliferation of M. tuberculosis, we examined the effects of Totarol™ on the assembly dynamics of M. tuberculosis FtsZ (MtbFtsZ) in vitro. Totarol™ decreased the assembly of MtbFtsZ protofilaments and potently suppressed the GTPase activity of MtbFtsZ.

Totarol™ can perturb the assembly dynamics of FtsZ protofilaments in the Z-ring. Totarol™ exhibited extremely weak inhibitory effects on HeLa cell proliferation. It did not affect microtubule organization in HeLa cells. The results suggest that Totarol™ inhibits bacterial proliferation by targeting FtsZ and it may be useful as a lead compound to develop an effective antitubercular drug.

(Bai. Y., "Antioxidant Capacity of Totarol"; Internal Report, HortResearch; October 2002).

THE EXTRACTION PROCESS

Totarol™ is 100% organic and sustainably sourced. Due to the unique supercritical and patented extraction process of Totarol™, pioneered by our team, no living Tōtara trees are touched as Totarol™ can be extracted from dead heartwood, negating the need to cut down live trees. We source only from fallen Tōtara trees from the forest floor, which is abundant throughout New Zealand, meaning stock is almost infinite.

The extraction process utilizes supercritical CO_2 as the extraction solvent where the latest methods and equipment to capture the finest natural extracts are utilized.



THE EXTRACTION PROCESS



There are **four main reasons** why we use our own supercritical extraction method:

1. It makes the product completely organic.
2. It cuts out any solvent residue.
3. It creates a unique Bioactive Totarol™ signature chemical structure under our patented technology.
4. It yields higher extraction rates.

STUDY RESULTS

Many years of testing **Bioactive Totarol™** has uncovered a lot of positive data. Testing is a core value of the company and something that continues to be undertaken to yield further results for commercial use.

The following information is a snap shot of key findings from testing and research that has been undertaken of Bioactive Totarol™. Further technical information is available at request, please contact us.





- A case report documents improvement in acne following regular application of an alcohol based Totarol™ product and a Totarol™ containing moisturiser **(Nixon and Hobbs, 2006)**. Totarol™ is a suitable active ingredient for anti-acne products and has been shown to be safe for topical (non-pregnant/non-lactating) human use.
- The median lethal dose of Totarol™ after single dermal administration to rats of both sexes, observed over a period of 14 days is: LD50 (rat): greater than 2000 mg/kg body weight.
- Totarol™ is four times more potent than Enzogenol (derived from Pine Trees) as an anti-oxidant. **(Bai. Y., "Antioxidant Capacity of Totarol"; Internal Report, HortResearch; October 2002).**

WHITENING EFFECT OF TOTAROL™



THE EFFECT ON THE SUPPRESSION OF MELANIN SYNTHESIS AND ITS MECHANISM

* Japan Society for Bioscience, Biotechnology, and Agrichemistry / Congress in 2009

Totarol™ extracted from Podocarpus Tōtara (New Zealand), was tested on the effect of the suppressing melanin synthesis and its mechanism. It was that the effect was more than whitening agent as well-known Quasi Drug actives. To identify its mechanism, checked by cell fractionation method. Totarol™ was increasing at the fraction of premature malanosome, while decreasing in the mature fraction of melanosome. This was also observed with TRP-1,2 as well. Therefore, it's suggested that the role of Totarol™ on suppression of the melanin synthesis is involved in the suppression of maturation of melanosome.

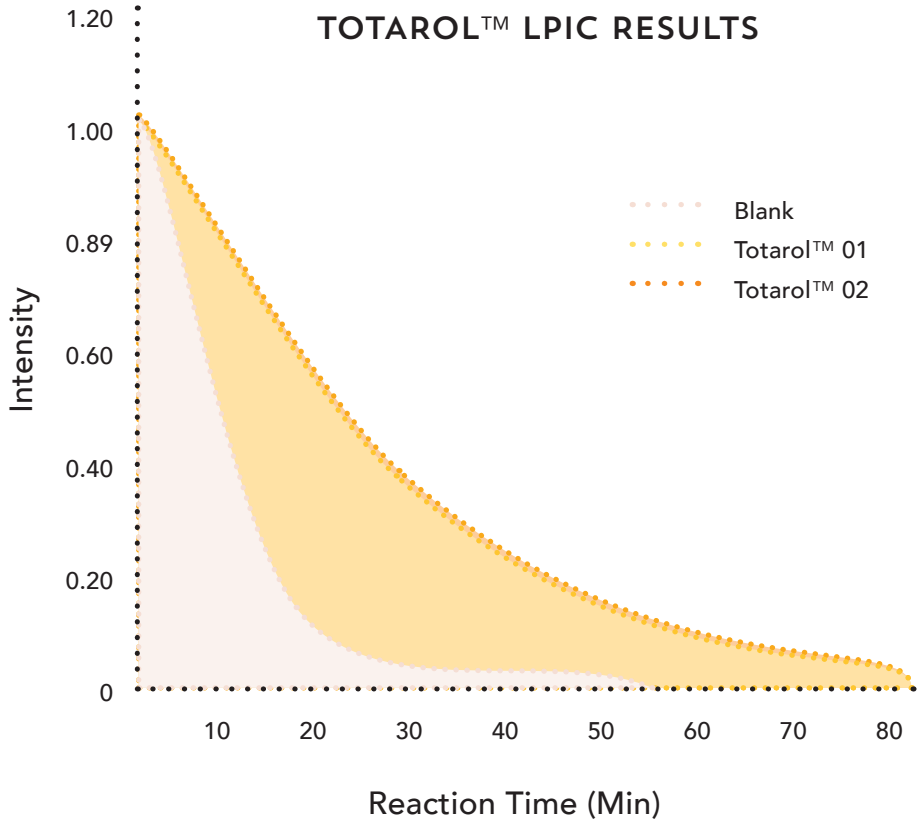
ANTIOXIDANT CAPABILITIES OF TOTAROL™

LAB: FOOD SCIENCE LAB, MARC, HORT RESEARCH, OCTOBER, 2002

This shows that Totarol™ has very high antioxidant activity in a lipid membrane system, where the solubility problem is overcome by incorporating the Totarol™ into the lipid phase.

Figure 1. This graph shows the LPIC value of Totarol™ as a function of time. Totarol™– 01 and Totarol™– 02 are duplicate measurements.

Conclusion: Totarol™ has a good antioxidant preservative activity in lipid or emulsion based systems.



ANALYSIS OF TOTAROL™ BY FLOW CYTOMETRY



TOTAROL™ IN VITRO TESTING ON HUMAN EPIDERMAL KERATINOCYTES (HEK)

Method:

1. Cells were treated with varying concentrations of totarol (4, 20, and 40 g/ml) and incubated for 24h.
2. Cells were then either exposed to UV or not and incubated for a further 24 h.
3. Cells were harvested and labelled for flow cytometry.
4. Parameters measured included DNA damage, oxidative stress, glutathione and mitochondrial membrane potential.

Results:

1. Totarol at these concentrations is not toxic to cells. The nature of the oil prevents cell growth at the higher concentrations but it is not toxic per se.
2. Totarol acts as an anti-oxidant and has mild protecting properties against UV.
3. Totarol enhances cell proliferation, which helps with healing and cell turnover.
4. Totarol can increase the cell renewal rate, which may improve skin tone and brightness. This also assist with improvement of acne-prone skin.



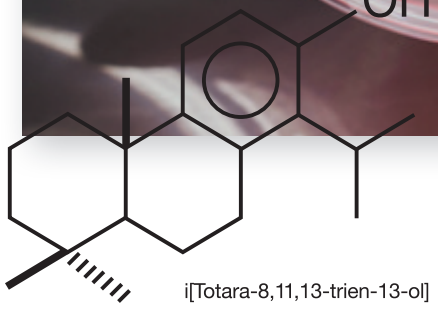
BASE FORMULATIONS

FRAME FORMULAS & APPLICATIONS

We have developed some frame formulations showing ways that Totarol™ can be used for different applications.

Note that these are desktop formulas, they have not been made in the lab to check aesthetics, performance or stability. These are initial starting point formulations.





i[Totara-8,11,13-trien-13-ol]

FRAME FORMULATION

TOTAROL™ ANTI-ACNE CREAM

The combination of Totarol™ providing anti-inflammatory, microbiome balancing, anti-oxidation and anti-aging properties with copper peptide to improve the skin permeability, allowing inorganic copper ions, which are difficult to penetrate stratum corneum, to penetrate deep into the skin to function. The complexes of cupric peptides with their copper ions can be used as activators and antioxidants for tissue remodeling. As signal peptide that promotes the degradation of large amounts of collagen aggregates outside scars, helps synthesis of beneficial collagen and elastin to skin, and controls the growth rate and migration of different types of cells.

Disclaimer: The above frame formulation is only a proposed suggestion on usage of Totarol™ for topical skincare use. The end user must determine the suitability of use, stability and performance of the Frame Formulation and accepts any and all liability that use of this Frame Formulation may confer.

NAME	%WT
PHASE A	
EMT-10	1.20
Dicaprylyl carbonate	2.00
Glyceryl linoleate (and) Glyceryl oleate (and) Glyceryl linolenate	1.00
Ethylhexyl palmitate	2.00
C26-28 Alkyl Dimethicone	0.20
Tocopherol acetate	0.20
Heat Phase A to 80°C under medium stirring	
PHASE B	
Water	To 100%
Glycerine	3.00
Xanthan Gum	0.18
PEG-26 Glyceryl ether	4.00
Carbomer	0.15
Allantoin	0.10
Glycerine and glyceryl polyacrylate	6.00
Betaine	2.00
Heat Phase A to 80°C under medium stirring, then apply high shear until a rich glossy emulsion has formed.	
Cool with stirring to 45°C	
PHASE C	
Water	5.00
Hyaluronic Acid 98%	0.10
Premix Phase C and add to the batch	
PHASE D	
Triethanolamine	0.13
Mix until homogenous and pH = 6.0 – 6.5	
PHASE E	
Totarol™ T 9	2.00
Dipotassium glycyrrhizinate	0.10
Preservative	QS
Fragrance (Parfum)	QS
GHK Copper Tripeptide	0.20
Add Phase E one ingredient at a time with constant stirring. Stir until Room temperature	
	100.00

FRAME FORMULATION

TOTAROL™ ANTI-WRINKLE CREAM

The combination of Totarol™ providing anti-inflammatory, microbiome balancing, anti-oxidation and anti-aging properties with SepiControl A5, which is an Aminovector™ solution which combines glycine and cinnamon bark extract which has astringent properties. This Anti-Acne Cream with non-comedogenic lipids restores the balance to acne-prone oily skin by reducing the number of blackheads and the sebum level.

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NAME	%WT
PHASE A	
Eumulium Mellifera	4.00
Brassica alcohols	2.00
Neossance Squalane	3.00
Argan Oil	2.00
Hemp Seed Oil	2.00
Safflower Seed Oil	5.00
Tocopherol acetate	0.50
Heat Phase A to 70°C under medium stirring	
PHASE B	
Water	To 100%
Glycerine	3.00
Xanthan Gum (and) sclerotium gum	0.30
Allantoin	0.20
Niacinamide	0.50
Allantoin	0.10
Heat Phase A to 70°C under medium stirring, then apply high shear until a rich glossy emulsion has formed.	
Cool with stirring to 35°C	
PHASE C	
SepiControl A5	4.00
Add Phase C to the batch with constant stirring	
PHASE D	
Triethanolamine	0.13
Mix until homogenous and pH = 6.0 – 6.5	
PHASE E	
Totarol™ T 9	2.00
Preservative	QS
Add Phase D one ingredient at a time with constant stirring. Stir until Room temperature	
	100.00

FRAME FORMULATION

TOTAROL™ MASSAGE GEL

Gel-to-oil transformation in a translucent O/W emulsion with rinse off effect. Totarol™ to balance the microbiome and provide anti-oxidant effect with a high content of natural Vitamin E to protect skin and product. Natural content cn: 54.1%, Natural origin content cno: 100% (incl. water, ISO 16128)

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NAME	%WT
PHASE A	
Glycerine	15.00
TEGO Care PBS 6 MB	2.00
Heat Phase A to 78°C under medium stirring	
PHASE B	
Tegosoft DC MB	28.15
Sunflower Seed Oil	To 100%
Mango Butter	1.00
Seabuckthorn Oil	0.10
Dermosoft GMCY MB	0.50
Tocopherol	1.00
Fragrance (Parfum)	QS
Heat Phase B to 60°C, then emulsify Phase B into Phase A with high shear mixing until homogenous	
PHASE C	
Totarol™ T 9	0.1 – 0.5
Water	1.50
Add Phase C under constant stirring until cooled.	
	100.00

FRAME FORMULATION

TOTAROL™ MUSCLE & JOINT BALSAM

This balsam contains several soothing ingredients for relief from itching, muscle & joint pain, and help to unclog your sinuses. Totarol™ provides microbiome balancing, anti-inflammatory and anti-oxidant performance.

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NAME	%WT
PHASE A	
Vegojelly 7036 Plus	To 100%
Beeswax	1.00
Hydrogenated Castor Oil	1.00
Glyceryl monostearate	0.50
Brassica Alcohols	0.50
Heat Phase A to 75°C under medium stirring	
PHASE B	
Olive Oil	6.00
Camphor crystals	6.00
Peppermint Oil	4.00
L-Menthol flakes	6.00
Methyl salicylate	6.00
Tocopherol	1.00
Fragrance (Parfum)	QS
Add Phase B one ingredient at a time with constant stirring. Stir until temperature is 35C	
PHASE C	
Totarol™ T 9	1.00
Add Phase C under constant stirring until homogenous	
	100.00

FRAME FORMULATION

TOTAROL™ ROSACEA BALM

For a homogeneous complexion, without blemishes, and extreme comfort, whether it is a matter of flushing or rosacea, it is now possible to keep inflammation and redness under control on a daily basis thanks to this balm with a rich, non-sticky texture. Enriched with Totarol™ to balance the microbiome and REDYLESS® , an active ingredient with a unique mechanism acting upstream and downstream of neuronal inflammation and redness.

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NAME	%WT
PHASE A	
Olivem 1000	5.00
Olivem VS Feel	1.50
Octyldodecanol	2.00
Dicaprylyl carbonate	4.00
Caprylyl methicone	3.00
Stearyl methicone	3.00
Coco caprylate	3.00
Cetyl palmitate	2.00
Shea Butter	5.00
Heat Phase A to 70°C under medium stirring	
PHASE B	
Water	To 100%
Glycerine	2.50
Carbomer	0.15
Heat Phase A to 70°C under medium stirring, then apply high shear until a rich glossy emulsion has formed. *Cool with stirring to 40°C*	
PHASE C	
Phase C	5.00
Titanium Dioxide (and) Mica	2.00
Totarol™ T 9	2.00
Redyless (Propanediol (and) Water (and) Piperonyl glucoside)	2.00
Methyl salicylate	6.00
Preservative	QS
Fragrance (Parfum)	QS
Add Phase B one ingredient at a time with constant stirring. Stir until temperature is 35C	
PHASE D	
Sodium Hydroxide 20% Solution	QS
Add Phase D under constant stirring, and adjust pH to 6.80 – 7.20	
	100.00

FRAME FORMULATION

TOTAROL™ TOOTHPASTE

- The liquid base is prepared first - water, sorbitol/glycerin and other liquid ingredients.
- Rheology modifiers may be pre-mixed with a non-aqueous liquid ingredient such as glycerin or the flavoring oil, or dry blended with other powdered ingredients to aid dispersion.
- The active ingredient, sweetener and preservative are added and dispersed.
- The abrasive/filler is then added. This may be supplied as a slurry, or premixed with part of the water prior to blending with the liquid base.
- Flavoring and coloring are added.
- The detergent is added last under slow speed agitation to minimize foaming. It is typically in solid form to avoid adding water to the formulation at this stage.

NAME	%WT
PHASE A	
Water	8.1
Glycerine	40
Xathan Gum	0.1
Carrageenan	0.5
Betafin BP20	4
Xylitol	4
Sispernat 22S (Hydrated Silica)	13
Calcium carbonate	25
Spearmint oil	0.2
Peppermint oil	0.2
Fennel oil sweet	0.2
Menthol crystals	0.2
Totarol™ T 8	1.5
Plantacare 810UP	3
	100.00

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