TEGO® Turmerone

The golden spice of India

- Has significant anti-oxidant activity
- Induces endogenous cellular defence mechanisms against oxidative stress
- Decreases wrinkle depth
- Is ideal for the improvement of skin radiance and evenness of skin tone
- Is the purified Turmeric Oil with improved color and odor without affecting efficacy
- Environmentally friendly supercritical CO_2 extraction process (solvent-free)
- Contains at least 65% of Turmerones
- Usage level: 0.1 – 1%

Personal Care

INCI Name (PCPC name)

Curcuma Longa (Turmeric) Root Extract

Chemical and physical properties (not part of specifications)

Form	Pale orange to yellow oily liquid with characteristic odor
Active matter	min. 65% of Turmerones

Turmeric (*Curcuma longa*) is a plant of the ginger family named Zingiberaceae which is native of South Asia. Turmeric powder, with typical deep orange-yellow colour, is extensively used as a spice in curries and Indian cuisine. In India, the biggest producer of turmeric, it is also known since ancient times for its cosmetic and wound healing properties. Traditionally, turmeric paste was applied to the bride before marriage in some regions of India to give glow to the skin and to keep harmful bacteria away from the body. In the Ayurvedic medicine, turmeric is thought to have many medicinal properties.

TEGO® Turmerone is the distilled fraction of turmeric oil that is extracted from the root of *Curcuma longa* by supercritical carbon dioxide. This solvent-free extraction process has a low environmental impact. *Curcuma longa* yields to 4-5% of turmeric oil whose main constituents are turmerones (approx. 60%, Figure 1). Molecular distillation as a second main step improves the colour of the oil (from brown to light yellow), enriches the turmerones, removes the undesired curcumins and reduces the strong odour without altering the efficacy of the product.

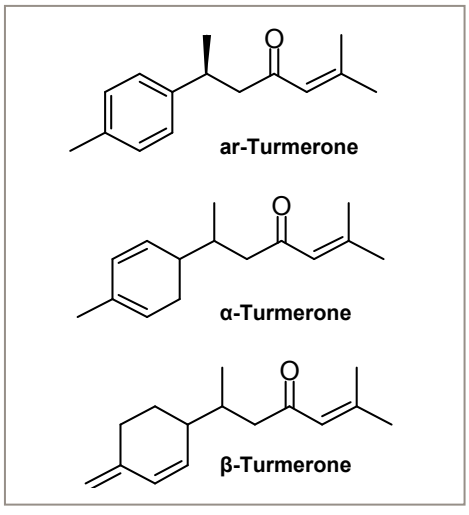

Figure 1: Chemical structures of ar-Turmerone, α-Turmerone and β-Turmerone

Properties

- ***In vitro* evaluation of intrinsic anti-oxidant activity of TEGO® Turmerone**

The anti-oxidant activity is measured by the inhibition of the coupled autoxidation of linoleic acid and ß-carotene as compared with a negative control (methanol). The bleaching of ß-carotene is monitored photometrical at 470 nm for 1h. The gradient of the curves between 20 and 40 min is calculated.

The anti-oxidant activity (AOA) is the percentage of inhibition of ß-carotene bleaching relative to the negative control.

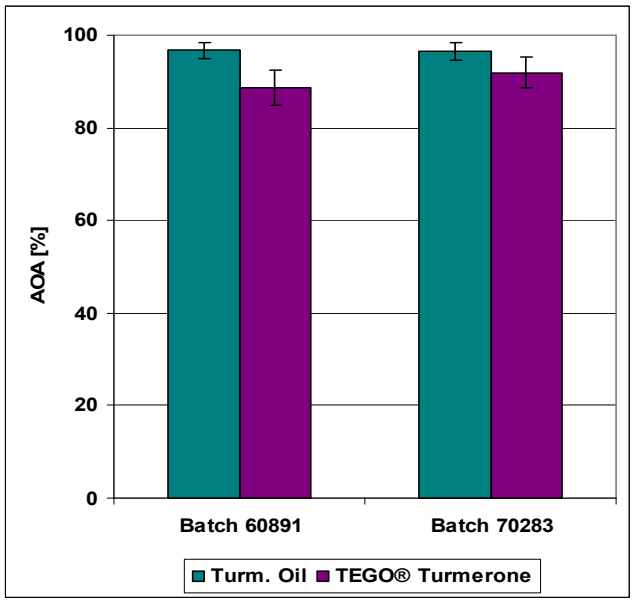

Figure 2: Anti-oxidant activity of TEGO® Turmerone

The anti-oxidant activity of TEGO® Turmerone inhibits the oxidation of ß-carotene by approximately 90%. The test confirmed as well that the distillation does not influence the product's efficacy (Figure 2).

- **Evaluation of the activity of TEGO® Turmerone on cellular anti-oxidant system on skin model**

Reactive oxygen species (ROS) play a significant role in skin aging. This includes oxidation of cellular macromolecules such as DNA, and peroxidation of membrane lipids that results in dysfunction of the cellular integrity, in chromosomal damage and, therefore, in mutagenesis and sometimes apoptosis. In order to counteract these detrimental effects of ROS, the cell possesses a variety of anti-oxidative mechanisms mainly based on enzymatic systems. Among these are catalase (CAT), thioredoxin reductase (TXNRD1), glutathione peroxidase (GPX1) and NAD(P)H dehydrogenase, quinone 1 (NQO1). Whereas catalase is able to directly eliminate the ROS hydrogen peroxide (H_2O_2) by catalyzing its decomposition to water and oxygen, thioredoxin reductase and glutathione peroxidase generate ROS scavengers called thioredoxin and glutathione. Both of these ROS scavengers possess highly reactive SH-groups that are able to neutralize ROS. Generation of

thioredoxin and glutathione requires NAD(P)H that is provided by NAD(P)H dehydrogenase.

Another source of ROS is the reaction of photosensitizers with UV irradiation. The reaction of ROS with membrane lipids and DNA provides not only direct cytotoxic effects, but also induces melanogenesis through diverse intermediates.

Method: The study was performed at the University of Regensburg (D). The objective was to investigate the effects of 0.5% TEGO® Turmerone on UV-B irradiated skin. For this purpose untreated and TEGO® Turmerone treated reconstructed human skin (SkinEthic skin models) were irradiated with 350 mJ/cm² UV-B. Cells were harvested, lysed and RNA samples were isolated 12 hrs after irradiation.

DNA-Chip technique was used to evaluate the effect of TEGO® Turmerone on irradiated reconstituted human skin on the molecular level. Quantitative RT-PCR was carried out in order to verify the expression levels of selected upregulated genes.

Results: Most prominent expression for TEGO® Turmerone was found for genes involved in the cellular oxidative stress response. Among these genes were thioredoxin reductase (TXRDN1), catalase (CAT), glutathione peroxidase (GPX1) as well as NAD(P)H dehydrogenase, quinone 1 (NQO1). As presented in Figure 3 up regulation of these genes could be confirmed by quantitative RT-PCR.

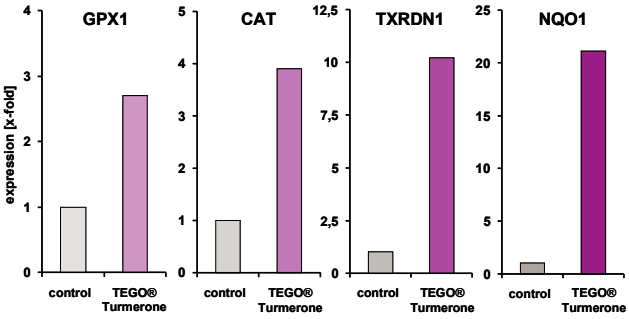

Figure 3: RT-PCR measurements of upregulated genes

These results confirmed that TEGO® Turmerone increases the components of the body's inherent anti-oxidative systems. TEGO® Turmerone triggers cellular radical defense mechanisms against oxidative stress.

- **Skin penetration analysis of TEGO® Turmerone**

In order to have the optimal performance, it is important that the active ingredient reaches the proper site of action. The bioavailability of the active ingredient is investigated by a dermal absorption assay based on porcine skin.

Method: Prior to the study the integrity of the used porcine skin was verified by both the measurement of the transepidermal water loss (TEWL), and caffeine penetration.

A skin layer of defined thickness, 1000 µm, was cut off with a dermatome (containing the stratum corneum, epidermis, and a part of the dermis). The skin samples were mounted onto Franz' diffusion cells with the epidermis side up. The dermis side is completely covered with the receptor medium (PBS buffer, pH 7,0) Afterwards approx. 20 – 40 mg/cm² of the test formulation were applied on the skin and spread evenly by rubbing the formulation on the skin. The diffusion cells were placed in a climatic chamber (32 °C, 50% relative humidity). During the experiment a receptor medium is stirred with a magnetic stirrer at 300 rpm.

After 24 ± 1 hours the residual test formulation on the porcine skin is rinsed off with a Q-tip, and the skin samples are cut into small pieces for extraction overnight. Finally, the amount of TEGO® Turmerone in the receptor medium, the rinse-off medium, and the skin extract was analysed by HPLC.

Result:

The bioavailability of TEGO® Turmerone in porcine skin has been shown to be between 4-24% (Figure 4). The degree of bioavailability depends on the polarity of the formulation. In the presence of polar emollients the uptake of TEGO® Turmerone was the best. This result is in line with the theoretical logP value of 4.5.

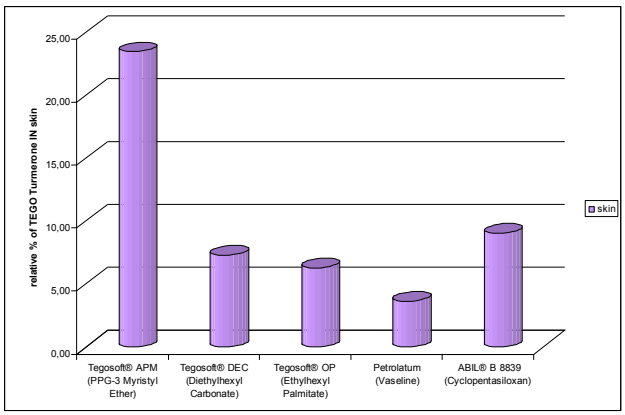

Figure 4: Bioavailability of TEGO® Turmerone

- ***In vivo* evaluation of TEGO® Turmerone**

Method: For this study 30 volunteers were recruited. 15 volunteers received a test formulation with 0.5% TEGO® Turmerone, 15 received the formulation without active ingredient (vehicle). They applied the test formulation twice daily over a period of 8 weeks on the left inner forearm.

The measurement was carried out before the treatment started and after 8 weeks of application. Prior to each measurement the volunteers had to acclimatize for at least 15 min at room temperature and 50% relative humidity.

For the evaluation of the skin tone a special camera (Visioscan VC 98, Courage & Khazaka, Cologne, D) was used. Via the grey level distribution the software calculates different texture parameters. These

texture parameters are related to colour differences of neighbouring pixels and reflect the skin tone.

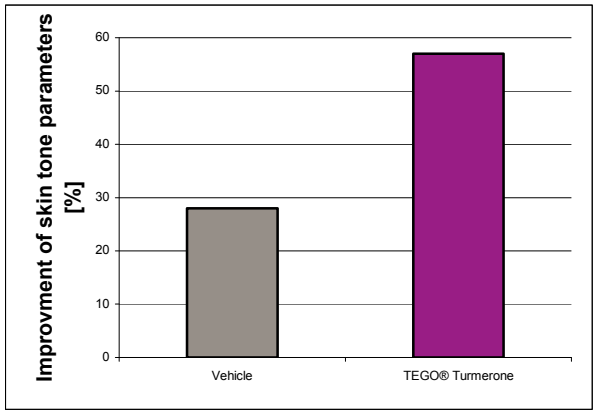

Figure 5: **Improvement of skin tone parameters**

Results: Figure 5 shows the improvement of the total of the skin tone parameters. The application of a formulation with 0.5% TEGO® Turmerone increases the skin tone by approximately 30% in comparison to vehicle. It could be demonstrated by this *in vivo* evaluation that TEGO® Turmerone leads to more even skin tone and improved radiance of the skin as shown in figure 6. The skin looks younger and healthier.

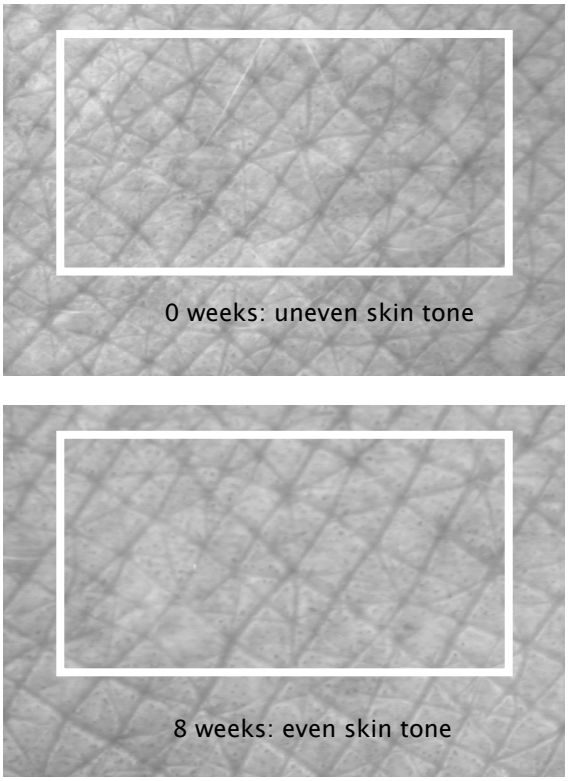

Figure 6: **The skin before and after treatment with TEGO® Turmerone**

Further *in vivo* data on skin moisturization and anti-wrinkles benefits are available on request.

Preparation

Preparation of O/W emulsion (cream or lotion): The emulsion is prepared in the usual way. TEGO® Turmerone is added during the cooling process at temperature below 40 °C.

Preparation of W/O emulsion (cream or lotion): The emulsion is prepared in the usual way. TEGO® Turmerone is added prior to homogenisation.

Recommended usage concentration

0.1 – 1.0% of TEGO® Turmerone

Possible Applications

- Anti-Aging
- Face Care for even skin tone
- Men's Care for dull & tired skin
- Sun Care
- Baby Care

Packaging

1.0 kg packaging

4.0 kg packaging

Hazardous goods classification

Information concerning

- classification and labelling according to regulations for transport and for dangerous substances
- protective measures for storage and handling
- measures in accidents and fires
- toxicity and ecological effects

is given in our material safety data sheets.

Guide Line Formulations

Anti-aging cell protection body lotion MAC 546/3/18	
Phase A	
TEGOSOFT® OS (Ethylhexyl Stearate)	6.5%
TEGOSOFT® DO (Decyl Oleate)	5.7%
TEGIN® 4100 Pellets (Glyceryl Stearate)	0.5%
Stearic Acid	0.7%
Phase B	
TEGO® Care CG 90 (Cetearyl Glucoside)	1.0%
TEGO® Cosmo C 100 (Creatine)	0.5%
Glycerin	3.0%
Water	79.9%
Phase C	
TEGO® Carbomer 141 (Carbomer)	0.2%
TEGOSOFT® OS (Ethylhexyl Stearate)	0.8%
Phase D	
TEGO® Turmerone (Curcuma Longa (Turmeric) Root Extract)	0.5%
Sodium Hydroxide (10% in water)	0.7%
Phase Z	
Preservative, parfum	q.s.

Preparation:

1. Heat phase A and B to approx. 80 °C.
2. Add phase A to phase B while stirring.[1)]
3. Homogenise.
4. Cool with gentle stirring to approx. 60 °C and add phase C.
5. Homogenise for a short time.
6. Cool with gentle stirring and add phase D below 40 °C.

[1)] Important: If phase A has to be charged into the vessel first, phase B must be added without stirring.

Men's Care for even skin tone MK 4/08-1	
Phase A	
TEGO® Care 450 (Polyglyceryl-3 Methylglucose Distearate)	3.0%
TEGIN® M Pellets (Glyceryl Stearate)	2.0%
TEGO® Alkanol 18 (Stearyl Alcohol)	2.0%
TEGOSOFT® CT (Caprylic/Capric Triglyceride)	7.5%
TEGOSOFT® DC (Decyl Cocoate)	9.5%
Avocado (Persea Gratissima) Oil	2.0%
Phase B	
Water	70.0%
Glycerin	3.0%
Phase C	
TEGO® Turmerone (Curcuma Longa (Turmeric) Root Extract)	0.5 %
Preservative, parfum	q.s.

Preparation:

1. Heat phase A to approx. 80°C.
2. Add phase B (room temperature) slowly to phase A while stirring.
3. Add phase C while stirring.
4. Homogenise for a short time (1200 min^{-1}, 2 min).
4. Cool with gentle stirring below 30°C and homogenise again.

Evonik Industries AG Goldschmidtstraße 100 45127 Essen, Germany
P.O. BOX 45116 Essen PHONE +49 201 173-2854 FAX +49 201 173-1828
personal-care@evonik.com www.evonik.com/personal-care

EVONIK INDUSTRIES