GROUP
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Good Quality Comes
From Qualified Materials

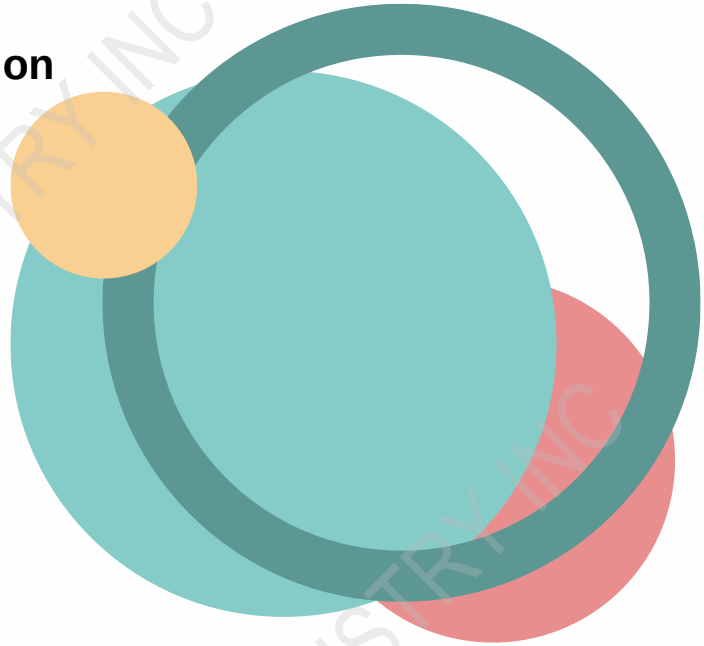
Superoxide Dismutase

---SpecKare® SOD Series

Spec-Chem Group

Nov., 2024

Content



01 What is SOD

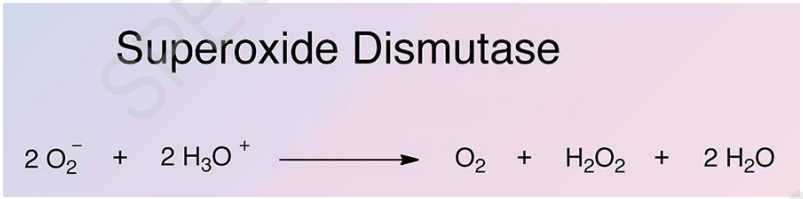
Orgotein Superoxide Dismutase ,

Alias liver protein, abbreviated as: SOD,

International classification number: EC 1.15.1.1

SOD is an active substance derived from organisms (bacteria, fungi, algae, plants, protozoa, insects, fish and mammals, etc.) that can eliminate harmful substances produced by organisms during metabolism.

01 Origin of SOD



More than 80 years of research history

- In 1938, Mam and Keilin first isolated a blue copper-containing protein from bovine red blood cells and named it Erythrocuprein, but its physiological function has not been clearly studied.
- In 1969 , Fridovich, McCord and etc. rediscovered this protein and discovered its biological activity. It can catalyze the dismutation reaction of superoxide anions. Based on the characteristics of its enzyme-catalyzed reaction, it was officially named Superoxide dismutase.

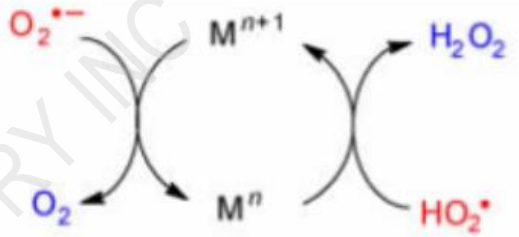
01 SOD Classification

Superoxide dismutase is a type of metalloenzyme, which can be divided into three types according to the different metal cofactors it contains:

- The first type contains copper and zinc, called copper-zinc superoxide dismutase (Cu.Zn-SOD) , which is blue-green and mainly exists in the cytoplasm of eukaryotic cells;
- The second type contains manganese, called manganese superoxide dismutase (Mn-SOD) , which is purple and mainly exists in the matrix of prokaryotic cells and eukaryotic cells (such as mitochondria, etc.);
- The third type contains iron, called iron-containing superoxide dismutase (Fe-SOD) , which is yellow-brown and mainly exists in prokaryotic cells and a few plant cells.
- Scientists have discovered two new SODs, one is a nickel-containing enzyme, Ni-SOD, and the other is an enzyme containing iron and zinc, Fe/Zn-SOD. All are tetramers.

01 SOD Reaction Mechanism

- The catalytic action of SOD is achieved through the alternating electron gain and loss of metal ions M^{n+1} (oxidized state) and M^{n} (reduced state).



- It is generally believed that superoxide anion radicals ($(O_2^{\bullet-})$) first form an internal complex with metal ions, and M^{n+1} is reduced to M^{n} by superoxide anion radicals in the body, generating O_2 at the same time . M^{n} is then oxidized to M^{n+1} by $HO_2\cdot$, generating H_2O_2 at the same time. SOD is then oxidized to the initial oxidation state of SOD. Finally, H_2O_2 is catalytically decomposed into water (H_2O) and O_2 under the action of catalase.

01 SOD Preparation Method

1. Animal extraction:

- Extracted from the blood, liver and brain of animals such as cattle, sheep and pigs, mainly CuZn-SOD and a small amount of Mn-SOD .
- Prone to virus cross infection (Since 1997, the European Union has banned the use of animal SOD), the unit activity is low and it is not easy to preserve at room temperature and in aqueous solution.

2. Plant extraction:

- Chemical extraction
- SOD obtained is not a single component, and it is difficult to achieve a high level of purity and activity.

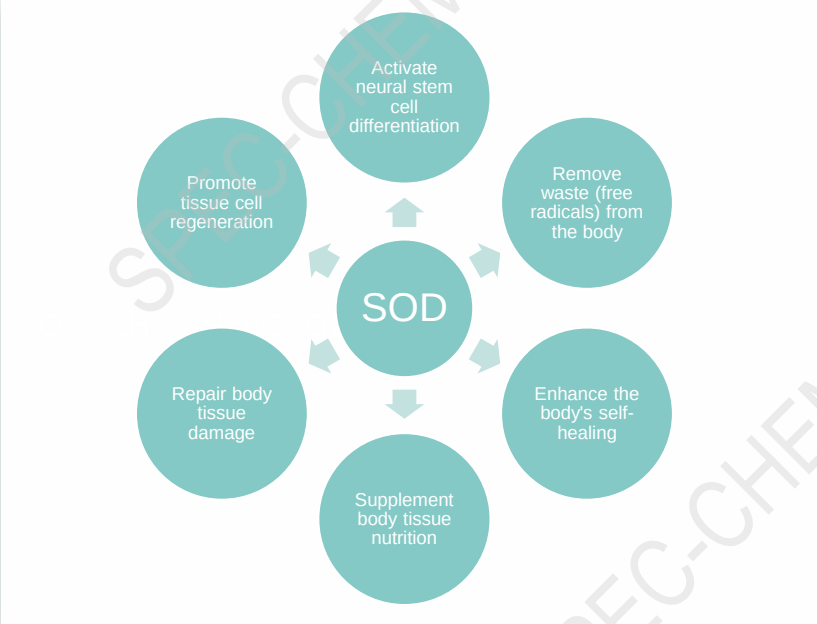
3. Microbial fermentation:

- Select SOD high-yield strains for fermentation production, which has high yield and simple extraction process.
- Since the source of SOD is limited, the immunogenicity of foreign proteins is unstable due to factors such as temperature and pH.

4. Genetic engineering method:

- Microbial genetic engineering: the total RNA of human fetal liver tissue or human liver cell line (L02) are used as templates and SOD is obtained by RT-PCR.

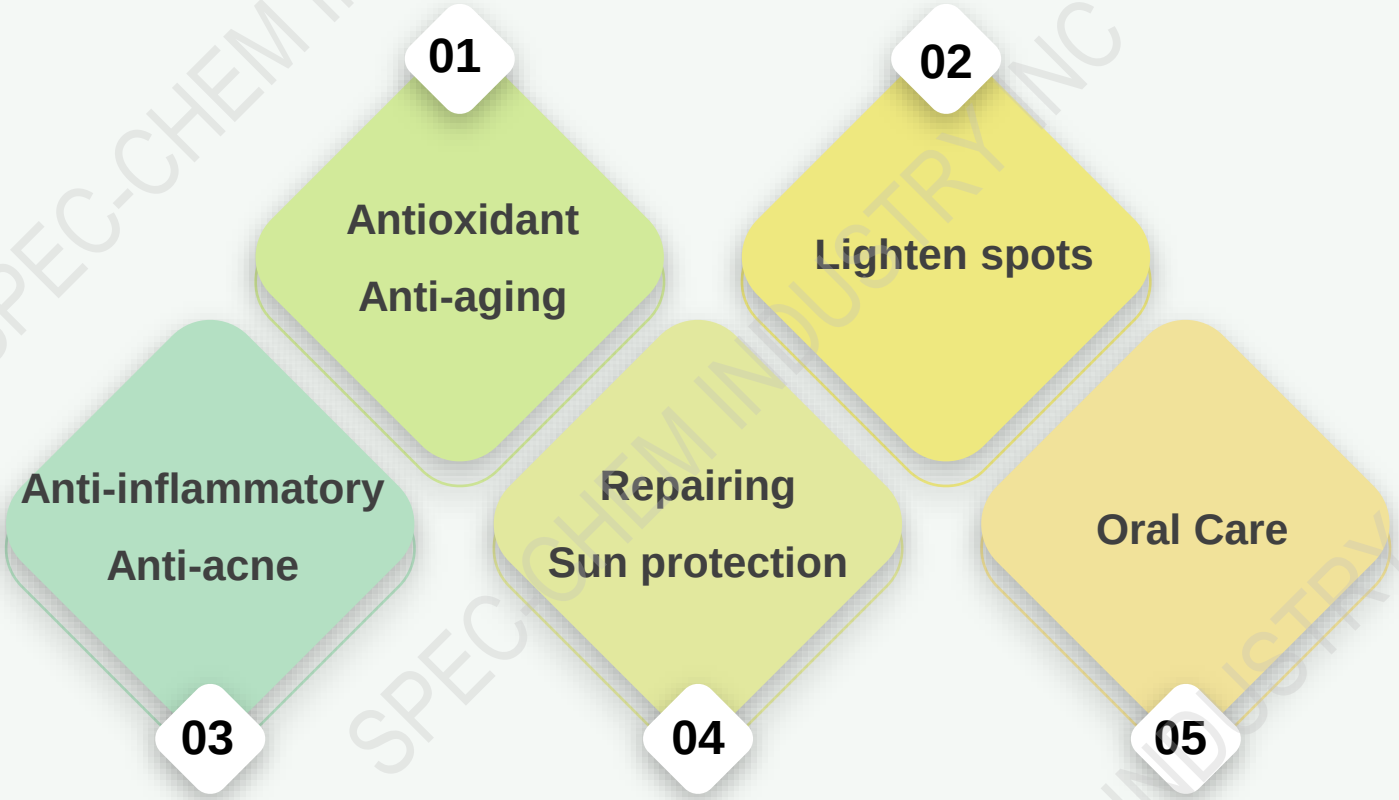
01 SOD Effects



- ✓ Free radicals are normal metabolic products in organisms. However, the accumulation of free radicals will cause lipid peroxidation in cell membranes and cause membrane fission, leading to cell damage or even death.
- ✓ SOD is the most important and best free radical scavenger in the body, maintaining the body's metabolic balance.

01 SOD Application Areas

01 SOD in Daily Care Field



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02 SpecKare® SOD Series-Product info

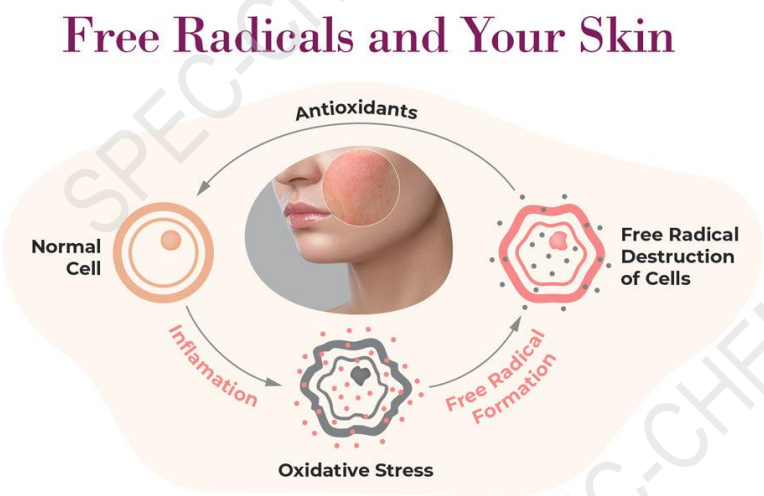
Product Name	SpecKare® SOD1
Product No.	12005501
INCI name	Water, Glycerin, Mannitol, Trehalose, Superoxide Dismutase, 1,2-Hexanediol, Hydroxyacetophenone
Appearance	Colorless to light blue transparent liquid
Active	≥ 10000 IU/ml
Origin	Fermentation
Recommended Dosage	0.5 - 20%
Usage	Water soluble. Add in the post-production stage.

Product Name	SpecKare® SOD
Product No.	12005500
INCI name	Superoxide Dismutase, Maltodextrin
Appearance	Light yellow powder
Enzyme activity	≥ 8000 U/g
Origin	Plant Extracts
Recommended Dosage	0.1 - 1.0%
Usage	Water soluble. Add in the post-production stage.

02 Factors that cause free radicals

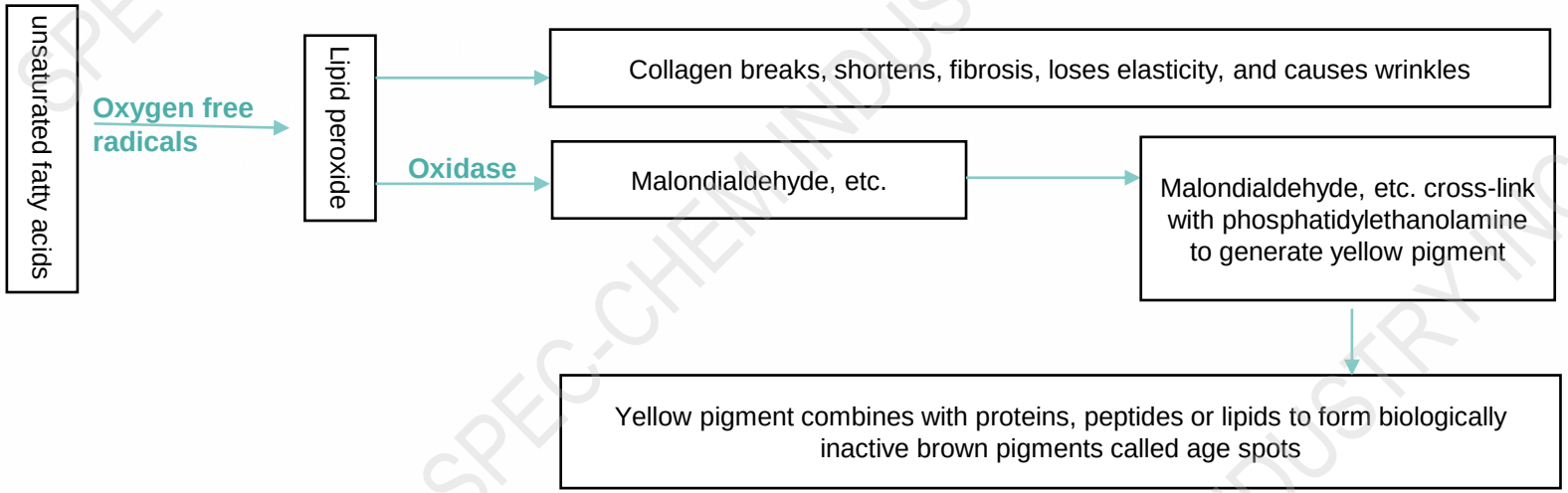
- Free radicals are the source of toxic substances produced by the human body. They are killers of human health and are highly destructive.
- Excessive accumulation of free radicals in the human body will accelerate cell aging, reduce the body's immunity, and cause a variety of diseases.

02 Oxidative Damage to the Skin



02 SOD - Antioxidant

SOD can effectively remove superoxide anions in the body, prevent lipid peroxidation, and inhibit the formation of lipofuscin.



02 SOD - Antioxidant

SpecKare® SOD - Anti-oxidant ability *(human immortalized keratinocytes)*

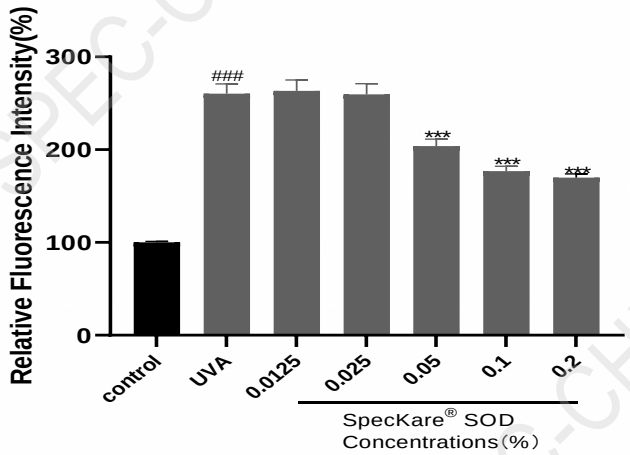


Fig.1 Effects on the relative fluorescence intensity of ROS

(###p<0.001 vs control, ***p<0.001 vs UVA)

Test results:

- After UVA stimulation, a large number of intracellular ROS accumulated in a short time and oxidative stress damage occurred.
- The inhibition rate of 0.2% SpecKare® SOD on ROS was ***34.8%***.
- SpecKare® SOD can significantly ***inhibit ROS accumulation*** after UVA irradiation, and has the effect of anti-oxidant.

02 SOD - Anti-aging

The activity of SOD in erythrocytes of different ages

Age Group	Number of people tested	SOD activity in erythrocytes (U/gHb)
0-14	615	1914±462
15-44	3865	1667±451
45-64	1397	1487±392
65-94	541	1259±452

SOD content with age:

I. The SOD activity of various organs in the body decreases
II. Increased free radical production in the body
III. SOD is consumed or destroyed
IV. Decline in the activity of SOD synthesis in senescent cells
V. ….

02 SOD - Anti-aging

Two levels of anti-aging:

- **The first** is to remove, to remove excess free radicals to the greatest extent possible, and reduce oxygen free radicals into water .
- **The second** is to correct errors and correct the aging damage caused by free radicals.

The anti-aging effect of SOD not only makes you look younger on the surface, but more importantly, it can keep your body functions young as well, avoiding degenerative diseases that are easily formed during the aging process, such as lumbar disc herniation, osteoporosis, joint swelling and pain, etc.

02 SOD - Lighten Spots

Inhibition effect on tyrosinase activity and melanogenesis in melanocytes

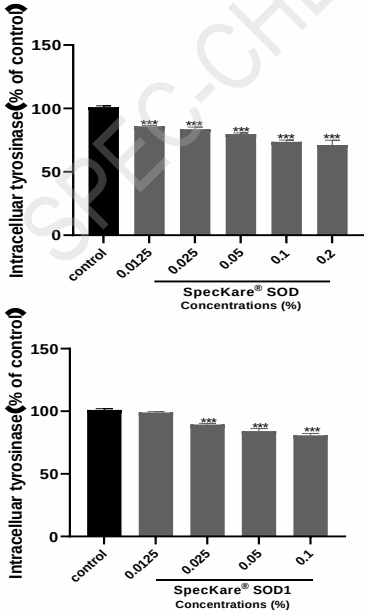


Fig.1 Activity of tyrosinase
(***p<0.001 vs. control)

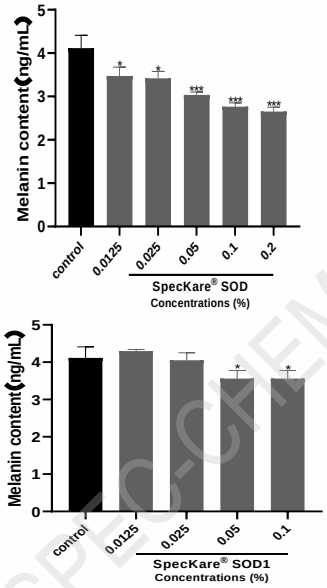


Fig.2 Intracellular melanin content
(*p < 0.05 vs. control)

Test results:

- Both SpecKare® SOD and SpecKare® SOD1 can inhibit the activity of tyrosinase and melanin content in melanocytes. And the inhibition effects were dose-dependent.
- 0.2% SpecKare® SOD: the inhibition rate of tyrosinase activity is 28.9%, and the inhibition rate of melanin generation is 35.7%.
- 0.1% SpecKare® SOD1: the inhibition rate of tyrosinase activity is 19.2%, and the inhibition rate of melanin generation is 20.1%.

02 SOD - Lighten Spots

SOD inhibition on the conversion of DOPA into DOPA red by tyrosinase

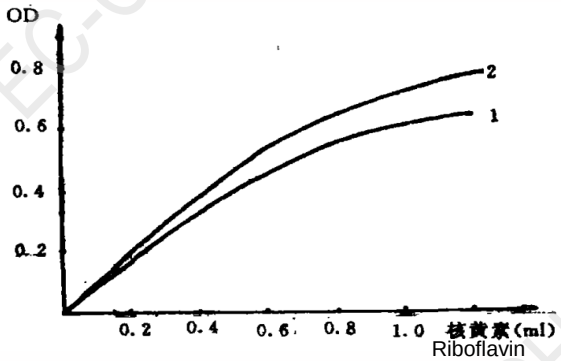


Fig.1 (1) SOD Suppression curve
(2) Interference curve of tyrosinase on SOD activity

The results show that:

- SOD has a significant inhibitory effect on tyrosinase-catalyzed production of DOPA red by DOPA.
- This is because SOD removes the oxygen free radicals that trigger DOPA to ultimately produce melanin.

The Respective Activities of Coexisted SOD and Tyrosinase –Gao Xiurui

02 SOD - Lighten Spots

Japan conducted a SOD test on 10 women with pigmentation

No.	Age	Site	Case	Usage period	Effects	Side effects
1	33	Cheeks	Appeared about 8 years ago, darker in summer	6 months	Partial lightening of pigmentation	None
2	26	Near eyes	Appeared about 6 months ago	2 months	Pigmentation basically disappeared	None
3	28	Oral lip	Appeared about 1 year ago	1 month	Total loss of pigmentation	None
4	44	Jaw	Appeared about 5 years ago, darker in summer	1 month	Partially lightened	None
5	27	Jaw, Near eyes	Appeared about 1 year ago	2 months	All faded	None
6	38	Cheeks	Appeared about 8 years ago, darker in summer	1 month	All faded, but with residual marks	None
7	39	Cheeks	Appeared about 1 year ago	2 months	Mostly gone	None
8	41	Oral lip, Jaw	Appeared about 4 years ago, darker in summer	3 months	Partially disappeared	None
9	23	Oral lip, Jaw	Appeared about 6 months ago	2 weeks	All faded	None
10	26	Jaw	Appeared about 8 months ago	3 weeks	Almost disappeared	None

- The results showed that SOD had an **inhibitory effect** on pigment formation and precipitation.

02 SOD – Anti-inflammation & anti-acne

SpecKare® SOD - Anti-inflammatory activity *(macrophage cell line RAW264.7)*

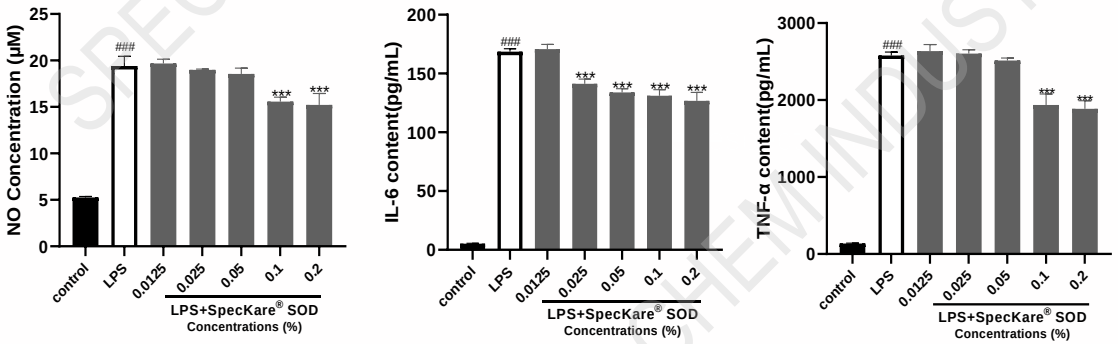


Fig. The effects of different concentrations of SpecKare® SOD on release of NO, IL-6 and TNF-a

Test results:

- The inhibitory rate of 0.2% SpecKare® SOD for NO, IL-6 and TNF-a were 21.6%, 24.8% and 26.8%, respectively.
- SpecKare® SOD has a good anti-inflammatory effect.

02 SOD – Anti-inflammation & anti-acne

Compound with SOD as main ingredient: therapeutic effect on patients with acne

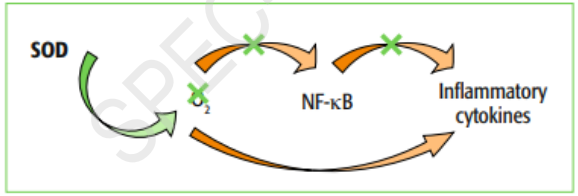


Figure 4 Anti-inflammatory action of SOD

Grading	Case Number	Cured		Improved		Effective		Ineffective	
		Number	%	Number	%	Number	%	Number	%
Mild	60	49	81.7	9	15.0	58	96.7	2	3.3
Moderate	80	62	77.5	15	18.7	77	96.2	3	3.8
Severe	40	31	77.5	7	17.5	38	95.0	2	5.0

- In the vast majority of patients, the erythra subsided significantly and the pigmented spots became lighter after using the drug.
- Especially in patients with severe infections and scar formation, the scar subsided and the skin was fine after adhering to the drug, and only a few cases had new rashes appearing after discontinuing the drug.

1) The role of superoxide dismutase (SOD) in skin disorders A review, March 2014Nutrafoods 13(1)

2) “Observation on the Clinical Efficacy of Superoxide Dismutase Compound in the Treatment of Acne " by Fan Xueyun

02 SOD - Oral Care

Clinical observation on the therapeutic effect of SOD superoxide dismutase mouthwash

Table 1 Gingivitis treatment results

Group	Case Number	Significant (%)	Effective (%)	Poor (%)
Test	50	32 (64)	16 (32)	2 (4)
Control	50	15 (30)	14 (28)	21 (42)

Table 2 Periodontitis treatment results

Group	Case Number	Significant (%)	Effective (%)	Poor (%)
Test	50	30 (60)	16 (32)	4 (8)
Control	50	14 (28)	16 (32)	20 (40)

Table 3 Oral ulcer treatment results

Group	Case Number	Significant (%)	Effective (%)	Poor (%)
Test	50	28 (56)	18 (36)	4 (8)
Control	50	13 (26)	12 (24)	25 (50)

- The results show that: SOD has the function of **inhibiting** the infiltration of inflammatory cells and **protecting** tissues from invasion by immune complexes, and has **significant therapeutic** effects on gingivitis, periodontitis and oral ulcers.

《 Clinical efficacy observation of SOD superoxide dismutase mouthwash 》 Xu Jing

03 SOD Market Application

[Freshly Cosmetics](#)
Superoxide Dismutase Face Mist

Face treatment for wrinkles, imperfections & uneven skin tone

[Skin Actives Scientific](#)
Anti-aging Hydramist With Ros Bionet And Apocynin

Refreshes and rejuvenates skin throughout the day. Instantly smooths fine lines and wrinkles. Reduces the appearance of redness.

03 SOD Market Application

Paula's Choice

Moisture Boost Essential Hydrating Toner

This silky, hydrating toner soothes and renews skin while fighting signs of aging.

Cosmedix

Affirm Antioxidant Firming Serum

Enriched with vitamin E, resveratrol and age-defying biopeptides, Affirm visibly eliminates the appearance of environmental damage and improves the look of photodamaged skin for a firmer and healthier-looking complexion.

03 SpecKare® SOD Series-Product Features

Features:

- No risk of blood virus and cross infection
- Strong heat resistance
- High stability
- High bioavailability

Tips:

- Avoid using ingredients that may cause protein denaturation, such as proteases, strong acids, strong alkalis, strong oxidizing substances (such as formaldehyde), heavy metal salts (such as mercury salts), and high-concentration organic solvents.

THANK YOU

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