[Functional antibacterial products]

High Transparent Antimicrobial Film & Zinc Gluconate Antibacterial Solution

Creation & Innovation

in the Parts & Materials Industry

RPE Corporation

Contents

I. Introduction

(1) Corona pandemic & Antimicrobial Environment Necessity

- ✓ By reducing the risk of infection in every store due to COVID19 pandemic, making antibacterial environment where the customers and employees can contact to ensure the safety of store operations and continuous activities of businesses and customers.

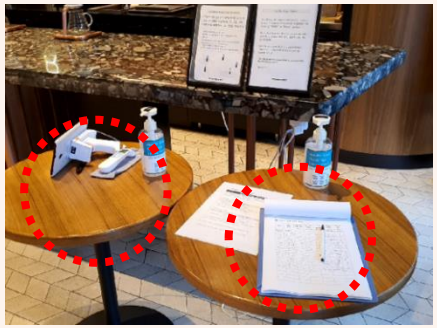
+

- ✓ A Proposal for the Application of Antimicrobial Environment in various Stores
- ✓ Method of proposal implement: High Transparent Antimicrobial Film is attached and installed in the areas and spots where people can contact in the store

I. Introduction

(2) Proposed Antimicrobial Environment

Customer and Employee Contact Environment



✓ Inevitable contact occurs when ordering and delivering products

✓ Bacteria and viruses may persist on the table face

✓ As non-face-to-face sales are preferred, ordering by kiosks significantly increase.

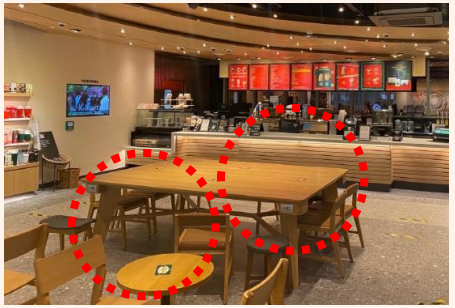
✓ Various kinds of products and services are provided and may by also exposed to bacteria and viruses.

I. Introduction

(2) Proposed Antimicrobial Environment

Contact area/spot and service environment in the store






- ✓ Door handles at the entrance of the store are touched by everyone entering and leaving
- ✓ Residual bacteria and viruses can cause infection by contact others
- ✓ Each tables in the stores can be attached with each others as the customer needs.
- ✓ Bacteria and viruses may move and persist on the table face

II. High Transparent Antimicrobial film

(1) Summary of High Transparent Antimicrobial Film

Features of the proposed product

1) Securing 99.9% surface antibacterial capability

2) High transparent film does not affect the appearance of attachment

→ Does not affect the interior of the store

→ 90% or more Transmittance and 2% or less Haze

3) Hard coating and inner door performance can make the surface strong and not easily contaminated.

→ The hard coating film protects the surface of the table

→ Hardness 3H or higher

4) Made of harmless materials to the human body

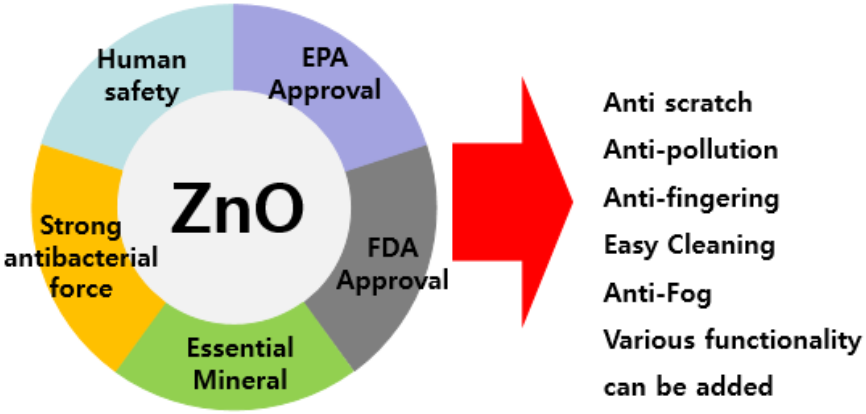
II. High Transparent Antimicrobial film

(2) High Transparent Antimicrobial Film Overview

▣ 99.9% Zinc Oxide Safe for Human Body

- U.S. Environmental Protection Agency (EPA) approved zinc oxide as a safe antimicrobial agent

- The Food and Drug Administration (FDA) recognized zinc oxide as a safe food additive



▣ Additional film functions other than antibacterial functions

Virus protection

Cell phone protection film (with Anti-Fingering)

Easy Cleaning

Transparent divider, table mat, floor mat

Anti-Fingerprint

Attach to various areas where contact is essential

Anti-Fog

Face Shield, Mask

II. High Transparent Antimicrobial film

(2) High Transparent Antimicrobial Film Overview

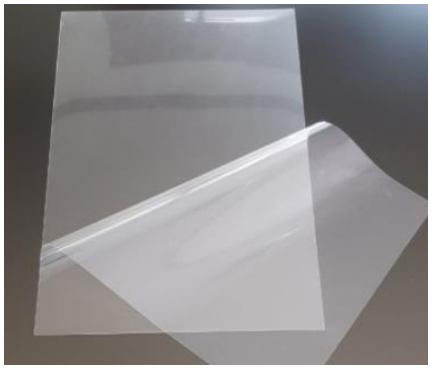
◈ **New Technology in Development Technology**

- 99.99% anti-bacterial capability is certified as a film with hard coating of zinc oxide harmless to human body on PET
- Ag and Cu, which are commonly used, are opaque due to the nature of metals, and are limited in use because there are substances that are harmful to the human body depending on conditions

◈ **Key contents of development technology**

- The appearance of the existing product is translucent, but the antibacterial film of RPE is not only transparent but also the surface strength is high.

Existing Cu Antibacterial Film ➔



Commercial Zn+ Antibacterial Film ➔

New ZnO Antibacterial Film

II. High Transparent Antimicrobial film

(3) Antimicrobial Capability Verification

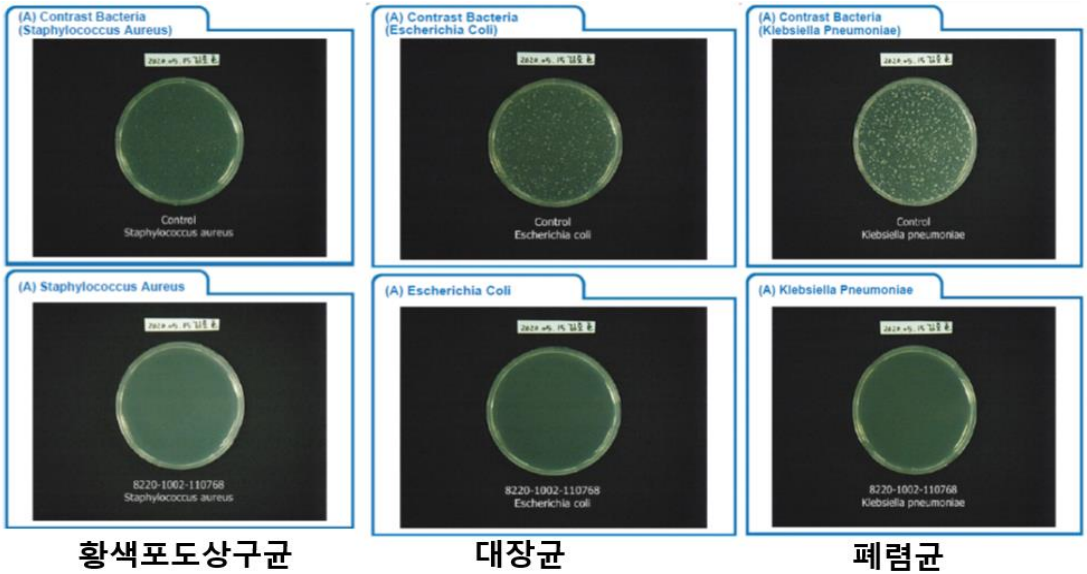
KOTITI

Antibacterial Test, %
(JIS Z 2801:2010)

Test Conducted	Test Results		
(A)	Staphylococcus aureus	Klebsiella pneumoniae	Escherichia coli
Original			
Control Specimen(Inoculated)	5.8×10^5	6.1×10^5	6.1×10^5
Control Specimen(After 24 Hours)	1.8×10^6	6.0×10^6	7.6×10^6
Sample(After 24 Hours)	< 10	< 10	< 10
Antibacterial Activity Value	5.3	5.8	5.9
Reduction(%)	99.9	99.9	99.9

Test Organism Staphylococcus aureus(ATCC 6538P)
Klebsiella pneumoniae(ATCC 4352)
Escherichia coli(ATCC 8739)

Control specimen Polyethylene film



황색포도상구균 대장균 폐렴균

▣ **Same as existing Cu series antibacterial features**
→ Antibacterial activity levels for Staphylococcus aureus, Pneumonia, and E. coli are 5 or higher

▣ **High transparent Antibacterial film**
→ Equivalence of antibacterial ability 5 or more antibacterial activity values for Staphylococcus aureus, Pneumonia, and E. coli (disinfecting more than 99.9%)

▣**Verification agency: KOTITI**
(National Authorized Testing Agency)

II. High Transparent Antimicrobial film

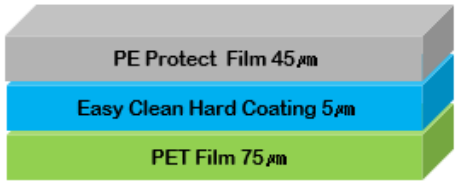
(4) Product and Providing Spec

Anti-Bacterial Hard Coating Film TDS
(Easy Clean)

1. DESCRIPTION

- Excellent hardness
- Excellent slip properties
- Excellent anti-bacterial

2. PRODUCT STRUCTURE



3. PHYSICAL PROPERTY

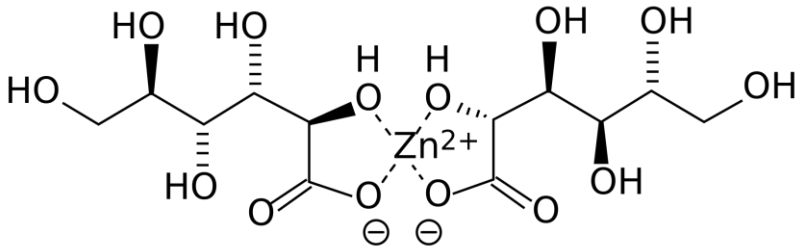
Model Name		REH-B3-75SP	
LIST	Unit	Spec.	NOTE
Hard Coating	㎛	5	KS T-1028
PET Film Thickness	㎛	75	
TOTAL Thickness	㎛	80	
Hardness	H	3H	JIS K 5600-5-4 (RPE METHOD)
Haze	%	2↓	ASTM D 1003
T.T	%	90↑	ASTM D 1003

- Item : Antimicrobial film (+EC)
- Code : REH-B3-75SP
- Base Film : PET 25~250um
- Anti-Bacterial Hard Coating Film (High Transparent)
- Includes Easy Clean performance
- Base Film and adhesion can be changed as requested
- Anti-Fog coating is possible on the back.

III. Zinc Gluconate Antibacterial Solution

(1) Solution overview & Antimicrobial Capability Verification

▣ 4NS Zinc Gluconate Organic/Inorganic Hybrid Antimicrobial Solution



- OH Alcoholics are attached to the function of alcohol hand sanitizer, bacterial protein deformation, and cell wall lipids (same function as alcohol disinfectants on the market)
- Destruction of bacterial cell walls by Zn ions and inhibition of proliferation of coronavirus.
- -99.99% purity or higher due to the development of 4NS method; enhanced solubility prevents precipitation
- Increase usability with sanitizer and sprayer

▣ Zinkgluconate 0.5% Solution Test Results

표 4. 연구 대상자 기본 정보 -요약

전체 연구 대상자 수	31명	
성별	남 : 0명	여 : 31명
평균 연령	48세	

22	0	0	0	0	0	0
23	0.5	0	0	0	0	0
24	0	0	0	0	0	0
25	0	0	0	0	0	0
26	0	0	0	0	0	0
27	0.5	0	0	0	0	0
28	0	0	0	0	0	0
29	0	0	0	0	0	0
30	0	0	0	0	0	0
31	0	0	0	0	0	0
자극 지수	0.038			0.005		
판정	저자극			-		

* 첩포 제거 후 30분에 측정

→ Hypoallergenic Judgment by Korea Institute of Skin Science

시험 항목		시험방법	시험 결과			시험환경
			초기농도 (CFU/mL)	24시간 후 농도 (CFU/mL)	세균감소율 (%)	
항균시험 : 대장균	BLANK	KCL-FIR-1002 :2018	1.9×10^4	8.6×10^5	-	(37.0 ± 0.2) ℃
	BPT-QB00		1.9×10^4	< 10	99.9	
항균시험 : 녹농균	BLANK		2.2×10^4	8.9×10^5	-	
	BPT-QB00		2.2×10^4	< 10	99.9	
항균시험 : 황색포도상구균	BLANK		2.8×10^4	4.1×10^5	-	
	BPT-QB00		2.8×10^4	< 10	99.9	

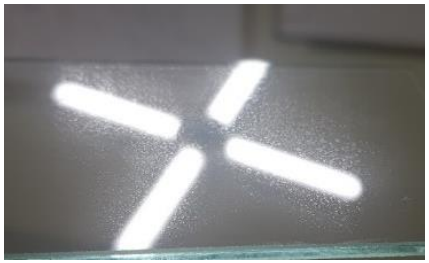
→ KCL Antibacterial Test Results 99.9%

III. Zinc Gluconate Antibacterial Solution

(2) Summary of RPE- Zinc Gluconate solution

- 4NS Zinc Gluconate: 99.99% high purity 4N Zinc Gluconate solution
- Technical summary: High purity Zinc-Gluconate synthesis and aqueous solution dispersal technology suitable for the manufacture of non-depleted full aqueous solutions
- Full aqueous solution that absorbs quickly and leaves no residual
- Anti-aging, antioxidant, skin regeneration, antibacterial, anti-coronavirus, nutritional supplements, etc.
- Does not precipitate for long storage

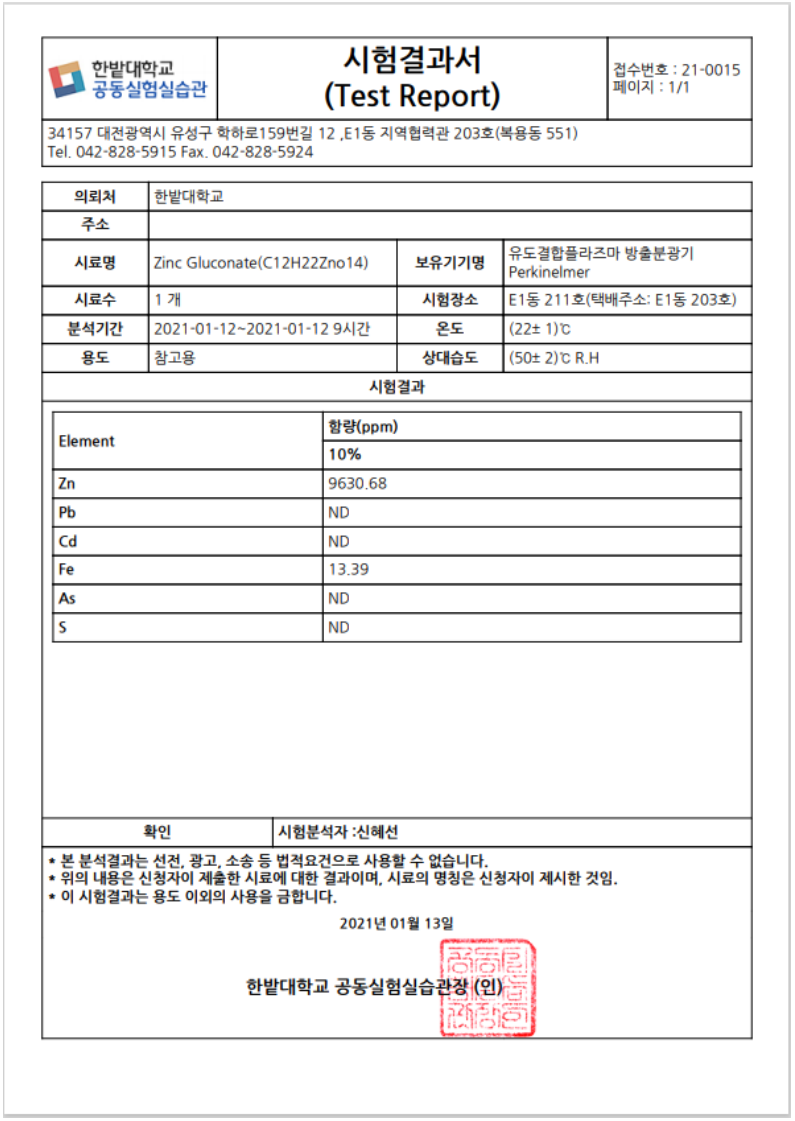
  → Existing aqueous solution will result in solid deposition after 6 months.
- Dry after spraying 0.5% solution on the glass surface: Transparent residual visible



Solution stored for 2 years does not cause of precipitation

III. Zinc Gluconate Antibacterial Solution

(3) Component analysis data ... Zinc Gluconate solution ICP data



한밭대학교 공동실험실습관

시험결과서 (Test Report)

접수번호 : 21-0015
페이지 : 1/1

34157 대전광역시 유성구 학하로159번길 12 ,E1동 지역협력관 203호(복용동 551)
Tel. 042-828-5915 Fax. 042-828-5924

의뢰처	한밭대학교		
주소			
시료명	Zinc Gluconate(C12H22Zno14)	보유기기명	유도결합플라즈마 방출분광기 Perkinelmer
시료수	1 개	시험장소	E1동 211호(택배주소: E1동 203호)
분석기간	2021-01-12~2021-01-12 9시간	온도	(22± 1)℃
용도	참고용	상대습도	(50± 2)℃ R.H

시험결과

Element	함량(ppm)
	10%
Zn	9630.68
Pb	ND
Cd	ND
Fe	13.39
As	ND
S	ND

확인	시험분석자 :신혜선

* 본 분석결과는 선전, 광고, 소송 등 법적요건으로 사용할 수 없습니다.
* 위의 내용은 신청자이 제출한 시료에 대한 결과이며, 시료의 명칭은 신청자이 제시한 것임.
* 이 시험결과는 용도 이외의 사용을 금합니다.

2021년 01월 13일

한밭대학교 공동실험실습관장 (인)

Element	10% Solution (ppm)
Zn	**9630.68**
Pb	ND
Cd	ND
Fe	13.39
As	ND
S	ND

[Content Measurement Results by Substance]

- The Zn content in the 10% Zinc Gluconate solution is 9630.68 ppm, which is measured at 1% level in the sample
- Pure Zinc Gluconate, which does not include processes such as dilution, is distributed in 10 to 14% by calculation based on molecular weight
- No toxic substances in the ingredients have been detected
- Establishment of Zinc Gluconate's component analysis and analysis process in collaboration with Professor Lee Sang-yeop of the Department of New Material Engineering at Hanbat National University and joint laboratory practice
- The joint laboratory for analysis is a KOLAS certification institution.

III. Zinc Gluconate Antibacterial Solution

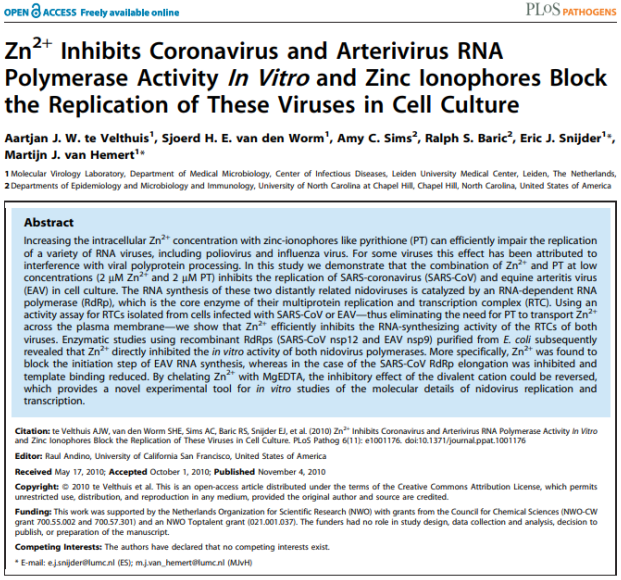
(4) The efficacy of Zinc Gluconate solution & Zinc material

Skin care

- anti-aging
- anti-oxidant astringent
- anti-acne agent
- anti-inflammatories
- anti-redness restructuring and replenishing agents

Hair Care

- Zinc gluconate: Zinc efficacy + skin absorption
- 5-Alpha Reductase (DHT) Removal: Hair loss prevention effect
- Remove dandruff & reduce pores
- Good for boring scalp, regenerating damaged scalp
- Thickening hair (South America uses ZnCl2)



OPEN ACCESS Freely available online PLoS PATHOGENS

Zn^{2+} Inhibits Coronavirus and Arterivirus RNA Polymerase Activity *In Vitro* and Zinc Ionophores Block the Replication of These Viruses in Cell Culture

Aartjan J. W. te Velthuis[1], Sjoerd H. E. van den Worm[1], Amy C. Sims[2], Ralph S. Baric[2], Eric J. Snijder[1]*, Martijn J. van Hemert[1]*

1 Molecular Virology Laboratory, Department of Medical Microbiology, Center of Infectious Diseases, Leiden University Medical Center, Leiden, The Netherlands, 2 Departments of Epidemiology and Microbiology and Immunology, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, United States of America

Abstract

Increasing the intracellular Zn^{2+} concentration with zinc-ionophores like pyrithione (PT) can efficiently impair the replication of a variety of RNA viruses, including poliovirus and influenza virus. For some viruses this effect has been attributed to interference with viral polyprotein processing. In this study we demonstrate that the combination of Zn^{2+} and PT at low concentrations (2 μM Zn^{2+} and 2 μM PT) inhibits the replication of SARS-coronavirus (SARS-CoV) and equine arteritis virus (EAV) in cell culture. The RNA synthesis of these two distantly related nidoviruses is catalyzed by an RNA-dependent RNA polymerase (RdRp), which is the core enzyme of their multiprotein replication and transcription complex (RTC). Using an activity assay for RTCs isolated from cells infected with SARS-CoV or EAV—thus eliminating the need for PT to transport Zn^{2+} across the plasma membrane—we show that Zn^{2+} efficiently inhibits the RNA-synthesizing activity of the RTCs of both viruses. Enzymatic studies using recombinant RdRps (SARS-CoV nsp12 and EAV nsp9) purified from *E. coli* subsequently revealed that Zn^{2+} directly inhibited the *in vitro* activity of both nidovirus polymerases. More specifically, Zn^{2+} was found to block the initiation step of EAV RNA synthesis, whereas in the case of the SARS-CoV RdRp elongation was inhibited and template binding reduced. By chelating Zn^{2+} with MgEDTA, the inhibitory effect of the divalent cation could be reversed, which provides a novel experimental tool for *in vitro* studies of the molecular details of nidovirus replication and transcription.

Citation: te Velthuis AJW, van den Worm SHE, Sims AC, Baric RS, Snijder EJ, et al. (2010) Zn^{2+} Inhibits Coronavirus and Arterivirus RNA Polymerase Activity *In Vitro* and Zinc Ionophores Block the Replication of These Viruses in Cell Culture. PLoS Pathog 6(11): e1001176. doi:10.1371/journal.ppat.1001176

Editor: Raul Andino, University of California San Francisco, United States of America

Received May 17, 2010; **Accepted** October 1, 2010; **Published** November 4, 2010

Funding: This work was supported by the Netherlands Organization for Scientific Research (NWO) with grants from the Council for Chemical Sciences (NWO-CW grant 700.55.002 and 700.57.301) and an NWO Toptalent grant (021.001.037). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: The authors have declared that no competing interests exist.

* E-mail: e.j.snijder@lumc.nl (ES); m.j.van_hemert@lumc.nl (MJvH)

Hindawi Publishing Corporation
Dermatology Research and Practice
Volume 2014, Article ID 709152, 11 pages
http://dx.doi.org/10.1155/2014/709152

Hindawi

Review Article

Zinc Therapy in Dermatology: A Review

Mrinal Gupta, Vikram K. Mahajan, Karaninder S. Mehta, and Pushpinder S. Chauhan

Department of Dermatology, Venereology & Leprosy, Dr. R. P. Govt. Medical College, Kangra (Tanda), Himachal Pradesh 176001, India

Correspondence should be addressed to Vikram K. Mahajan; vkmahajan1@gmail.com

Received 1 May 2014; Accepted 23 June 2014; Published 10 July 2014

Academic Editor: Craig G. Burkhart

Zinc, both in elemental or in its salt forms, has been used as a therapeutic modality for centuries. Topical preparations like zinc oxide, calamine, or zinc pyrithione have been in use as photoprotecting, soothing agents or as active ingredient of antidandruff shampoos. Its use has expanded manifold over the years for a number of dermatological conditions including infections (leishmaniasis, warts), inflammatory dermatoses (acne vulgaris, rosacea), pigmentary disorders (melasma), and neoplasias (basal cell carcinoma). Although the role of oral zinc is well-established in human zinc deficiency syndromes including acrodermatitis enteropathica, it is only in recent years that importance of zinc as a micronutrient essential for infant growth and development has been recognized. The paper reviews various dermatological uses of zinc.

[Zinc Application Research Document]

RPE Corporation
ROLL PRINTING ELECTRONICS

Thank you !

RPE 주식회사 알피이
ROLL PRINTING ELECTRONICS