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We Find and Create "Value Difference" from Nature for our Healthy Beauty

MC-DTOC

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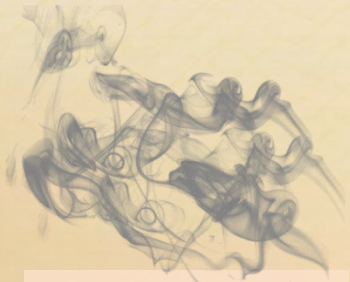
MC-DTOC : Development



Yellow dust, Heavy metal

Smoke

Exhaust

UV

Increase in ROS

Inflammatory cytokines, NO…

Aging substance (MMP)

Apoptosis

Cell Aging

Inflammation

Decrease in skin density

Increasing necessity for SKIN **DETOXIFICATION.**

- Skin rejuvenation from environmental pollutant
- Strengthen the ability to maintain healthy skin
- Reinforcement of toxification

MC-DTOC : Development

Skin Detox & Anti-Pollution by Korean traditional medicinal herb

To develop MC-DTOC, lots of surveys had been conducted and **解毒湯 (Haedoktang)** in 東醫補監(Donguibogam) was selected.

* 東醫補監 : Korean traditional medicinal book

*** 解毒湯(Haedoktang)**

Ingredients : Licorice, Peony, Angelica root, Rhubarb root, Angelica Nepta herb, Amur cork (8g each)

Method : Chop all ingredients and boil them with green onion and jujube in water. Rinse the damaged skin with the final liquid.

MC-DTOC

Based on prescription of skin detox!

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MC-DTOC : Ingredients

Name	Common Name	INCI name
甘草	Licorice	Glycyrrhiza Uralensis (Licorice) Root Extract
川赤芍	Peony	Paeonia Albiflora Root Extract
朝鲜当归	Angelica root	Angelica Gigas Root Extract
掌叶大黄	Rhubarb root	Rheum Palmatum Root Extract
独活	Angelica	Angelica Pubescens Root Extract
荆芥	Nepta herb	Schizonepeta tenuifolia Extract
黄皮树	Amur cork	Phellodendron Amurense Bark Extract

MC-DTOC : Ingredients

Glycyrrhiza Uralensis 1
-Detoxification of heavy metal

Angelica Gigas 2
-Anti-aging through collagenesis

Rheum Palmatum 3
- Reducing Inflammation

MC-DTOC

Phellodendron Amurense 7
-Whitening effect

Angelica Pubescens 4
-Reducing inflammation

Schizonepeta tenuifolia 6
-Anti-atopic dermatitis

Paeonia Albiflora 5
- Detoxification of aconitine

1) J. Pharmacol Exp Ther, 321, 2, 816, 2007, 2) Kor. J. Herbology, 26(1), 2011, 3) Fitoterapia, 72(3), 221, 2000,
4) J. Inflam., 35(3), 913, 2012, 5) J. Eth. pharm, 141, 701, 2012, 6) Phytother. Res. 27, 1131, 2013, 7) J. Appl., Biol., Chem. 54(2), 108, 2011)

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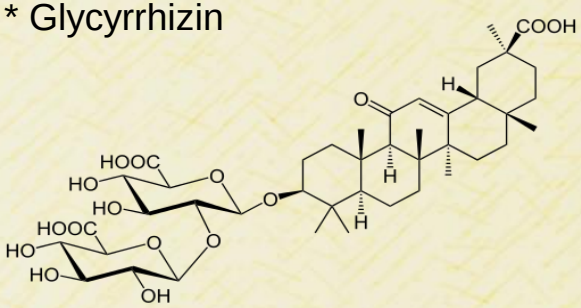
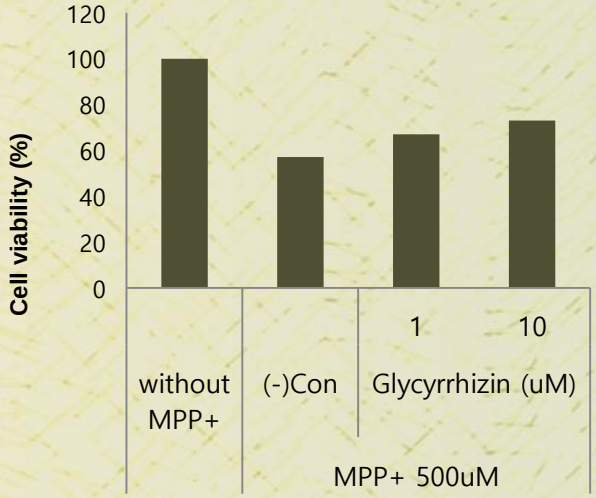
Efficacy of Licorice (MC-DTOC ingredient)

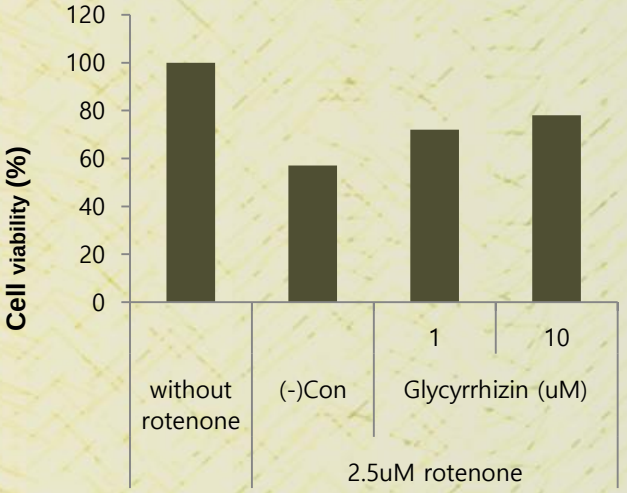
Glycyrrhizin – Reducing toxicity of MPP^+

* Glycyrrhizin





- In case of producing MPP^+ by adding MPTP to nerve cell, Glycyrrhizin reduced toxicity of MPP^+ .
- Glycyrrhizin protects nerve cell from Rotenone through its detox effect.



※ MPP^+ (1-methyl-4-phenylpyridinium) : Toxic metabolite of MTPT, It destructs neurons.

※ Rotenone : derived from roots of Derris elliptica, It has a toxic to nerve, so it is used as an ingredient for pesticide.

(Ref. *J. Pharmacol Exp Ther*, 321, 2, 816-822, 2007)

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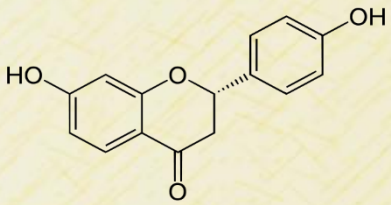
Efficacy of Licorice (MC-DTOC ingredient)

Liquiritigenin - Reducing heavy metal toxicity

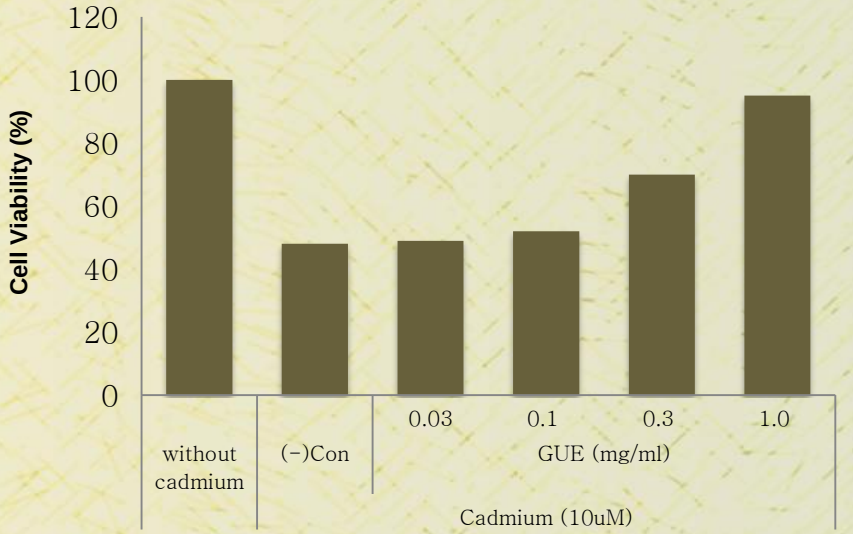
* Liquiritigenin

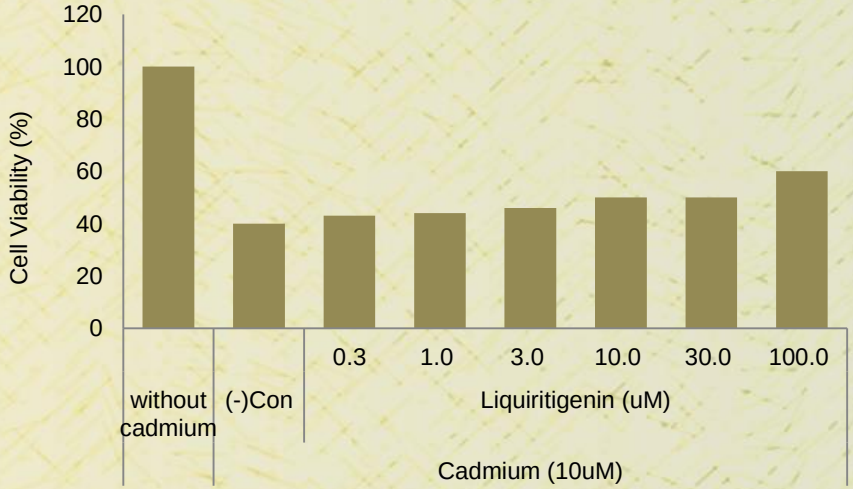


- Licorice extract relieved the toxicity of cadmium in yellow dust in dose-dependent manner.
- Liquiritigenin also reduced the cadmuim-induced toxicity.

※ H4IIE cell : rat-derived hepatocyte cell line
※ GUE : Glycyrrhiza Uralensis (Licorice) Root Extract

(Ref. *Toxicity*, 197, 239-251, 2004)





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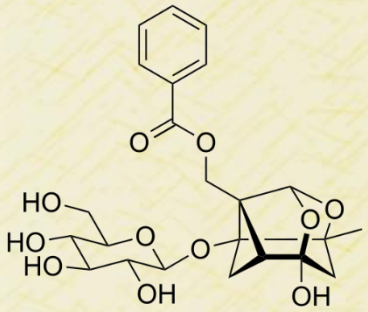
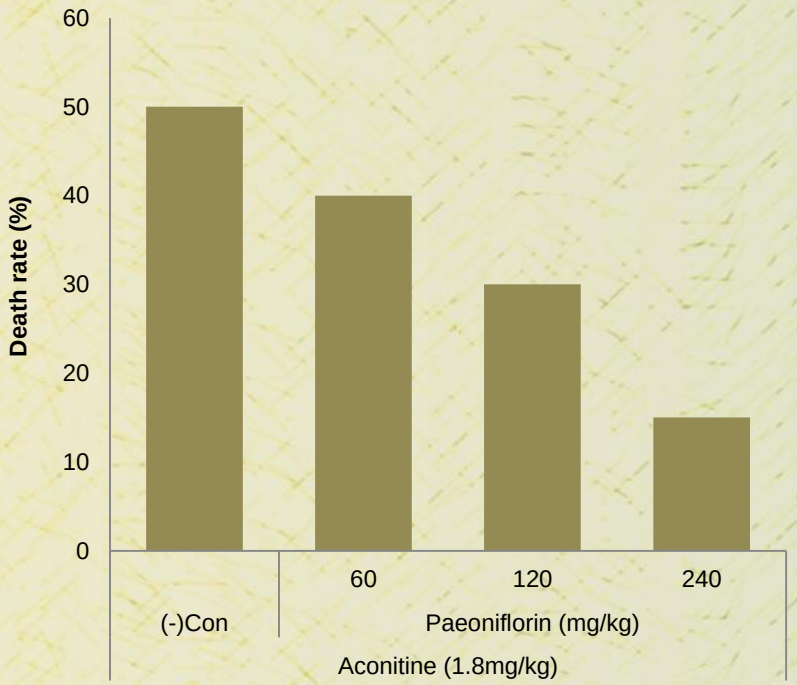
Efficacy of Peony (MC-DTOC ingredient)

Paeoniflorin – Relieving the toxicity of Aconitine

* Paeoniflorin





- Paeoniflorin in Peony reduces the death rate of the aconitine-injected animals.

※ Aconitine : Substance found in aconite, It cause itchiness and turns blue when applied on skin. It is fetal if taken large amount.

(Ref. : *Jounal of Ethnopharmacology*, 141, 701-708, 2012)

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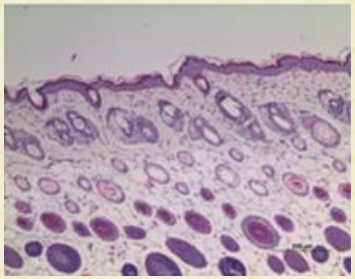
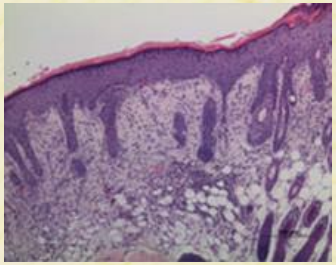
Efficacy of Nepta herb (MC-DTOC ingredient)

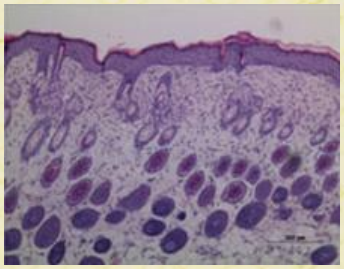
Recovery effect in Atopic dermatitis



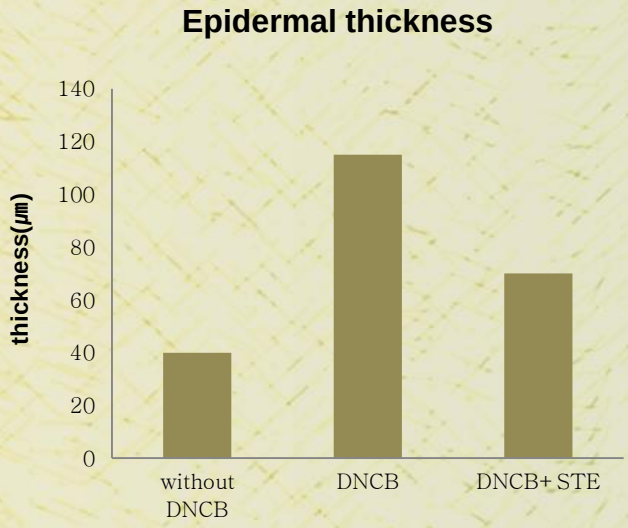
Without DNCB



DNCB



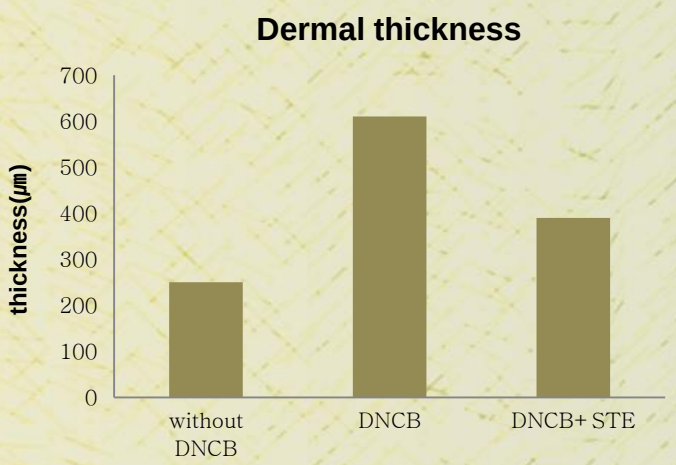
DNCB+ST



- Nepta herb extract had a positive effect on recovering the thickness of epidermis and dermis in DNCB-induced atopic dermatitis.

※ DNCB(Dinitrochlorobenzen) : It causes atopic and contact dermatitis

※ STE : Nepta herb extract



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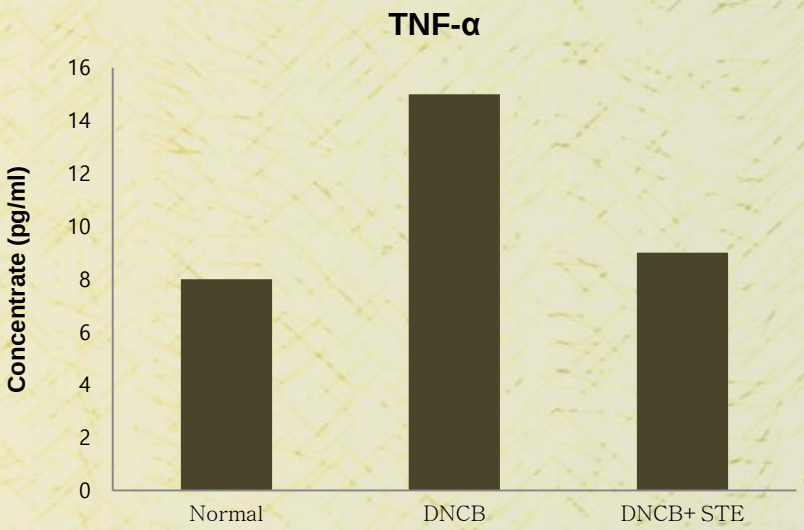
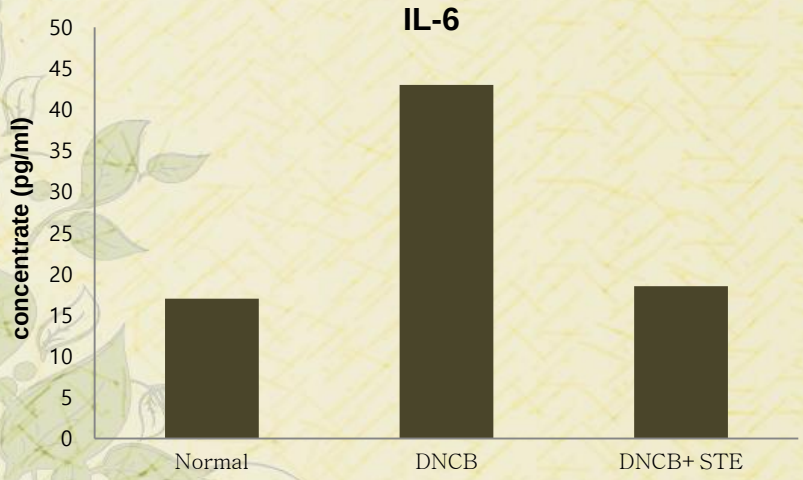
Efficacy of Nepta herb (MC-DTOC ingredie

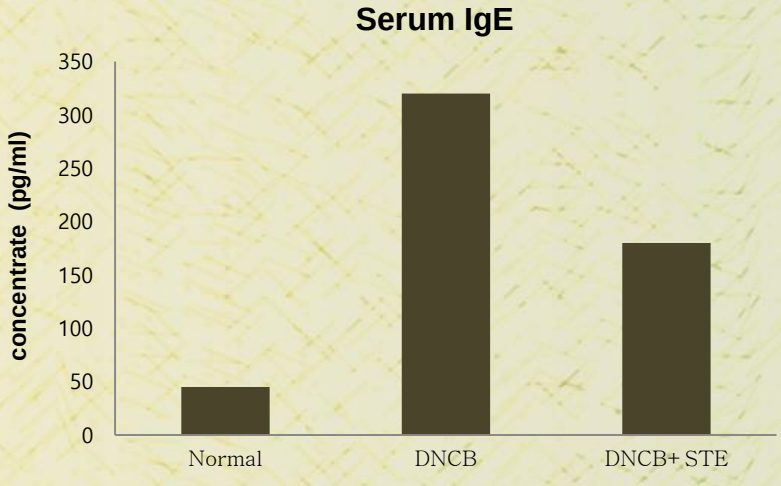
- Nepta herb extract reduced the level of IgE and inflammatory cytokines in DNCB-induced atopic dermatitis.

※ IgE : Immunoglobulin E
※ TNF-α : Tumor Necrosis Factor-α
※ IL-6 : Interleukin 6

(Ref. *Phytother. Res*. 27: 1131–1135, 2013)







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MC-DTOC : Mechanism of action

The stage of Skin-Detoxification

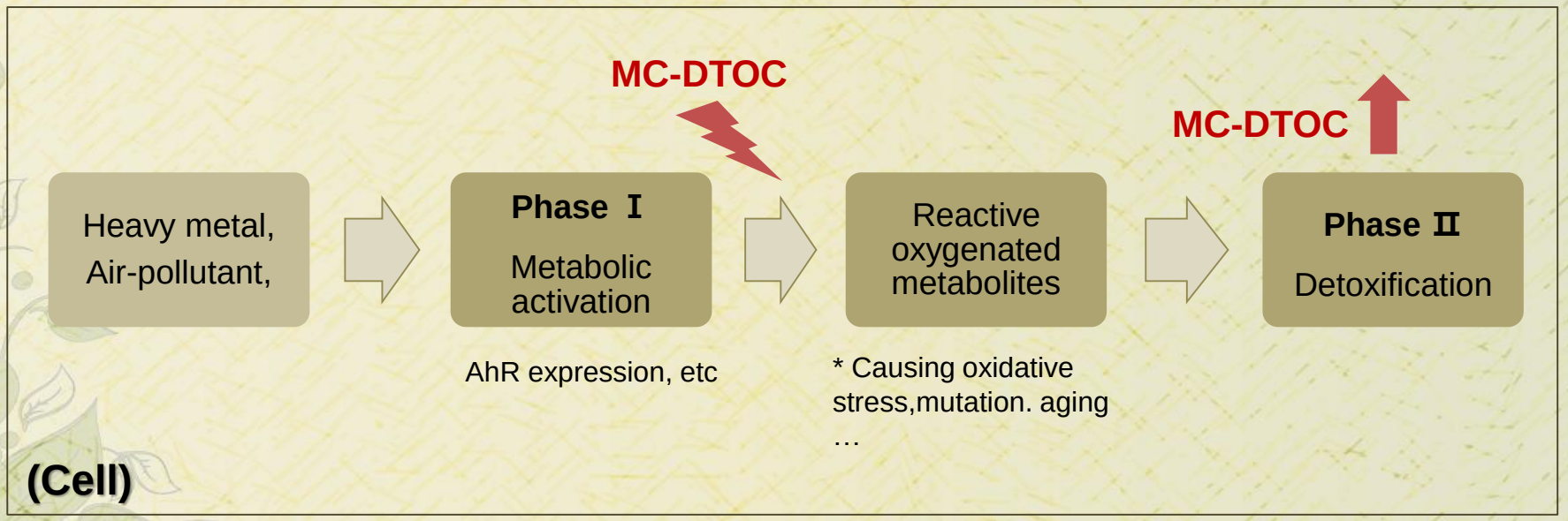
- MC-DTOC activates the skin detoxification system composed of Phase Ⅰ and Ⅱ proteins.

- Phase Ⅰ : Increasing the activity of hydrophobic substance by adding polar functional group

  * Metabolites cause oxidative stress and skin aging

- Phase Ⅱ : Reaction of anti-oxidative enzyme

  Enzymes help toxic metabolites moved out and suppress oxidative agent.



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Anti-Pollution Effect of MC-DTOC

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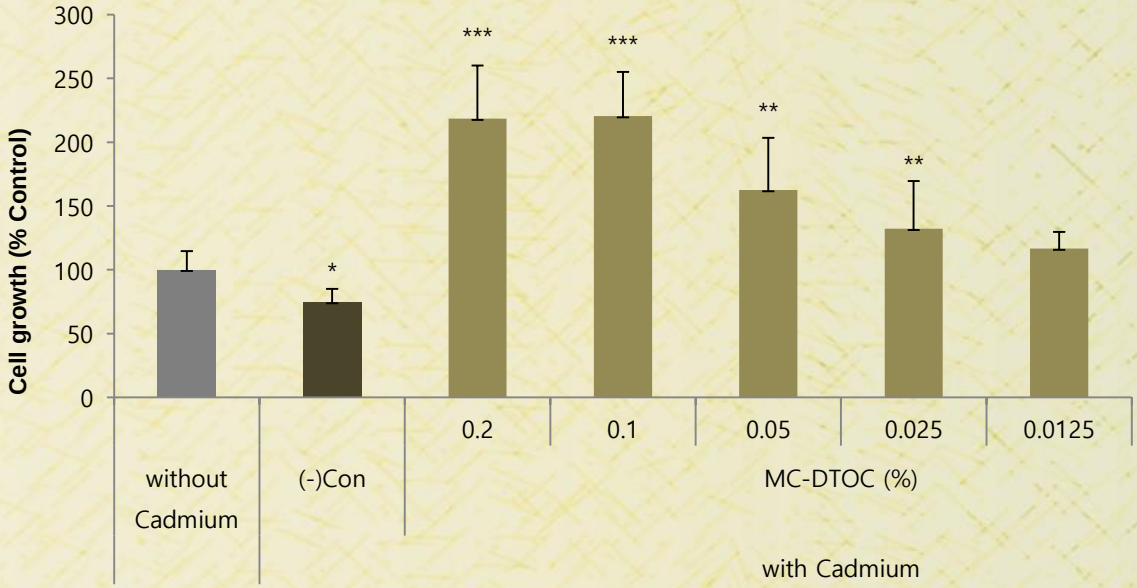
Efficacy of MC-DTOC – 1. Heavy Metal

1) Against Cadmium-induced Toxicity ①

- When applying cadmium on keratinocytes, the number of survived cells decreased by 30%. However, MC-DTOC recovered the survival rate of those keratinocytes.
- The survival rate of keratinocyte starts to display its effect at the 0.0125% of MC-DTOC.
- 0.2% of MC-DTOC made it increased by 144% more than that of cadmium-treated group.



The data shown represent the mean±SD derived from three determinations. Fetal bovine serum used as a positive control.
$***p<0.001, **p<0.01, *p<0.05$ indicated statistically significant differences from cadmium control group.

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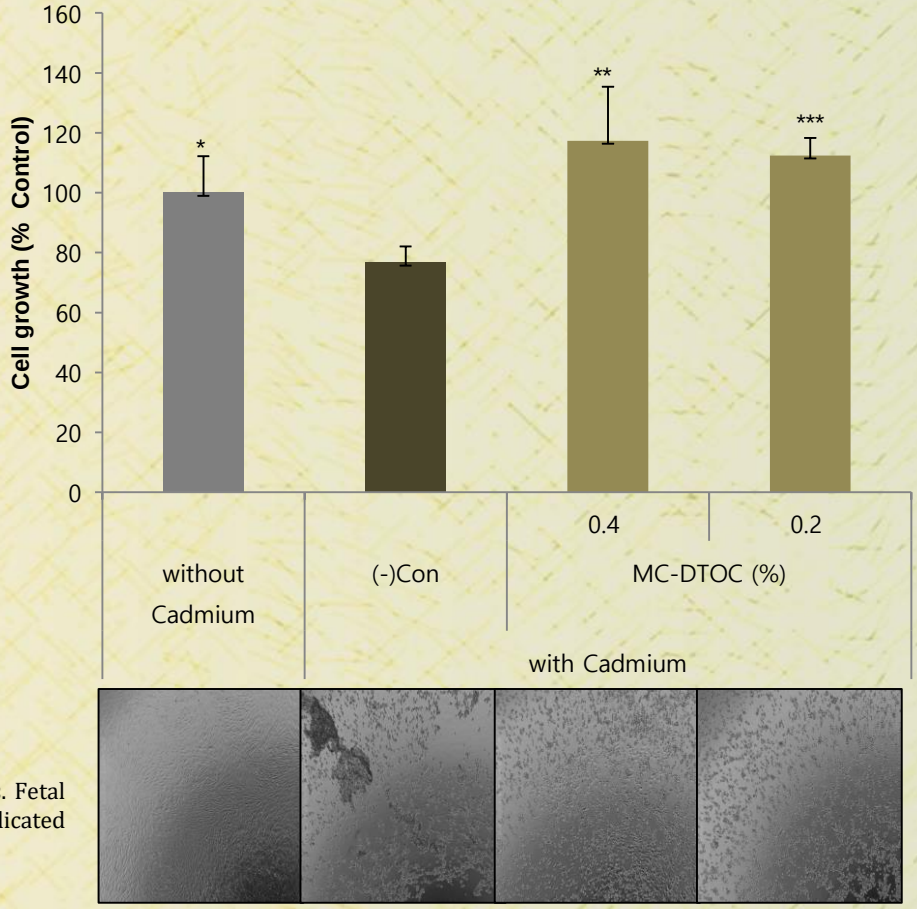
Efficacy of MC-DTOC – 1. Heavy Metal

2) Against Cadmium-induced Toxicity ②

- When cadmium was treated on fibroblasts, the cell growth decreased by 30%.
- 0.2% and 0.4% of MC-DTOC made the cell growth double compared to cadmium-treated group.



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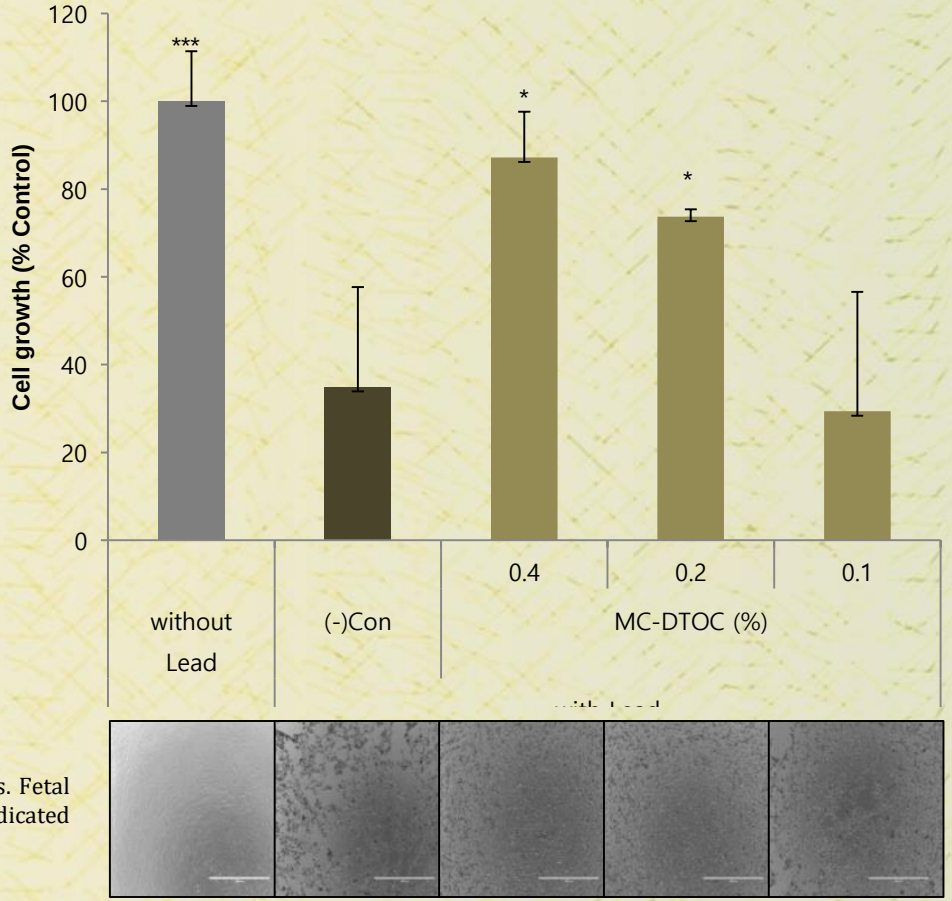
Efficacy of MC-DTOC – 1. Heavy Metal

3) Decreasing toxicity of Lead

- Lead reduced the fibroblasts growth by 65%.
- 0.2% and 0.4% of MC-DTOC treated group showed survival rate each 39% and 52% higher than lead-treated group.



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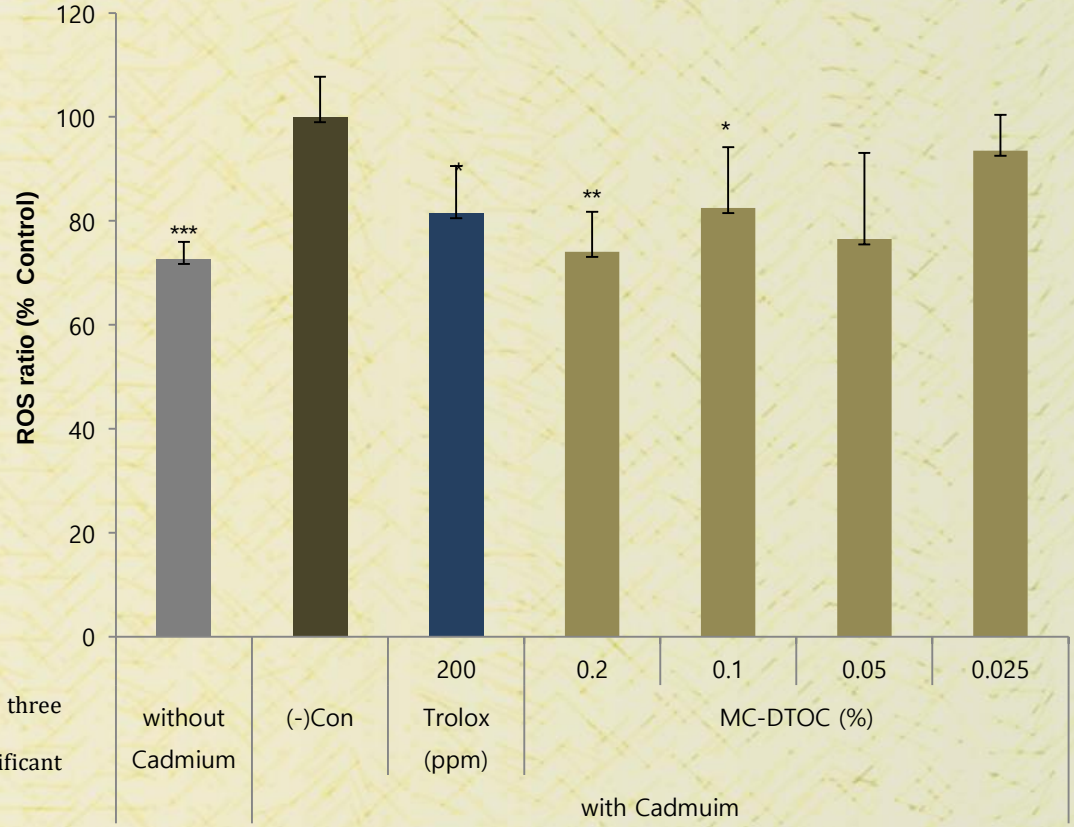
Efficacy of MC-DTOC – 1. Heavy Metal

4) Removal Cadmium-induced ROS

- Cadmium produced ROS in keratinocytes.
- 0.2%, 0.1% and 0.05% of MC-DTOC treated group reduced ROS by 26%, 18%, 24%, respectively.

※ ROS (Reactive Oxygen Species)
: unstable oxygen species which causes oxidative stress and stimulates aging.



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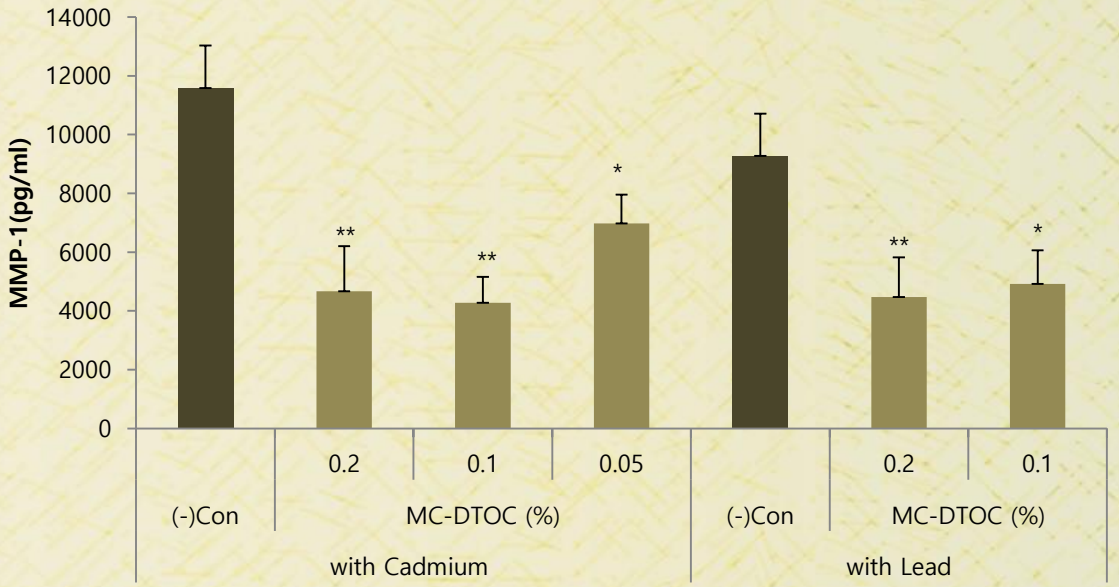
Efficacy of MC-DTOC – 1. Heavy Metal

5) Suppressing MMP-1 Expression

- MC-DTOC suppressed the expression of MMP-1.

※ MMP-1 (Matrix metalloproteinase-1)

: enzyme that degrades collagen-1,3, which stimulates wrinkle formation and skin aging



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Efficacy of MC-DTOC – 1. Heavy Metal

6) Decreasing inflammatory cytokines

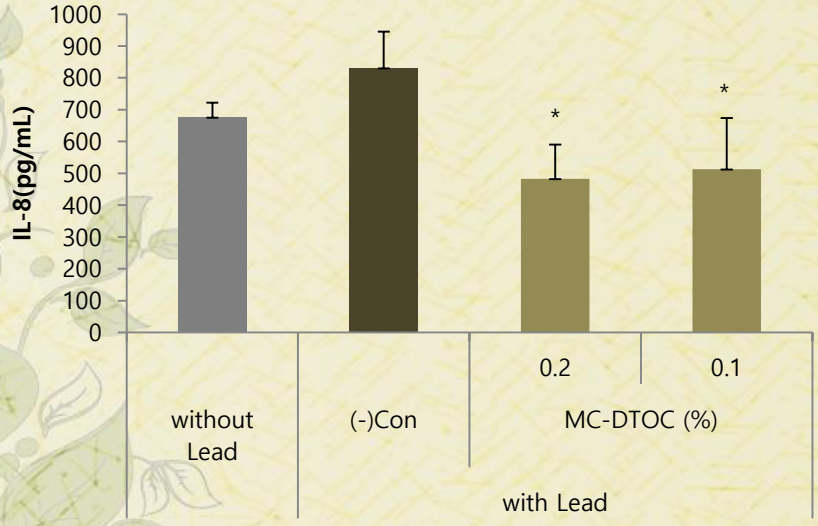
Detoxification both in Epidermis(;keratinocytes) & Dermis(;fibroblasts)

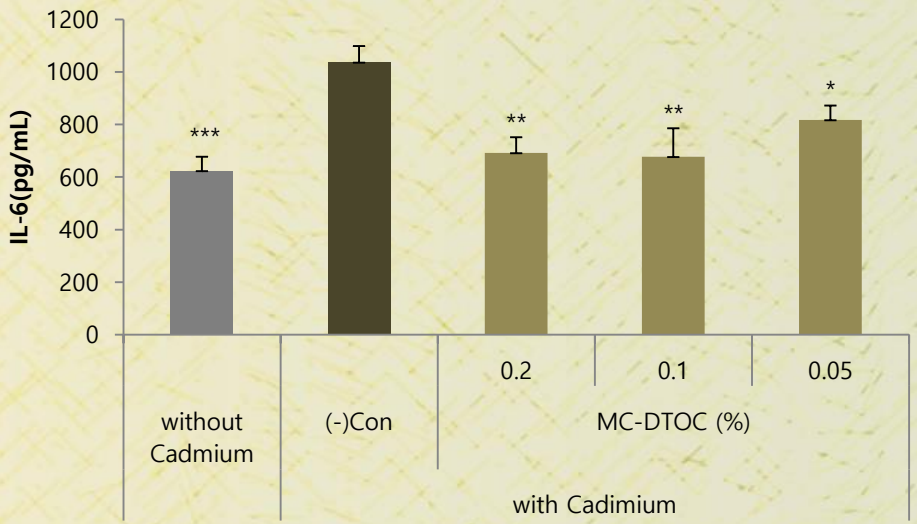
- The level of IL-8 in **keratinocytes** increased due to lead.
- MC-DTOC reduced the formation of IL-8.

※ IL-8 : interleukin-8, inflammatory cytokines

- The level of IL-6 in **fibroblasts** increased after treating cadmium.
- MC-DTOC reduced the formation of IL-6.

※ IL-6 : interleukin-6, inflammatory cytokines





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Efficacy of MC-DTOC – 2. Air Pollutant

1) Suppressing Benzopyrene induced-gene expression

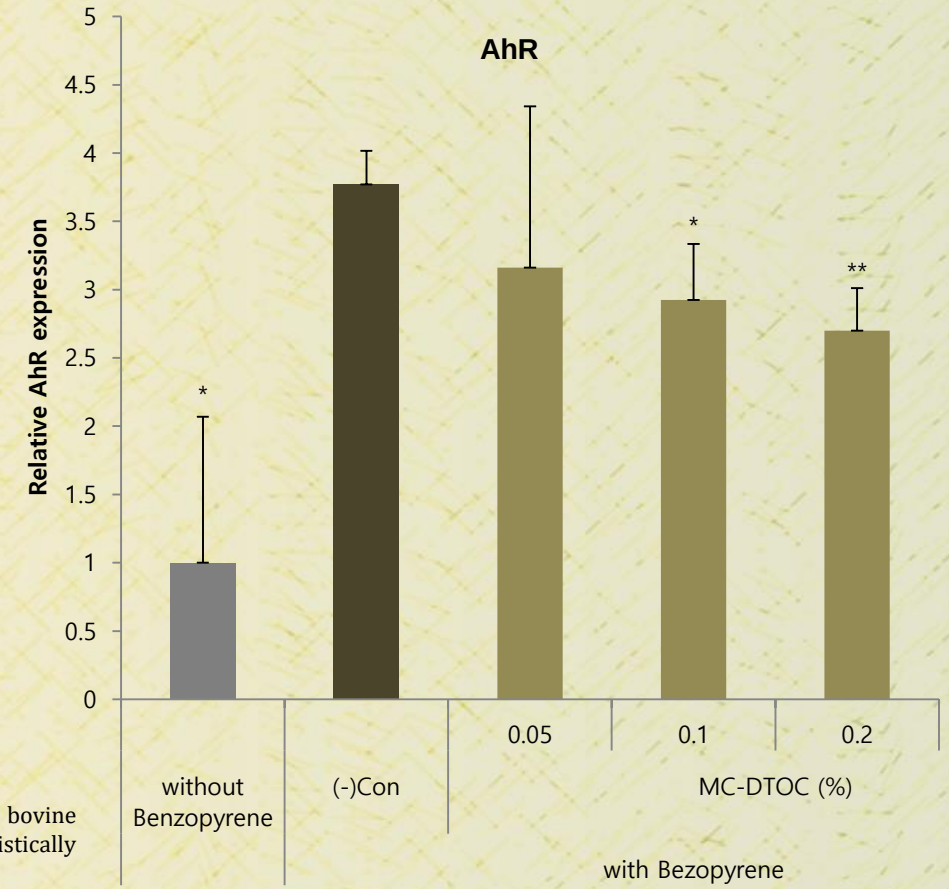
- AhR gene expression in keratinocyte was increased by benzopyrene.
- MC-DTOC reduced the level of AhR.

※ Benzopyrene : one of a carcinogen in smoke and exhaust.

※ CYP1A1, CYP1A2

: enzymes that are formed after AhR (Arylhydrocarbon Receptor) gene expression and activation.

: These enzymes increase inflammatory factors and melanin and induce skin aging and pigmentation



The data shown represent the mean±SD derived from three determinations. Fetal bovine serum used as a positive control. $***p<0.001$,$**p<0.01$,$*p<0.05$ indicated statistically significant differences from benzopyrene control group.

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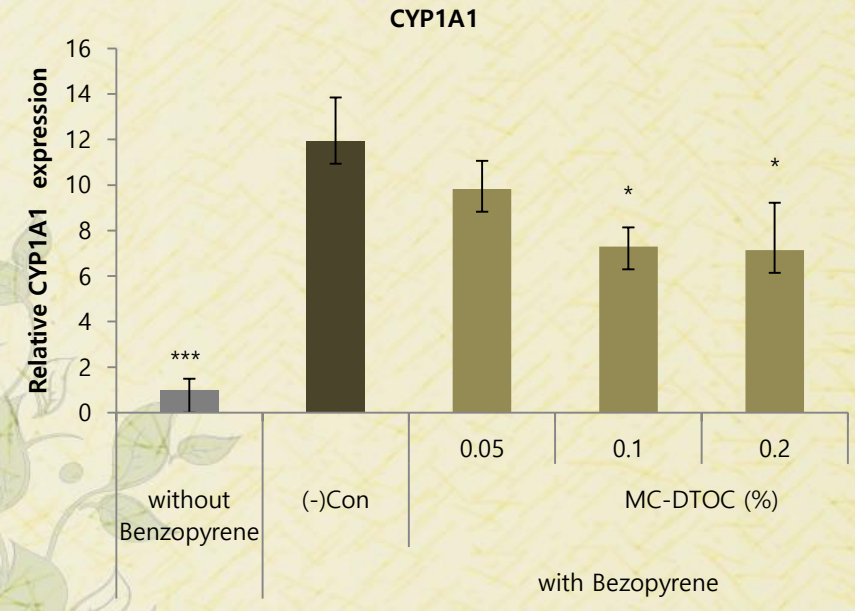
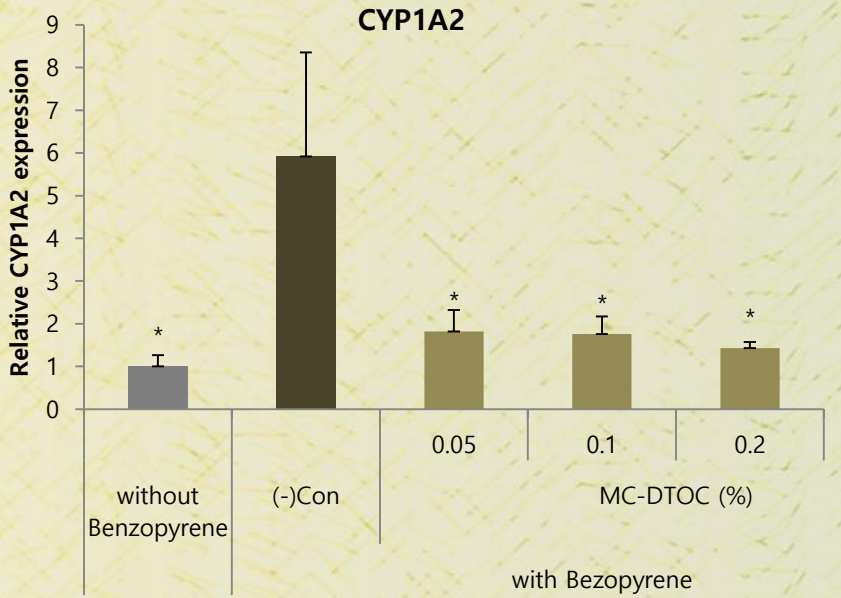
Efficacy of MC-DTOC – 2. Air Pollutant

2) Suppressing Benzopyrene-induced enzyme

- Benzopyrene increased the level of CYP1A1 and CYP1A2 in keratinocytes.
- MC-DTOC reduced CYP1A1 and CYP1A2 .





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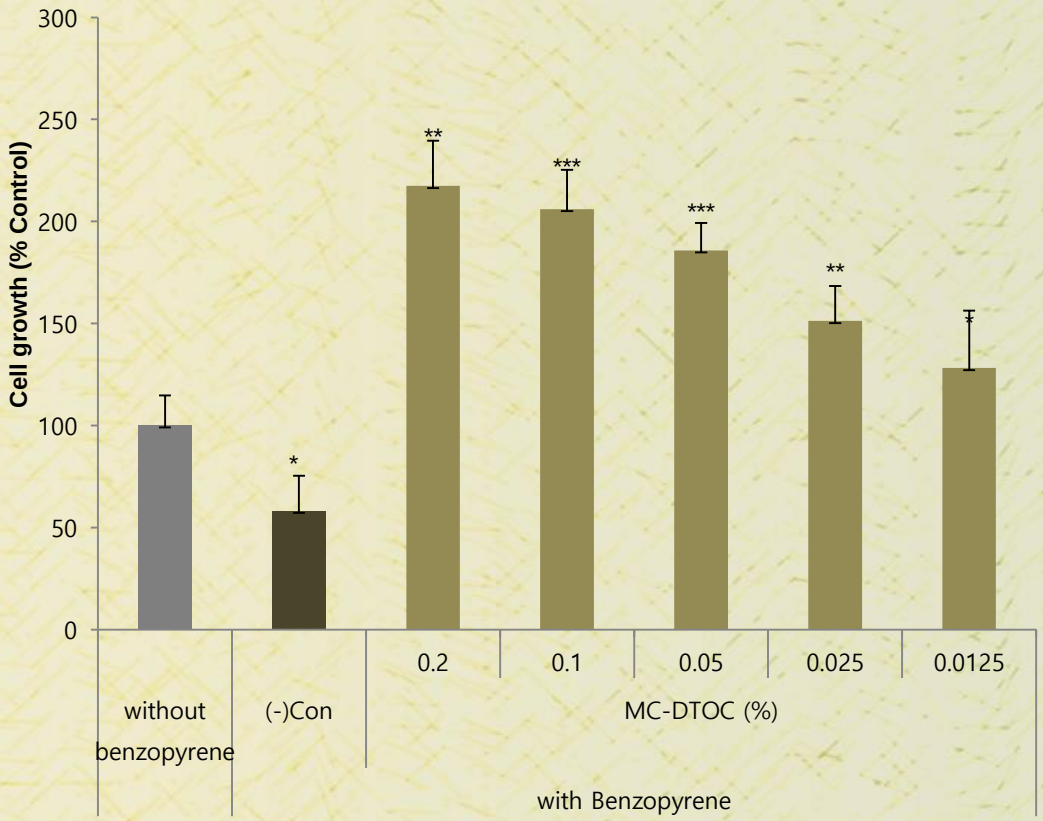
Efficacy of MC-DTOC – 2. Air Pollutant

3) Decreasing Toxicity of Benzopyrene

- Benzopyrene lowered the survival rate keratinocytes by 40%.
- The survival rate of keratinocyte starts to display its effect at the 0.0125% of MC-DTOC.
- 0.05% of MC-DTOC-treated group showed 159% higher survival rate than benzopyrene group.



The data shown represent the mean±SD derived from three determinations. Fetal bovine serum used as a positive control. $***p<0.001$, $**p<0.01$, $*p<0.05$ indicated statistically significant differences from benzopyrene control group.

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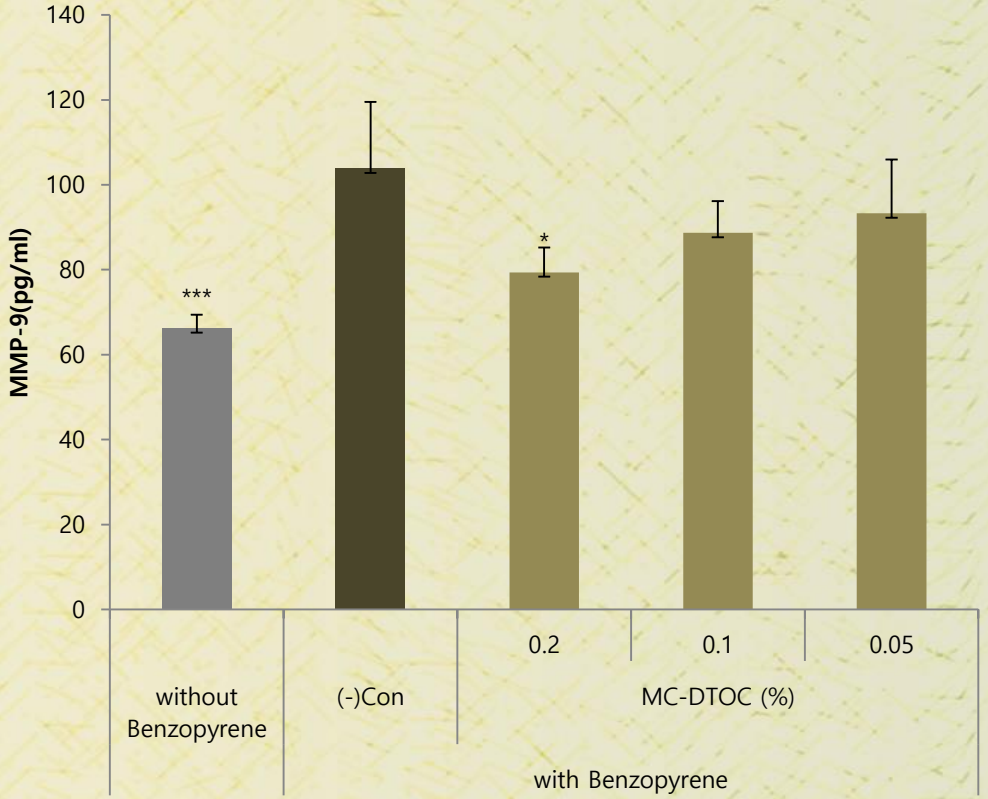
Efficacy of MC-DTOC – 2. Air Pollutant

4) Suppressing Benzopyrene induced-MMP-9

- Benzopyrene increases MMP-9 in keratinocytes.
- MC-DTOC reduces MMP-9 by detoxification against benzopyrene.

※ MMP-9 (Matrix metalloproteinase-9)
: enzyme that degrades collagen-Ⅳ, Ⅴ which stimulates wrinkle formation and skin aging



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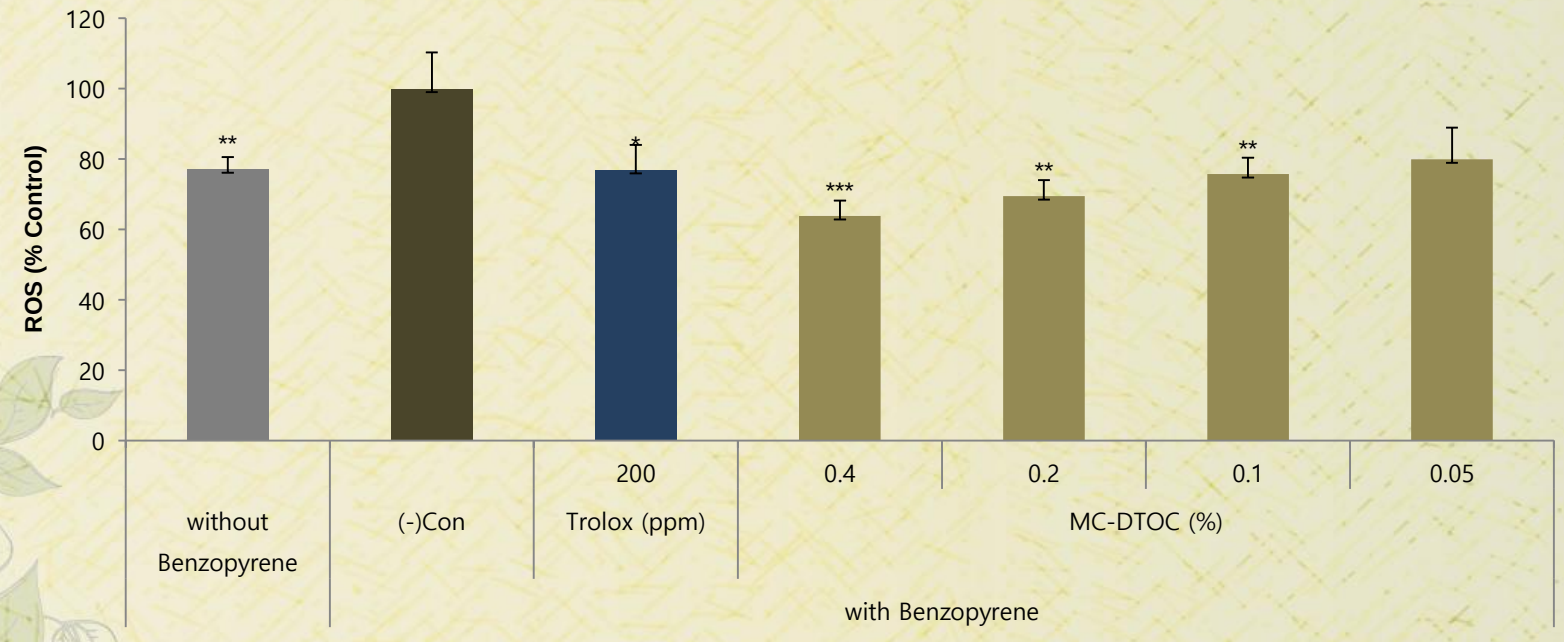
Efficacy of MC-DTOC – 2. Air Pollutant

5) Removal of ROS caused by Benzopyrene

- Benzopyrene increased ROS in keratinocytes by 30%.
- ROS in keratinocytes was removed to 36%, 31% and 24% after MC-DTOC had been treated 0.4%,0. 2% and 0.1%, respectively.



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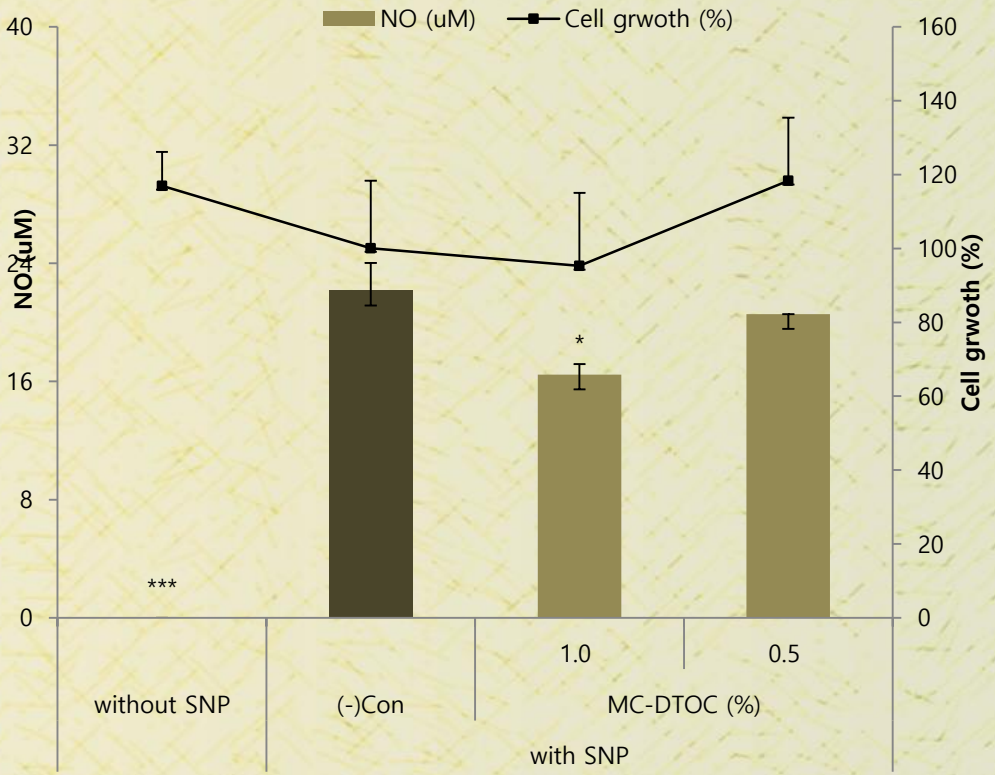
Efficacy of MC-DTOC – 2. Air Pollutant

6) NO Removal caused by SNP

- MC-DTOC alleviated the skin irritation by removing NO caused by SNP.
- 1.0% of MC-DTOC reduced the formation of NO by 26% less than SNP-treated group.



The data shown represent the mean±SD derived from three determinations. Fetal bovine serum used as a positive control. $***p<0.001, **p<0.01, *p<0.05$ indicated statistically significant differences from benzopyrene control group.

※ NO (Nitric Oxide) : causes chronic inflammation

※ SNP : Sodium Nitroprusside, one of the components of exhaust.

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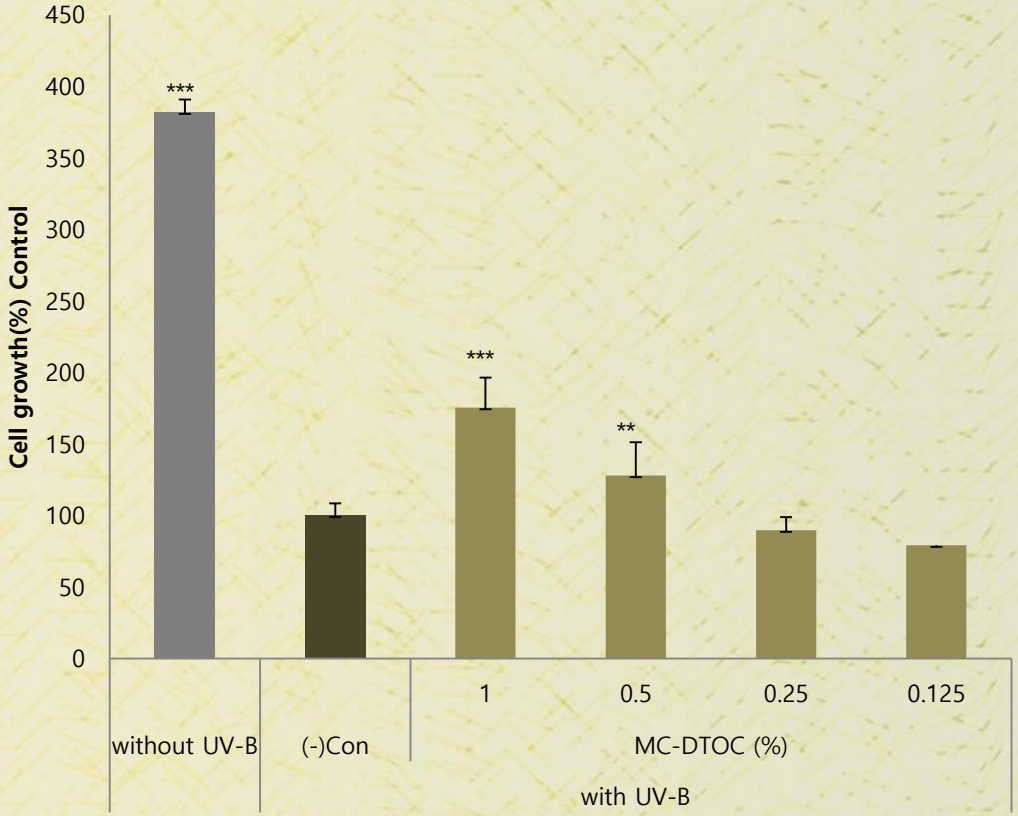
Efficacy of MC-DTOC – 3. UV

1) Reducing negative effect of UV on keratinocytes

- After causing UV-induced irritation on keratinocytes and treating MC-DTOC on them, a protective effect was observed.
- 1% of MC-DTOC increased the cell growth by 36% more than UV-treated group.



The data shown represent the mean±SD derived from three determinations. Fetal bovine serum used as a positive control. $***p<0.001, **p<0.01, *p<0.05$ indicated statistically significant differences from UV control group.

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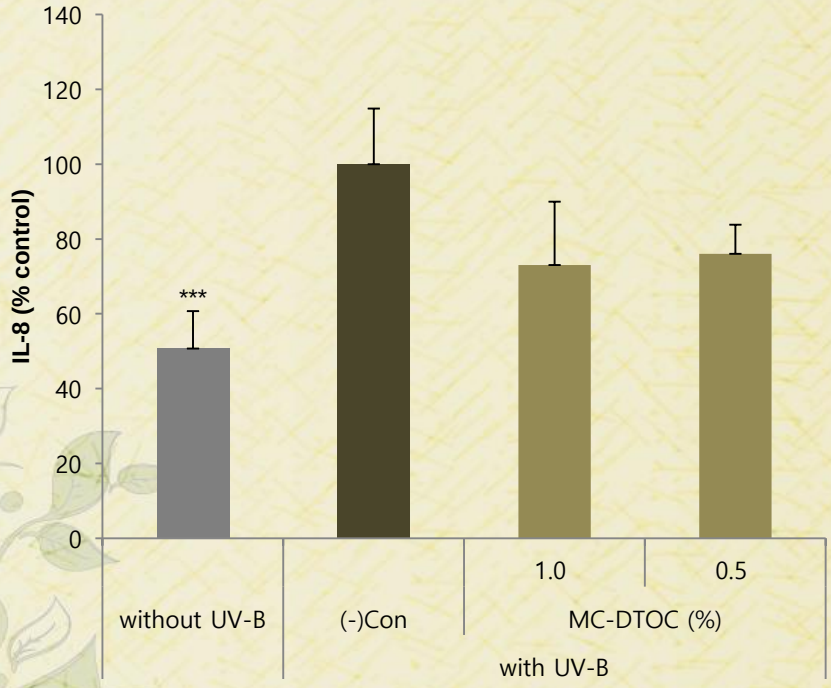
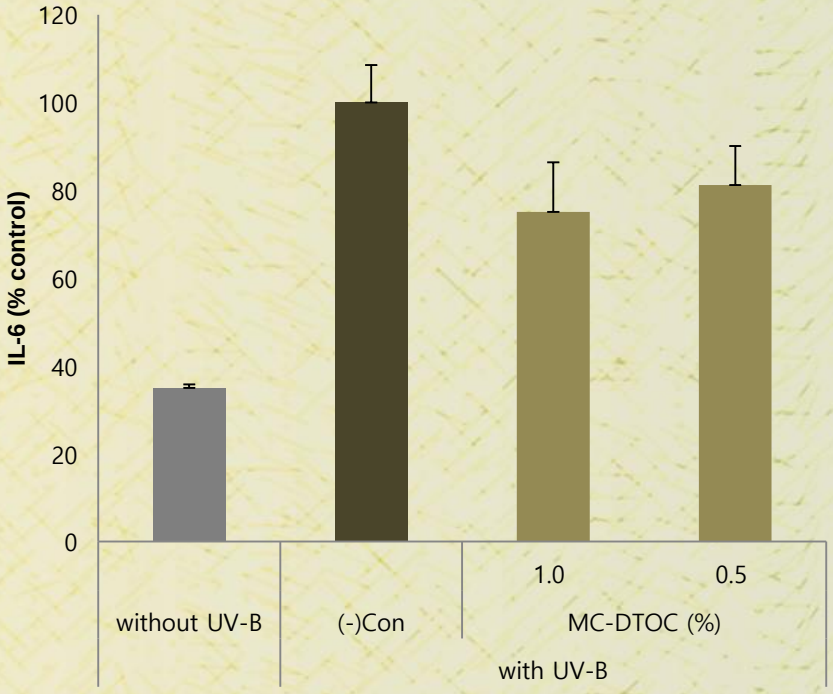
Efficacy of MC-DTOC – 3. UV

2) Suppressing Formation of UV-induced Inflammatory cytokines

- When UV-induced irritation occurred in keratinocytes, MC-DTOC reduced the level of IL-6 and IL-8 by protecting cells





The data shown represent the mean±SD derived from three determinations. Fetal bovine serum used as a positive control.
$***p<0.001, **p<0.01, *p<0.05$ indicated statistically significant differences from UV control group.

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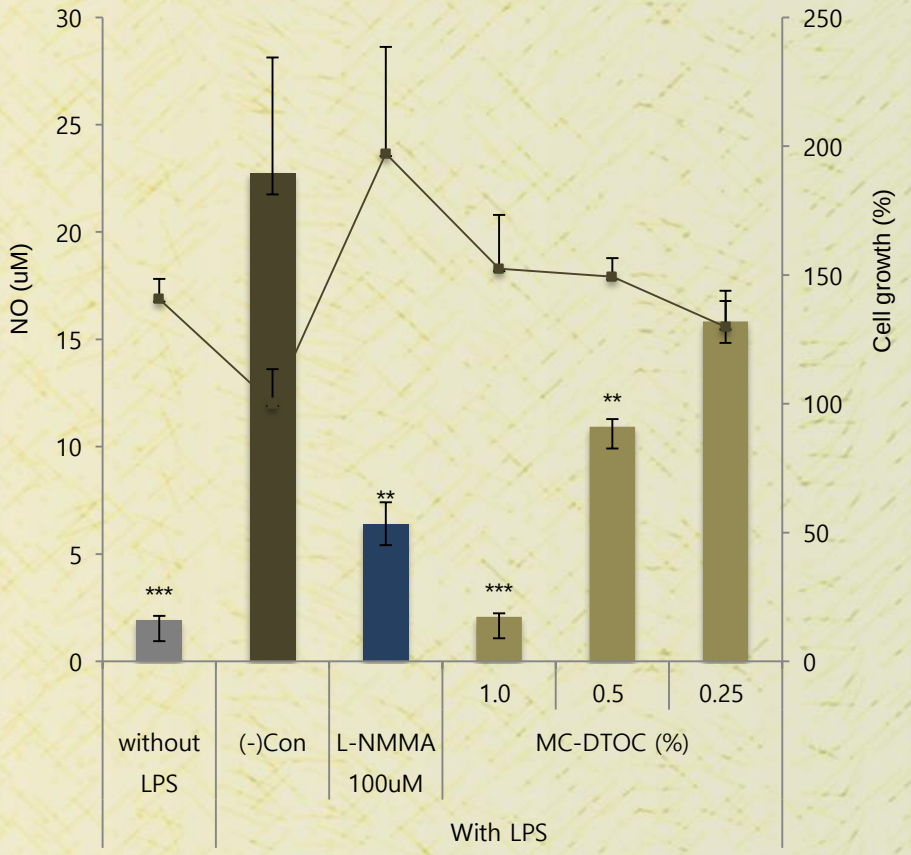
Efficacy of MC-DTOC – 4. LPS

1) Inhibition of NO Formation

- MC-DTOC reduced the toxicity of LPS, resulting in NO formation in raw 264.7 cells.
- 1.0, 0.5 and 0.25% of MC-DTOC showed the inhibitory effect on NO formation by 91.52 and 30% respectively.

※ L-NMMA : NG-monomethyl-L-arginine

※ LPS : Lipopolysaccharide. A kind of Endotoxin



The data shown represent the mean±SD derived from three determinations. Fetal bovine serum used as a positive control. $***p<0.001$,$**p<0.01$,$*p<0.05$ indicated statistically significant differences from UV control group.

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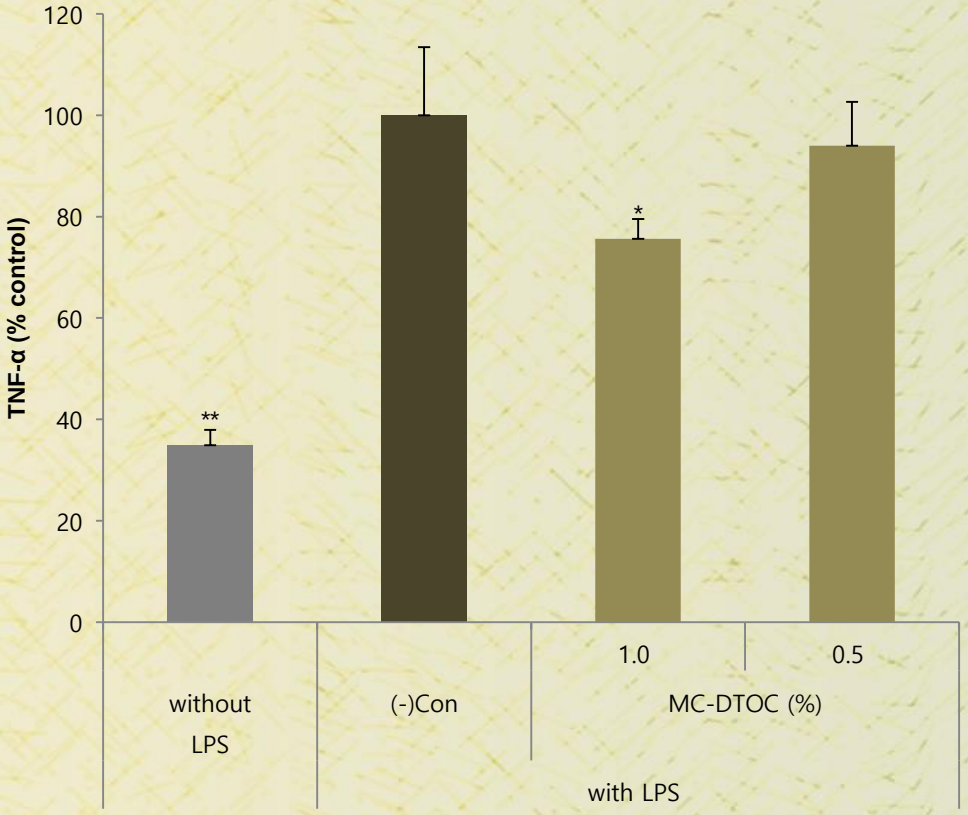
Efficacy of MC-DTOC – 4. LPS

2) Suppressing Formation of Inflammatory cytokines

- MC-DTOC exerted positive effect on reducing TNF-α in raw 264.7 cell.
- 1.0% of MC-DTOC decreased TNF-α formation by 24%.

※ TNF-α : Tumor Necrosis Factor-α



The data shown represent the mean±SD derived from three determinations. Fetal bovine serum used as a positive control. $***p<0.001$,$**p<0.01$,$*p<0.05$ indicated statistically significant differences from LPS control group.

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MC-DTOC

- **Application**

- Anti-Pollution

- Defense toxicity

- **Formulation Instruction**

- Appearance : Transparent liquid

- Recommended use level : 0.1 – 7.0 %

- Stability : Temperature does not affect stability

- **Solubility**

- Water : Soluble

- Butylene glycol : Soluble

- Glycerin : Soluble

- Mineral oils : Insoluble

- Ethanol : Partially soluble

- **Physical Properties**

- Appearance : Transparent yellow liquid

- Odor : Characteristic

- pH : 3.0 – 5.0

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