

## A Study on the Trends of the Natural UV Protection Materials Related to Skin Beauty

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### 피부미용 관련 천연 자외선 차단 소재 연구동향 분석

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**Abstract** : The purpose of this study is to provide basic data for the development of UV protection products using natural materials. The research method is investigation and analyzation of the current status of the domestic and foreign industries, natural material research trends, and patent status of skin care-related sunscreen. As the result of the study, the U.S. market for sunscreen is the largest one, accounting for about 21% of the world, and the Chinese market is rapidly growing. The top four major types of functional cosmetics in Korea are complex functional products, followed by wrinkle improvement, sunscreen and whitening, and both the global and domestic markets continue to grow continuously. Over the past decade, research trends in natural sunscreen materials have shown that *Scutellaria baicalensis*, *Humulus lupulus* L., licorice, Finger root, Green tea, *lespedeza cuneata* extracts are effective, and in addition, they are also effective in photo-aging, antioxidant, anti-inflammatory, antibacterial, whitening, and wrinkle improvement. The patent registration status is on the rise and the ingredients were secured from plants and seaweeds. As the conclusion of this research, It is expected that natural UV protection material will be able to be used as multi-functional cosmetics material by developing safe and proven natural materials in line with future global trends.

*Keywords* : Sunscreen, UV protection natural materials, functional cosmetics, photo-aging, patents

**요약** : 본 연구의 목적은 천연 소재를 이용한 자외선 차단 제품 개발의 기초 자료로 제공하는 것을 목적으로 하였다. 연구 방법은 피부미용 관련 자외선 차단제의 국내외 산업 현황과 천연 소재 연구 동향, 그리고 특히 현황을 조사하여 분석하였다. 연구 결과 자외선 차단제는 미국 시장이 전 세계의 약 21%를 차지하는 가장 큰 시장이며 중국 시장이 급격하게 성장하고 있다. 기능성 화장품 주요 4종의 국내 생산실적

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1위는 복합기능제품이며, 주름개선과 자외선 차단제, 미백의 순으로 나타났으며 세계시장 및 국내시장 모두 지속적으로 성장하고 있다. 최근 10년간 천연 자외선 차단 소재 연구동향을 조사하여 분석한 결과 황금, 홉, 감초, 핑거루트, 녹차, 야관문 추출물 등이 효능이 있으며 그 이외에도 광노화, 항산화, 항염, 항균, 미백, 주름개선 등의 효능도 있는 것으로 나타났다. 특히 등록 현황은 건수가 증가하는 추세이며 식물이나 해조류에서 성분을 확보하고 있었다. 본 연구의 결론은 향후 세계적 트렌드에 맞춰 안전하고 효능이 증명된 천연 자외선 차단 소재들을 개발해 간다면 다기능 천연 기능성 화장품 소재로 충분히 활용 가능할 것으로 전망된다.

*주제어 : 자외선 차단제, 자외선 차단 천연 소재, 기능성 화장품, 광노화, 특히*

## 1. Introduction

Globally, the trend in the cosmetics industry is increasing demand for natural cosmetics due to increased interest in eco-friendly and concerns about the noxious environment. The trend of this change is affecting the stability of cosmetics ingredients and the production process, and is showing a high preference for green products that exclude harmful environmental production facilities and animal testing [1]. According to the recently enacted law by the Hawaii State Council, two chemicals included in the sunscreen, 'Oxybenzone' and 'Octinoxate', have a detrimental effect on the marine environment and ecosystem in Hawaii. And therefore, Hawaii State Council reported that it wanted to preserve the marine ecosystem including coral reefs by banning the sale and distribution of sunscreen personal care products containing 'Oxybenzone' and 'Octinoxate' to Hawaii [2].

According to the Korean Cosmetics Act, sunscreen has been defined as 11 types of functional cosmetics prescribed by whitening, wrinkle improvement, skin burn or scattering, hair dye, bleaching, hair loss, skin barrier, hair removal, and hair loss prevention since May 30, 2017 [3]. Sunscreen is a functional cosmetic product that helps prevent skin diseases such as dryness of skin due to photoaging, reduced skin elasticity due to the destruction of collagen and elastin fibers, pigmentation, freckles, and sunspots. In

particular, sunscreen can reduce the cause of basal cell carcinoma and squamous epithelial cell carcinoma, which account for 80% of skin cancer by preventing damage to skin DNA by UVB, and reduce the possibility of skin cancer such as melanoma by UVC [4].

Considering this trend and the direction of future development of cosmetics, it is necessary to develop materials with natural UV protection effect to use sunscreen as an eco-friendly and non-toxic safe cosmetics. One of the most representative natural materials we use to protect our skin from ultraviolet rays are Flavonoids, tocopherols, and vitamins extracted from green tea natural extracts. And antioxidants such as vitamin C, beta-carotene, superoxide dismutase, glutathione peroxidase are also found to be very effective [5].

The purpose of this study is to identify the industry status of UV protection cosmetics, which are used daily cosmetics regardless of age or gender, and to investigate, analyze, and draw conclusions on patent status along with research trends on natural sunscreen materials, and provide the results as basic data for the development of sunscreen products using natural materials.

## 2. Materials and Method

### 2.1. Data collection and Scope

In order to achieve the purpose of this

study, the market size and production performance of sunscreen in the world, major countries including the U.S. and domestic markets were identified through various research reports. In order to analyze the research trends of natural UV protection materials related to skin care, a literature survey was conducted based on the papers published in the last 10 years from 2010 to 2020 and the papers published in domestic academic journals. As with the trend analysis of research papers, related data will be collected, investigated and analyzed based on patents related to natural sunscreen materials registered with the Korean Intellectual Property Office from 2010 to 2020.

## 2.2. Analysis of the Industrial Status of UV Protection Cosmetics

In order to identify the latest trends related to sunscreen, the current status of global markets and markets in major countries such as the U.S., China, Japan, and France was investigated and analyzed based on various research reports and data released by research institutes. And lastly, analyzation of domestic production trends of four major types of functional cosmetics (Whitening, Wrinkle improvement, Sun care, and Multiple functionality) including sunscreen was conducted.

## 2.3. Analysis of Research Trends of Skin-related Natural UV Protection Materials

Researches and analysis on natural UV protection materials based on the dissertation and academic journal thesis published in the last 10 years (2010–2020), which were verified the efficacy of cell protection against UV rays through in vitro experiments, were conducted.

## 2.4. Analysis on the Patents of Skin-related Natural UV Protection Materials

Regarding natural UV protection materials,

the trend of natural UV protection materials in Korea is identified based on the contents registered with the Korea Intellectual Property Office over the past 10 years(2010–2020). The searching keywords were set to 'UV+blocker' and 'UV+blocker+natural' to identify the estimate trend of patent registration in Korea and among patents related to natural UV protection materials listed above, the representative patent that most closely conforms to this study is selected and analyzed.

## 3. Results and discussion

### 3.1. Industrial Status of UV Protection Cosmetics

For sunscreen, it can be classified into three categories: Sun Care and the subcategories Adult Sun Care and Baby and Child Specific Sun Care, and the market size from 2015 to 2017 is shown in (Fig. 1) Sun Care's market size around the world is on a modest growth trend, from 9,745(million dollars) in 2015 to 9,829(million dollars) in 2017. Most of these are accounted for by Adult Sun Care, and Baby and Child Specific Sun Care is smaller than the Adult Sun Care market by less than 10% [6].

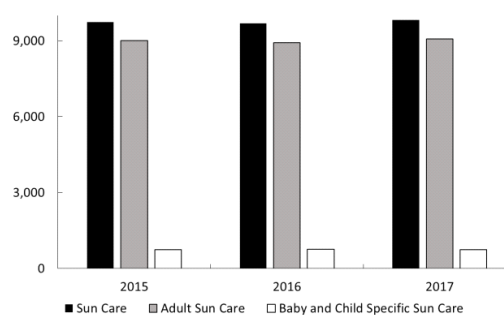


Fig. 1. Worldwide Sun Care Market Size (2015–2017).

In addition, the U.S., China, Japan, and France's representative national sunscreen

survey shows that the U.S. market size is the largest in all years, with an average of 2,025.6(million dollars), followed by China with an average of 836.0(million dollars). France and Japan remain in third place at a similar level, and the difference is minimal. Market trends in each country show that the size of the sunscreen market tends to increase continuously, although there is a slight difference in most countries except France, which is stagnant. In particular, China is showing a very rapid growth trend, prior studies explains the cause of this trend with increased interest in beauty due to the improvement of income levels [7].(Fig. 2)

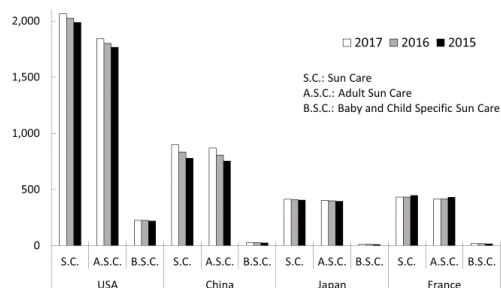


Fig. 2. Sun Care Market Size by Country (2015-2017, Unit: million dollars)

According to the Korea Health Industry Promotion Agency's 2019 Cosmetic Industry

Analysis Report, as of 2018, the market size (production+import-export) calculated using domestic cosmetics production and import/export data rose 6.5 percent year-on-year to KRW 10.401 trillion, while the average annual growth rate (2015-2018) is also showing steady growth at 5.4 percent. In addition, the total production of the domestic cosmetics industry increased 14.7% year-on-year to KRW 15.5028 trillion, and the annual average growth rate (2015-18) in the past four years continued to grow by more than 10% every year. In the case of cosmetics exports, the number of exports increased at a rapid pace every year with 26.5% year-on-year to KRW 6.908 trillion in 2018, and imports also increased 5.4% year-on-year to KRW 1.8064 trillion. As a result, the trade balance in 2018 has tripled in four years since 2015 [8].(Table 1)

In particular, the production performance of multi-functional cosmetics showed an average annual growth rate of about 9.0% over the four years between 2015 and 2018. Production performance in 2018 for single-function products such as whitening, wrinkles, and UV protection increased by 7.8% compared to 2017, which is 2.69 trillion won. On the other hand, production performance of multi-function products in 2018 is estimated to be

Table 1. Cosmetic Industry Analysis(Korea Health Industry Promotion Agency, 2019)

(Unit: million dollars)

Sortation	2015	2016	2017	2018
Market Size	9,072,037	10,042,139	9,769,267	10,401,144
	8,243	9,124	8,876	9,451
Production	10,732,853	13,051,262	13,515,507	15,502,849
	9,752	11,859	12,280	14,086
Export	3,225,267	4,615,410	5,459,384	6,908,101
	2,931	4,194	4,960	6,277
Import	1,564,450	1,606,287	1,713,144	1,806,396
	1,421	1,459	1,557	1,641
Trade balance	1,660,817	3,009,123	3,746,241	5,101,705
	1,509	2,734	3,404	4,635

KRW 2,2873 trillion, down about 3.0% from the previous year [9].(Table 2)

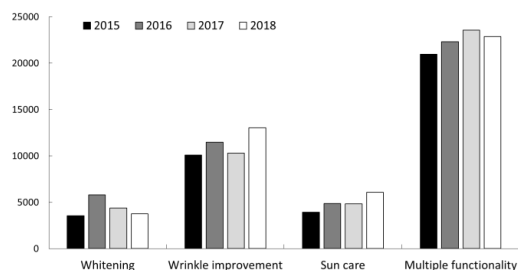


Fig. 3. Productivity Performance of Functional Cosmetics (Ministry of Food and Drug Safety, 2020, Unit: KRW 100 million)

(Fig. 3) compared the production performance of whitening, wrinkle improvement, UV protection, and multi-function products that can check the production performance during the survey period among functional cosmetics [10]. As a result, the items with the highest production performance are multi-function products, which show an overall growth trend, except for a slight decrease in 2018 during the survey period. In the case of wrinkle improvement, which ranks second in production performance, and sunscreen, which ranks third, also tend to increase continuously

for most of the period of the survey, except in 2017, when it showed a tendency to stagnate. On the other hand, whitening has been on the decline overall except in 2017, showing a rather unusual trend comparing to other functional cosmetics.

### 3.2. Research Trends of Skin-related Natural UV Protection Materials

The main natural ingredients for natural sunscreen cosmetics are provided in the law with Camellia genus, Aloe genus, Panax genus, Scutellaria genus, Rosmarinus genus, Citrus genus, Vitis genus, Angelica genus, Achillea genus, Sacchrams genus, etc. [11]. In the academic research information service, 1,904 integrated searches, 531 domestic academic papers, and 659 dissertations were searched with the keywords [UV+block], and 314 integrated searches, 32 domestic academic papers, and 86 dissertations were searched with the keywords [UV+block+natural]. In this study, among the research papers on natural extracts from year 2010 to 2020, experimental papers on skin-related natural sunscreen materials were analyzed and the contents were summarized below.(Table 3)

After checking plant extracts' UV protection (280–400 nm area), 11 types of plant extracts

Table 2. Production Performance of Functional Cosmetics(Ministry of Food and Drug Safety, 2020, Unit: KRW 100 million)

Sortation	2015	2016	2017	2018
Total Sum	38,559	44,439	48,556	49,803
Multi-Function	20,980	22,326	23,565	22,873
Wrinkle improvement	10,087	11,462	10,299	13,050
UV protection	3,934	4,855	4,831	6,077
Whitening	3,558	5,796	4,361	3,758
hair-dyeing			3,916	2,192
Hair loss relief			1,507	1,763
Acne skin relief			60	77
waxing			17	12
Atopic Skin Moisturization			–	–
Stretch Mark Skin Relief				1

were found to have excellent UV protection capabilities, including *Scutellaria baicalensis*, *Humulus lupulus* L., Green tea, licorice, *Ledebouriella seseloides*, Arrowroot, *Graviola*, Wheat sprout, *Morus alba* L., *Sicyos angulatus* L., lacquer, etc. *Scutellaria baicalensis*, *Humulus lupulus* L. and licorice extracts are known for their high antioxidant and excellent UV protection at the same time, and are reported to be better suited for the formation of natural sunscreen when combined with the three [12].

The UV absorption spectrum analysis of Nipa palm, *Molokhia* and Finger root extracts showed UV-regional light absorption peaks in Nipa palm extract and Finger root extract, but the total transmittance measurement showed a similar level of UV-blocking effect as the conventional synthetic blocker Octocrylene. All extracts showed collagenase activity inhibitory efficacy, while Nipa palm extract can be used as antioxidant and wrinkle-improving material, and Finger root extract shows antimicrobial activity and is likely to be used as a preservative material [13].

After manufacturing and experimenting with natural sunscreen by adding shea butter and olive oil-based cream to Green tea extract, which is a natural sunscreen, the optimization of the emulsification process considering UV absorbance was able to be found [14].

The *Silybum marianum* extract has both antioxidant and UV filter functions, which makes it highly valuable to be used as a skin protection component against ultraviolet rays [15].

The cell survival rate of UV rays (UVB) was measured using sorghum extracts and confirmed that it has an effect of not only preventing skin wrinkles due to skin photoaging and natural aging but protecting the skin from ultraviolet rays [16].

Natural sunscreen (BHC-S) with peanut

sprout extracts, *Centella asiatica* extracts, and *ecklonia stolonifera* extracts has been tested and showed an equivalent UV protection effect with the synthetic sunscreen Parsol MCX-XR (OMC). In addition, it was confirmed that these materials have a safety effect on the skin and have a multifunctional effect such as wrinkle improvement [17].

As a result of checking the physiological activity as a functional cosmetic material of *Orostachys Japonicus* extract, it was effective in antioxidant, whitening, and wrinkle improvement and UV protection. And it also showed absorption ability of UVA and UVB with the high possibility as the cosmetics material [18].

It was confirmed that *Leonurus sibiricus* L. extract has protective and antioxidant effects on keratinocytes induced by UV rays, and can be used as a natural anti-aging cosmetics material [19].

*Aralia elata* ethanol extract has a high antioxidant effect, inhibiting inflammation caused by UVB and also inhibiting collagen reduction to protect against skin photoaging [20].

The UV protection effect was measured in the order of mother chrysanthemum, *Inulae flos*, and *carthami flos*. Especially *Chrysanthemum indicum* L. extract has excellent tyrosinase inhibitory effect and has high UVC, UVB blocking effects harmful to the human body, so it can be used as a material for functional whitening cosmetics and sunscreen. [21].

According to the UV rays(UVB) induced skin aging inhibitory activity of *Lespedeza Cuneata* extract, it reduces the inflammatory response of the skin and increases the oil and water content to prevent damage to the skin barrier, increasing the activity of antioxidant enzymes [22].

Table 3. A Study on Natural UV Protection Materials(2010–2020)

Author	Year	Academic Journal	Thesis title	Research content
J. S. Moon	2020	Journal of the Korean Applied Science and Technology	Development of natural sunscreen using plant extracts	Natural UV Protection
Y. J. Jeon	2020	A doctoral dissertation at Dongduk Women's University	Functional Characterization of Extracts from Nipa palm, Molokhia, and Finger root and Their Application to Cosmetics	UV protection, antioxidant, wrinkle improvement, antibacterial
S. B. Lee	2020	Appl. Chem. Eng	Emulsification of Natural Sunscreen with Green Tea Extract : Optimization Using CCD-RSM	UV protection
D. H. Kim	2019	J. Soc. Cosmet. Sci. Korea	Photoprotective Effects of Silybum marianum Extract	Antioxidant, UV Filter
Y. J. Jeon et al.	2019	Journal of the Korean Applied Science and Technology	Functional Characterization of the Extracts from Nipa Palm, Molokhia, and Finger Root for Cosmetic Ingredients[23]	Antioxidants, anti-wrinkle, UV Protection, antibacterial agents
J. H. Lee	2018	A Ph.D. thesis at Konkuk University Graduate School	Effects of Sorghum ( <i>Sorghum bicolor</i> Moench) Extracts on Anti-inflammatory, Anti-aging, and Ultraviolet Protection	Anti-inflammatory, anti-aging (optical aging), UV protection
C. Kim, et al.	2017	J. Soc. Cosmet. Sci. Korea	Development of Multifunctional Natural Sunscreen (BHC-S) Having Sunscreening and Anti-wrinkle	UV protection, Wrinkle improvement
J. Y. Hyun	2017	Master's thesis at Inje University Graduate School	Bioactive properties of <i>Orostachys japonicus</i> extracts as functional cosmetic materials	Antioxidant, whitening, Wrinkle improvement, UV protection
T. Y. Kim et al.	2016	Korean J. Plant Res.	Antioxidant and Protective Effects of <i>Leonurus sibiricus</i> L. Extract on Ultraviolet B (UVB)-induced Damage in Human Keratinocytes	Antioxidant, UV protection, Anti-aging
J. W. Yang et. al.	2016	Journal of Nutrition and Health	Inhibitory effect of <i>Aralia elata</i> ethanol extract against skin damage in UVB-exposed human keratinocytes and human dermal fibroblasts	Antioxidant, UV protection, Anti-aging
M. R. Han	2013	A Ph.D. thesis at Daegu Oriental Medicine University	study on the physiological activities of the compositae three species extracts ( <i>inulae flos</i> , <i>chrysanthemi flos</i> , <i>carthami flos</i> )	Antioxidant, Whitening, UV protection
H. J. Kim et al.	2012	J Korean Soc Food Sci Nut	Inhibitory Effects of <i>Lespedeza cuneata</i> Ethanol Extract on Ultraviolet-Induced photoaging	Antioxidant, UV protection, Anti-aging

### 3.3. Patents Trends of Skin-related Natural UV Protection Materials

Sunscreen is a functional cosmetic product that disperses and absorbs UV rays and is divided into inorganic and organic sunscreen. The components of sunscreen include octocrylene, ethylhexylmethoxinamate, ethylhexylsalicylate, ethylhexyltrizone, jinkoxide, titanium dioxide, and other sunscreen

compounds [24].

In order to find out the patent trends of sunscreen, specific keywords were proposed in KIPRIS, and 4,793 items were found in the case of the keywords [UV+blockers] and 2,532 items found in case of the keywords [UV+blockers+natural] over the 10 years of 2010–2020. In particular, the number of patents in 2017–2020 tends to surge compared

to the previous period, which can be inferred from the awareness of the importance of health and eco-friendly in quality of life and consumption activities, and this trend is also applied in the field of materials for cosmetics.(Fig. 4)

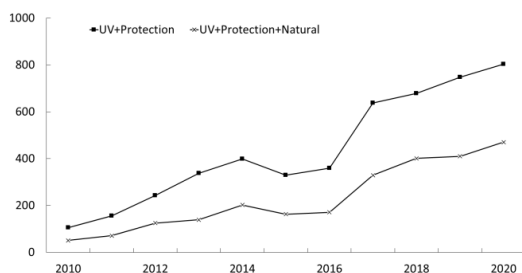


Fig. 4. Patents Count Annual Trend by Keywords.

In this study, we selected and described a typical patent case in the table among the patents with natural UV protection materials that meets the purpose of this study, except for such patents as pure technology or formulation production of sunscreen.(Table 4)

Overall patent registration shows some consistent trends: First, most of them are patented using natural UV protecting ingredients extracted from plants such as chamomile and lily or from sea weeds such as brown seaweed and chlorella. Second, most of the patents are mainly intended to be used as a composition of cosmetics, especially as sunscreen. Third, most applicants are composed of industry-academic cooperation groups belonging to universities(11 cases) or cosmetics companies(9 cases). and fourth, the number of registrations in the past three years accounted for 61.9% of the 10 years of survey period (7 out of 21 patents registered in 2020, 3 in 19 and 3 in 2018), and this trend has become stronger recently.

## 4. Conclusion

In this study, the current status of domestic and foreign industries, related research trends, and patent status of natural sunscreen materials related to skin beauty were investigated, and the results of the study were as follows.

First, in the case of sunscreen, the U. S. market has the largest one, accounting for about 21% of the global market, and the Chinese market has recently grown rapidly. In addition, according to the trend of domestic production of four major types of functional cosmetics(Whitening, Wrinkle improvement, Sun care, and Multiple functionality), the No. 1 product is multiple functional products, followed by wrinkles, sunscreen, and whitening. Both global and domestic markets are continuously growing in size of UV protection markets.

Second, the research trends of the natural UV protection materials which have been investigated and analyzed based on experimental papers published in the last 10 years(2010–2020) shows that *Scutellaria baicalensis*, *Humulus lupulus* L., licorice, Finger root, Green tea, *Silybum marianum*, Peanut sprout, *Centella asiatica*, *Ecklonia stolonifera*, *Orostachys japonicus*, *Leonurus sibiricus* L., *Aralia elata*, *Inulae flos* and *Carthami flos*. *Chrysanthemum indicum* L., *lespedeza cuneata* extract have UV effects. In particular, these extracts are a high-safety natural material, which has the effect of UV protection, as well as the effect of inhibiting photo-aging, anti-inflammatory, antibacterial, whitening, and wrinkle improvement.

Third, after verifying the patent registration status of UV protection materials over the past 10 years, the number of registration continues to increase, and among them, patents using



Table 4. Typical Patent Cases with Natural UV Protection Material [25]

Registration number	Registration Year	Name of invention	Applicant
10-2167111-0000	20.10.12	A composition for producing zinc nanocomposites comprising Dendropanax Morbifera extracts and the use thereof	Kyung Hee University Industry-Academic Cooperation
10-2156750-0000	20.09.10	Cosmetic composition comprising wood flour for scattering or reflecting UV radiation	Dongguk University Industry-Academic Cooperation
10-2093201-0000	20.03.19	A cosmetic composition for sun protection using karanja oil and Tamanu oil	Daegu Korean Medical University Industry-Academic Cooperation
10-2092595-0000	20.03.18	Cosmetic composition for UV screening comprising chlorella extract as an active ingredient	Neo-Nbiz, Inc.
10-2083718-0000	20.02.25	A cosmetic composition for sunprotection using a chamomile essential oil	Daegu Korean Medical University Industry-Academic Cooperation
1021729280000	20.10.27	Cosmetic composition having an improved UV blocking effect comprising the extract of eugenia caryophyllus bud	East Hill Inc.
1021328170000	20.07.06	Composition for protecting skin against ultraviolet ray comprising malonic acid from pine needle as effective component	Chosun University Industry-Academic Cooperation
1020542730000	19.12.04	A cosmetic composition for UV protection containing barley or colored barley extract	Jeju National University Industry-Academic Cooperation
1020306790000	19.10.02	Sun screen composition comprising Panax ginseng polysaccharide and Green tea polysaccharide	Amore Pacific
1020153000000	19.08.22	Cosmetic composition comprising actinidia polygama extract for absorbing UV or protecting skin from UV	Korea Institute of Science and Technology
1018858030000	18.07.31	A cosmetic composition for UV protecting antioxidating and whitening comprising extracts of novel endolichenic fungi	Sunchon University Industry-Academic Cooperation
1019042150000	18.09.27	A composition for antioxidating and blocking UV comprising extracts of jujube seed	Human Cosmetics, Inc.
1018224140000	18.01.22	Composition for preventing or treating UV induced skin damage containing extract of oenantae Javanica	Hallym University Industry-Academic Cooperation
1018156500000	17.12.29	A method for preparing UV screening nanocapsules comprising Poria cocos extract	Kyungbuk National University Industry-Academic Cooperation
1016017770000	16.03.03	Cornus walteri leaf extract for improving the photo-stability of sunscreen agent and cosmetic composition for UV screening containing the same	Saimdang Cosmetics Co., Ltd.
1014778910000	14.12.23	A Composition of Platanus orientalis L extract for anti whitening, wrinkle, aging	Hanul Life Sciences Co., Ltd.
1014617040000	14.11.07	Composition for protecting skin and inhibiting damage of skin against UV Comprising Polysiphonia morrowii Harvey	Jeju National University Industry-Academic Cooperation
1013265560000	13.11.01	Cosmetic composition for ultraviolet-proof containing the extract of Sanguisorba officinalis and V. linariaefolia	Derma Lab, Inc.
10-1148978-0000	12-05-16	Cosmetic composition for blocking UV-A comprising extract of gracilariopsis chorda	Adena, Inc.
1010170920000	11.02.16	UV Protection Composition Containing Lily Extract and Preparation Method of the Same	Industry-Academic Cooperation of Soonchunhyang University
10-0992088-0000	10-10-29	Cosmetic composition containing natural plant extracts with X-ray protecting effect	Cosmecca Korea Co., Ltd.

natural materials have been rapidly increasing in the past three to four years. Most of the patents use natural UV protection ingredients extracted from natural plants and seaweeds, and applications were made by cosmetics companies and university industry-academic cooperation groups for the purpose of using them as cosmetics or sunscreen.

Research on natural UV protection materials for skin care is on the rise in line with global trends that value health and quality of life. If safe and effective natural materials are continuously developed through further research to ensure the diversity and usefulness of materials, it is believed that various types of multi-functional cosmetics using natural materials will be possible and will contribute to the improvement of quality of life.

## References

1. S. Y. Park, "A Study on Recognition, Current Use and Satisfaction with Natural Cosmetic Products", *Sungshin Women's University*, p. 9, (2020).
2. State of Hawaii, "The Seventy-Ninth Legislature", 2018, S. B. NO. 2571. 2020, [https://www.capitol.hawaii.gov/session2018/bills/SB2571\\_.HTM](https://www.capitol.hawaii.gov/session2018/bills/SB2571_.HTM). (accessed Jan., 27, 2021)
3. National Legal Information Center, <https://www.law.go.kr/>, *Functional Cosmetics Act*. (accessed Jan., 22, 2021)
4. Y. J. Jeong, Y. H. Pyo, "Practical Cosmetology", *Kuminsa*, pp. 16-17, (2017).
5. H. Im, "The Developmental Trend & Future Prospect Of The Functional Cosmetics Market", *Chung-Ang University*, p. 49, (2004).
6. Korea Health Industry Promotion Agency. "2019 Cosmetic Industry Analysis Report", pp. 29, (2019).
7. Korea Health Industry Promotion Agency. "2019 Cosmetic Industry Analysis Report", pp. 31-37, (2019).
8. Korea Health Industry Promotion Agency. "2019 Cosmetic Industry Analysis Report", p. 42, (2019).
9. Ministry of Food and Drug Safety. "Functional Cosmetics production performance", p. 7, (2020).
10. Ministry of Food and Drug Safety. "Functional Cosmetics production performance", p. 7, (2020).
11. Ministry of SMEs and Startups. "Small and Medium Business Technology Roadmap", (2018-2020).
12. J. S. Moon. "Development of natural sunscreen using plant extracts", *Journal of the Korean Applied Science and Technology*, Vol.37, No.5, pp. 1138-1150, (2020).
13. Y. J. Jeon, "Functional Characterization of Extracts from Nipa palm, Molokhia, and Finger root and Their Application to Cosmetics", *Dongduk Women's University*, p. 70, (2020).
14. S. B. Lee, Chengliang Zuo, Yang Xu, and In Kwon Hong, "Emulsification of Natural Sunscreen with Green Tea Extract : Optimization Using CCD-RSM", *Applied Chemistry for Engineering*, Vol.31, No.5, pp. 532-538, (2020).
15. D. H. Kim, W. R. Bae, Yun-Sun Kim, Dong-won Shin, Sun-Gyoo Park, and Nae-Gyu Kang, "Photoprotective Effects of Silybum marianum Extract", *Journal of Society of Cosmetic Scientists of Korea*, Vol.45, No.2, p. 215, (2019).
16. J. H. Lee, "Effects of Sorghum (*Sorghum bicolor* Moench) Extracts on Anti-inflammatory, Anti-aging, and Ultraviolet Protection", *Konkuk University*, (2018).
17. C. Kim, S. B. Jeong, G. H. Im, M. H. Kang, J. H. An, J. H. Kim, H. Lee, "Development of Multifunctional Natural Sunscreen (BHC-S) Having Sunscreening and Anti-wrinkle", *Journal of Society of Cosmetic Scientists of Korea*, Vol.43, No.4, p. 321, (2017).
18. J. Y. Hyun, "Bioactive properties of

- Orostachys japonicus extracts as functional cosmetic materials”, *Inje University*, p. 50, (2017).
19. T. Y. Kim, S. A. Jang, Y. B. Chae, J. P. Park, “Antioxidant and Protective Effects of Leonurus sibiricus L. Extract on Ultraviolet B (UVB)-induced Damage in Human Keratinocytes”, *Korean Journal of Plant Resources*, Vol.29, No.1, p. 18, (2016).
  20. J. W. Yang, C. S. Kwak, “Inhibitory effect of Aralia elata ethanol extract against skin damage in UVB-exposed human keratinocytes and human dermal fibroblasts”, *Journal of Nutrition and Health*, Vol.49, No.6, p. 435, (2016).
  21. M. R. Han, “Study on the physiological activities of the compositae three species extracts (inulae flos, chrysanthemi flos, carthami flos)”, *Daegu Oriental Medicine University*, p. 97, (2013).
  22. H. J. Kim, K. S. Kim, D. I. Kim, “Inhibitory Effects of Lespedeza cuneata Ethanol Extract on Ultraviolet-Induced Photo Aging”, *Journal of the Korean Society of Food Science and Nutrition*, Vol.41, No.1, p. 1544, (2012).
  23. Y. J. Jeon, S. H. Lee, S. J. Heo, B. S. Jin, “Functional Characterization of the Extracts from Nipa Palm, Molokhia, and Finger Root for Cosmetic Ingredients”, *Journal of the Korean Applied Science and Technology*, Vol.36, No.3, pp. 821 – 829, (2019).
  24. KOTRA, “2018 Global Market Report”, p. 26, (2018).
  25. KPRIS, <http://www.kipris.or.kr>. (accessed Jan., 27, 2021)