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Phytocosmetics: A literature review

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Abstract

Phytocosmetics, cosmetic products containing active ingredients of plant origin, have been used for beauty and hygiene purposes by ancient civilisations and continue to arouse interest in modern times.

This study aims to define the term "phytocosmetics" on the basis of official regulatory sources, assess the state of the literature on phytocosmetics, present examples of natural active ingredients and highlight the advantages and limitations of their use in cosmetics.

The literature search was conducted in PubMed, Google Scholar and Science Direct, and revealed a relatively small number of articles on phytocosmetics despite the long-standing traditional use of plant ingredients. Although there is no official definition of phytocosmetic products, the term can be understood as cosmetic products containing components of plant origin. Examples of natural active ingredients with various benefits for the skin and hair were presented, focusing mainly on polyphenols and flavonoids.

Phytocosmetic products offer advantages over synthetic chemicals, including avoiding endocrine disruption and promoting sustainability through the use of agricultural waste. However, barriers such as the low bioavailability and chemical instability of some plant ingredients require innovative delivery systems, and the use of organic solvents can be mitigated by environmentally friendly extraction techniques.

Specific regulatory guidelines for phytocosmetic products are lacking, requiring the establishment of science-based quality and safety standards. Further research is needed to understand the potential adverse effects and mechanisms of action of plant-derived ingredients on the skin.

Keywords: Phytocosmetics; Polyphenols; Flavonoids; Active ingredients; Quality standards

1. Introduction

Phytocosmetics are not new to human kind. They have been used for centuries by ancient civilizations for beauty and hygiene purposes. The Egyptians were fervent users of such products, some of which are still used to this day (1), (2).

Products made from natural ingredients are slowly regaining interest due to the recent allegations made against synthetic chemical products and their harmful effects on overall health and environment. The claims directed towards these products are worrying as they are considered to be endocrine disruptors that can have harmful effects on human health (3).

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The resurgence of natural products is not surprising. Humans have been turning to nature for remedies since the dawn of times (4), (5).

From entire plant organs (leaves, flowers, seeds), to extracts (fixed oils, gels, essential oils) to specific phytochemicals (flavonoids, tanins), plants are particularly interesting for their different benefits on skin and hair (2).

Objectives

- Define the meaning of the word “phytocosmetic” according to official regulatory sources.
- Determine the state of the literature in regards to phytocosmetics.
- Showcase some examples of natural active ingredients found in phytocosmetics.
- Outlining some benefits and some limitations of using natural active ingredients in phytocosmetics.

2. Material and methods

To achieve the aims cited above, a literature research was conducted in the following scientific journals: PubMed, Google Scholar and Science Direct on June 2023.

- The keyword used was “phytocosmetics” and the study was performed from 1995 to 2023.
- The inclusion criteria used were: articles relevant to the topic of research and original articles.
- The exclusion criteria used were: duplicated articles, non-English articles and irrelevant articles.

3. Results and discussion

3.1. Official definition of phytocosmetics

The first step in studying these products was to define them, for this purpose the word “phytocosmetic” was entered in the search bar of different official websites both national and international:

- Official Journal of The Popular and Democratic Republic of Algeria (OJPDR),
- World Health Organization (WHO),
- Food and Drug Administration (FDA),
- European Committee (EC).

The outcome of this research was that there is no official definition of this word. Therefore, it can be concluded that “phytocosmetics” seem to fall under the category of cosmetics thus fitting the same classification criteria and the same regulatory demands.

In Algeria, cosmetics and personal care products are defined by the Executive Decree No. 97-37 as: “any substance or preparation, other than a drug, intended to come into contact with the various superficial parts surface parts of the human body, such as epidermis, hair and capillary system, nails, lips, eyelids, teeth and mucous membranes, to clean them, protect them, maintain them in good condition, modify their appearance, to perfume them or to correct their odor”.

The word “phytocosmetic” can be divided into two parts: the first being phyto, which relates to plants, and the second being cosmetic (see definition above).

Therefore, phytocosmetics can be defined as cosmetics that contain plant ingredients in their formulation.

3.2. Phytocosmetics in literature

Table 1 Number of articles found in the literature during specific timelines

Scientific Journal	Timeline	Results
PubMed	2002-june 2023	18 results
Science Direct	1995-june 2023	66 results
Google Scholar	2000-june 2023	182 results

The number of articles found for each scientific journal, for the word “phytocosmetic”, is shown in the table above (Table1).

These results show that the number of articles on phytocosmetics as a topic of scientific research is not very high. It is a relatively new area of interest despite nature being the first resource humans turned to find remedies for dermatological problems and for ingredients to be harnessed for their beautifying abilities. The lack of scientific papers on the subject can be due to the consumer that relies on traditional use of plant ingredients that is passed down from generation to generation without being documented.

It can also be explained by the absence of a definition for the word “phytocosmetic”, articles containing this keyword in the title are relatively low. The number of articles found does not represent the actual state of the literature regarding these products.

Many articles have studied cosmetic products containing plant ingredients. However, the word “phytocosmetic” did not appear in the title.

The main types of studies performed on phytocosmetics were found to be:

- Ethnobotanical studies: focusing on a certain region and the plants used by its inhabitants;
- Polyphenols mainly for their antioxidant activity;
- Specific plants, their chemical composition and their -potential- use as phytocosmetics;
- Formulations that contain herbal ingredients;
- *In vitro*, *in vivo* as well as clinical evaluations of products containing natural active ingredients.

3.3. Examples of natural active ingredients found in phytocosmetics:

There are many plants that have been used for centuries for their properties but are only now being evaluated in order to understand their target and their mechanism of action.

In this paragraph, some plants and parts of plants are cited to demonstrate the various applications they can have. They are not listed in any specific order nor importance.

The formulation of plant metabolites into cosmetics is attributed to their different benefits as: anti-oxidant, photoprotective, anti-aging, anti-microbial, anti-inflammatory, moisturizing, hyperpigmentation treatment and are also used for their skin repair and wound healing activities.

Examples for these benefits are illustrated in the table below

Table 2 Examples of natural active compounds and their cosmetic benefit

Cosmetic benefit	Examples
Sun protection	Silymarin extracted from <i>Silybum marianum</i> (6).
	Linarin extracted from <i>Buddleja scordioides</i> (6).
	Quercetin and rutin extracted from <i>Moringa oleifera</i> (6).
	Anthocyanins extracted from raspberry and blueberry (they showed one of the highest SPF of all plant extracts cited above) (6).
	Ellagic acid extracted from <i>Psidium guajava</i> (7).
	<i>Aloe vera</i> leaf extract (8).
Anti-inflammatory	Polymethoxyflavones from the plant <i>Kaempferia parviflora</i> (6).
	Galangin extracted from <i>Alpinia galanga</i> (L.) Willd (6).
	Epicatechin and gallic acid extracted from <i>Eugenia brasiliensis</i> (9).
Anti-aging	Taxifolin extracted from <i>Stizolophus balsamita</i> . Iwona (6).

	Flavonoids extracted from <i>Nymphaea lotus</i> L, <i>Ginkgo biloba</i> L, <i>Rhodiola rosea</i> L., <i>Vitis vinifera</i> L., and <i>Camellia sinensis</i> Kuntze (6).
	Polysaccharides from <i>Panax ginseng</i> (10).
	Triterpenoids from <i>Eriobotrya japonica</i> (10).
Hyperpigmentation treatment	Polymeric proanthocyanidins and phenolics from <i>Betula pendula</i> Roth leaves (11).
	Brazilin, 4-O-methylsappanol and other compounds from <i>Caesalpinia sappan</i> L (11).
	Safflomin A and safflomin B from <i>Carthamus tinctorius</i> L (11).
	Cedrol and widdrol from <i>Juniperus chinensis</i> L (11).
	Oxyresveratrol from <i>Morus alba</i> L (11).
	Macelignan from <i>Myristica fragrans</i> Houtt (11).
	Punicalgin from <i>Punica granatum</i> L (11).
	7a-methoxyrosmanol and isorosmanol from <i>Salvia officinalis</i> L (11).
Anti-greasy	Green tea or <i>Camellia sinensis</i> (L.) Kuntze (12).
Skin repair and wound healing	Steroidal metabolite from <i>Narcissus pseudonarcissus</i> L (13).
	Palmitoleic acid present in sea buckthorn oil from <i>Hippophae rhamnoides</i> (14).

For the table shown above (Table2), most of the cited biomolecules are polyphenols. Also, the screening of literature showed a particular interest in flavonoids. They are the leading compounds that are being studied for their various effects on skin and hair that are highly sought after by the cosmetic industry.

3.4. Benefits of using phytocosmetics

The renewed interest in natural phytocompounds for cosmetic use is justified by some of the following advantages:

- Avoiding the negative health effects of synthetic chemical substances especially their endocrine disrupting activity causing hormonal imbalances. Their impact on human health is significant, they affect the reproductive system, they cause metabolic disorders, they can lead to neurological issues and they can disrupt the hypothalamic-pituitary-gonadal axis (15), (16), (17), (18), (19).
- Sustainability is also a concern in the cosmetic industry. It can be achieved by using waste materials derived from agriculture in the formulation of phytocosmetics (20), (21).

3.5. Obstacles in implementing phytocosmetics and potential solutions

The study that has been lead has revealed some obstacles that may limit the process of harnessing the active ingredients needed for the formulation of phytocosmetics:

- Some active plant ingredients have a low bioavailability, are chemically instable and are have low water solubility. To mend this issue, certain delivery systems can be used to enhance the already discussed properties to obtain a safer and more efficient phytocosmetic (22).
- Use of organic solvents to extract herbal active ingredients which complicates the formulation and presents a toxicity risk by using plants extracts directly in humans. One solution for this issue is introducing green extractions as an alternative by using less harmful solvents, such as deep eutectic solvents (23), (24).
- The lack of regulatory guidelines limits the safe and controlled use of phytocosmetics. To alleviate this issue, regulatory standards should be based on scientific data to ensure the quality and absence of toxicity in the phytocosmetic product (3).
- Some natural products cannot meet the requirements of consumers because some chemical substances do not have natural alternatives yet (25).

4. Conclusion

The conducted review has showed that herbal ingredients are not only used for their benefits on skin and hair but also for their sustainability and their contribution to a greener cosmetic industry.

It was concluded that there are not any regulatory standards specific to phytocosmetics and it was noted that a set of guidelines should be put in place to guarantee the safety and the quality of the products.

Plants have a plethora of active ingredients to offer but there is insufficient data regarding their potential adverse effects on the skin and their mechanism of action on this organ.

Compliance with ethical standards

Disclosure of conflict of interest

The authors and all co-authors declare that they have no conflicts of interest in connection with this document, and the material described is not in the process of being published nor is it intended for publication elsewhere.

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