International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 11 | Nov 2020 www.irjet.net p-ISSN: 2395-0072

PLANT DERIVED SURFACTANTS USED IN COSMETICS FORMULATIONS

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Abstract - *Increased environmental awareness with different important factors of life like food, drug, Cosmetics and clothing having concern. Natural surfactants are naturally available substances present in plants and animal sources. Plants have the capacity to synthesize almost unlimited number of substances. Generally, any part of plant contains the various active ingredient. As consumer become more aware of ingredients in the product they put on their skin and use in their homes. Infact, there are numerous choices for natural surfactants in cosmetics and they work to improve the integrity and performance of cosmetic formulations. Surfactant properties play significant roles in industrial and consumer products including detergents, paints, cosmetics, pharmaceuticals and paper products etc. The ever-increasing environmental concern in relative to surfactant triggers an attention in natural surfactants. This review articles covers natural surface active agents derived mainly from plant origin, especially different parts of plants such as leaves, flowers, barks, fruits etc. Plant derived surfactants have great advantages as an eco-friendly alternative to synthetic surfactant.*

The study showed that surfactant produced from some plants are less harmful to the environment but a good scientific approach to preserve the quality of our life as well as cosmetic products.

Key Words: **Surfactants, eco-friendly, environmental awareness**

1. INTRODUCTION

An increasing trend in the food, pharmaceutical, and cosmetic industry is the utilization of natural plant extracts or plant-derived compounds, as an alternative to the application of chemical. Plants have the ability to synthesize an almost limitless array of substances. There are approximate 250,000–500,000 species of plants on Earth. A moderately small percentage (1–10%) of these is consumed as food by both humans and animal species. It is possible that a greater number are used for medicinal purposes[1].The word surfactant is an abbreviation of the term Surface active agents having dual characteristics of hydrophilicity and hydrophobicity and it itself suggests the surface active environment of these course of compounds and their tendency to adsorb at interfaces. The polar portion exhibits a strong affinity or attraction towards polar solvents and it is often called hydrophilic part.A polar part is called hydrophobic having attraction towards oil.[2] The effectiveness of a surfactant is determined by its efficiency to reduce the surface tension. More efficient surfactants have a lower critical micelle concentration (CMC).Most of these compounds are of synthetic origin and potentially bring out environmental and toxicology problems due to its recalcitrant and persistent nature. So at present, the attention is on the alternative environmental friendly process for the production of different type of natural-surfactants or bio surfactants. [3] Among different compounds derived from plants, saponins deserve a special mention. These chemicals may be considered as a part of plants' defense systems. They have been included in a large group of protective molecules found in plants named 'phytoanticipins' or 'phytoprotectants. The physiochemical and biological property of saponins have led to a total of traditional and industrial applications. They have traditionally been used as natural detergents. The mixture of a hydrophobic aglycone backbone and hydrophilic sugar molecules confers foaming and emulsifying properties of saponins. [4]

The carbon chains of natural surfactants are all the time linear and even numbered and it is rapidly biodegradable. As consumers are becoming more eco-conscious and aware about to preserve the qualities of value added costly fabrics use of harmful synthetic product is sure to be changed. Creating awareness and explore about the sources natural surfactant. [5]

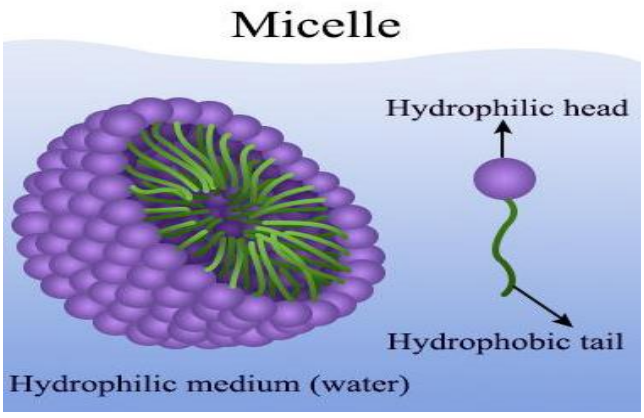

Fig. 1: Micelle formation [6]

Types of surfactants

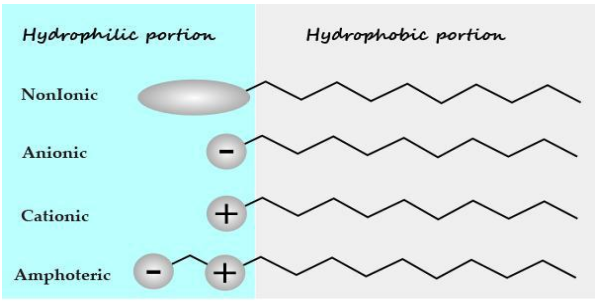

Fig. 2: Categorization of surfactants [7]

1.1 Anionic surfactants

They increase to a negatively charged surfactant ion upon dissolution in water. This is the mainly widely used category of surfactant for laundering, dishwashing liquids and shampoos because of its excellent cleaning properties. [7]

1.2 Cationic surfactants:

In solution, the top is positively charged. They are excellent 3 emulsifying agents. These surfactants have also been found to be excellent bactericides and a few find uses as topical antiseptics. Their germicidal properties formulate them especially helpful in bathroom and hand sanitizers. Cationic surfactants are involved to negatively-charged sites; they can bind to these site and provide the fabric with a soft, comfortable feel. Due to this cause, they are frequently used as fabric softeners.

1.3 Zwitterionic surfactants

Zwitterionic surfactants also well-known as amphoteric surfactants have together cationic and anionic centers attached to the same molecule. Zwitterionic surfactants are less frequent than anionic, cationic and non-ionic ones. These surfactants are extremely mild, making them mainly suited for use in personal care and household cleaning products. These surfactants can contain two charged groups of dissimilar sign. These surfactants have excellent dermatological properties. They are commonly used in shampoos and other cosmetic products, and as well in hand dishwashing liquids because of their high foaming properties. [8]

1.4 Non-ionic surfactants

Surfactants so as to do not ionize in aqueous solution, due their hydrophilic collection are of a non-dissociable type. These surfactants do not have an electrical charge, which make them resistant to water rigidity deactivation. They are excellent grease removers that are used in laundry products, household cleaners and hand dishwashing liquids. [9]

2. Test for presence of natural surfactant in plants:

Mainly two tests are used for the presence of saponinin plants and animals.

–Persistent foam test in acidic solution.

–Blood hemolytic test.

Both tests are done by TLC (Thin layerchromatography) and PC (Paper chromatography) methods of separation (Harborne, 1973). [10]

2.1 Formation of foam:

The formation of persistent foam during plantextraction is the reliable evidence for presence of saponin.1ml. of water extract or alcoholic extract separate with 2ml[10] of distilled water. Shake it for 15 min. One centimetre layer of foam indicates saponins.

2.2 Homolytic test:

In a glass slide one drop of blood is placed and then plant extract is added. If hemolytic zone is appeared it will prove the presence of natural saponin. [11]

3. Use of natural surfactant:

3.1 Cosmetics uses:

Cosmetics product as wetting agent, for reducing surface tension, foaming agent, emulsifying agent, detergency phenomenon etc.

3.2 Medicinal uses:

To develop immune system against diseases: decrease blood lipid, improve bone health, lower colon cancer risk , promote healing of skin injuries, enhance brain functions, inhibition of dental caries and platelet aggregation, treating malaria, to treat eczema, helpful in female reproductive health, synthesis of hormones, prevention of swine flu, cholesterol reduction, penetration of micro molecule through cell membrane etc.

3.3 Textile processing:

Natural surfactant is used to eliminate the impurities from raw material such as cotton, wool and silk. It is used as alubricant, desizing agent, scouring agent, leveling agent, bleaching assistant. For dyeing purpose, natural surfactant is mostly need for - cellulose dyeing, polyester dyeing, acrylic fiber dyeing and as a dispersing agent.

Common name	Botanical name
Agave (Som) Century plant	*Agave americana*
Alfalfa	*Medicago sativa*
Aloe barbadenosis	*Aloe vera*
Amarantha	*Amaranthus spinosus*
Asparagus (fern)	*Asparagus officinalis*
Balloon flower	*Platycodon granditonem*
Bonponial	*Miliusa roxburchiana*
Broom weed	*Gulierrezia* sp.
Ber	*Ziziphus jujuba*
Chalkonari	*Thevetin paraviann*
China rose	*Hibiscus rosa sinesis*
Christmas rose	*Helleborus niger*
Corn cockle	*Agrostemma githago*
Cow cockle	*Saponaria vaccaria*
Daisy	*Bellis perennis*
Desert date	Balanities
Dhatura	*Datura stramonium*
Fagaceae (Korash)	*Castanopsis armata* (Spach)
Fenugreek	*Trigonelia foenum graecum*
Figwort	*Scrophuloria nodosa*
Ginseng	*Panax araliaceae*
Horse chestnut	*Aesculus hippocastanum*
Jarmoni bon	*Chromolaena odorata*
Keharaj	*Eclipta alba*
Maple	Aceraceae
Oat	*Avena sativa*
Chickpea	*Cicer arientinum*
Peppers	*Piper nigrum*
Red onion	*Allium cepa* L. var. *tropea*
Safed musli	*Chlorophylum borvillianum*
Shikakai herb	*Acacia concinna*
Snake venom	*Arstolochina* sp.
Soapbark	*Quillaja saponaria*
Soapnut/ soap herry	*Sapindus mukorossi*
Soapwort	*Saponaria officinalis*
Spinach	*Spinacea oleracea*
Tea	*Camellia ossamica*
Tomato	*Lycopersicon esculentum*
Wild yam	*Dioscorea* sp.
Yucca	*Yucca schidigera*

Table 1: Commonly available natural surfactants in plants [10]

4. Common method of extraction of natural surfactant

Boil a surfactant containing part (10-15 shells) for 5-10 min in a container of water. After it cools the part is removed and poured it in a plastic or glass container and refrigerated it, without using any chemical. This liquid can be used to spray on plants for cleaning purpose, jewellery polish, as natural pesticides and to repel insect.

4.1 Natural surfactants:

Out of the enlisted sources of natural surfactants, details information on few plants which contain highest amount of saponin is given below-

4.1.1 Soapnut

A soapnut tree produces hundred kilos of berries each year. They are sometimes called wash berry or washnut. The dried nuts look like soft walnut. It contains highest amount of saponin (14%) having cleaning properties. They are naturally hypo-allergic, odourless and do not damage the surface of any material. The small berry is approximately 2-2.5cm in diameter that are deseeded and shell is dried before used. [11]S. mukorossi is a ordinary plant available at different places in India. The plant is broadly used in cosmetic preparation similar to shampoos and cleansers. It is reported to contain mainly oleanane, dammarane and tirucullane type saponins. These were isolated from the galls, fruits and roots of Sapindus mukorossi. [12]

4.1.2 Soapbark

Quillaja saponins have been employed in the food industry as emulsifiers for beverages and food additives. In the cosmetic industry, they have been used as antidandruff, cleansing, emulsifying, foaming, masking, moisturizing, skin conditioning, and surfactant agents. The European Commission of Cosmetic Ingredients (CosIng) record has scheduled some Quillaja products as cosmetic ingredients, such as the bark, bark extract, root extract, and wood extract.

4.1.3 Soapwort

Is resident to Europe and Western to Central Asia and cultivated in lots of countries throughout the world. Soapwort contains large amounts of saponin which froth when extracted using water. S. officinalis has been as well known for the detergent property and used to make soap since ancient times. In folk medicine, it is also used for skin complaints and rheumatic disorders. [13]

4.1.4 Shikakai Herb

The pod of A. concinna contains a number of saponins, highly polar compounds, such as prosapogenol, and monoterpene glycoside in various parts of the plant. The structures of some triterpene genins and prosapogenins were found. The bark and pod in addition contain high levels of saponins which are foaming agents, a natural surfactant. In the

northern part of Thailand, the locals use the pods of Sompoi as one ingredient of Thai traditional holy water to sacrifice for senior people. In India, the fruits are used as a traditional shampoo, and the saponins from the pods are also traditionally used as a natural detergent. [14]

4.1.5 Ginseng

Nonionic surfactants were extracted from ginseng. The removal of these surfactants from the plant was finished by soxhlet. After the removal, we used FT-IR spectroscopy for characterization of extracted saponin. [15] Steroide saponin & triterpenoide saponin are commonly found saponins in ginseng .[16]

5. CONCLUSION

Finding natural surfactants to use in ordinary cosmetic formulations continues to be a challenge. The choices are limited and the ensuing product aesthetics are not nearly as good as what synthetic formulations have to present. Natural surfactants are easily available with cheap cost and having a lot of boon for studies.

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