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A Review

Cosmetotextiles: A novel technique of developing wearable skin care

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■ **ABSTRACT :** Clothes have always fulfilled a variety of functions - be it fashion, warmth, protection and support. With the growing trend in enhancing beauty through healthy means, customers request for apparels and home textiles containing not only their original basic characteristics, such as warmth and comfort, but also ones that carry extra functions, including cleaning, perfuming, changing appearance, protection, or correction of body odors and keeping the more natural and healthier life. Cosmetotextile is a concept of releasing cosmetic ingredient to the human skin. Though the term "Cosmetotextiles" is new but it originated from Ayurveda which is an ancient medical treatise, summarizing the art of healing and is practiced in India for more than 5,000 years. The technology of Cosmetotextile is at the neonatal stage. On contact with human body and skin, Cosmetotextiles are designed to transfer an active substance for cosmetic purposes. The principle is achieved by simply imparting the cosmetic and pharmaceutical ingredients into the fabric of the clothing so that with the natural movements of the body, the skin is slowly freshened, revitalized or cured according to the ingredient used.

■ **KEY WORDS:** *Ayurvastra*, Cosmetic, Herb, Microencapsulation, Textile

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In people's daily life, clothing plays an important role in protecting the human body from dangers in the environment such as weather, insects, noxious chemicals, weapons and contact with abrasive substances and other hazards material. How to maximize the health related function of textile is becoming more important in today's era. Owing to the rapid development of novel sciences and technologies, textile materials have also found applications in the cosmetics field in recent years. A new sector of cosmetic textiles is launched and the textile industry is very optimistic that these products will open up new target groups and sustainable markets (Bhargava and Jahan, 2012).

"A Cosmetotextile is a textile article that contains a substance or a preparation that is intended to be released sustainably on to the different superficial parts of the human body, especially the skin, and which claim one (or more) particular property(s) such as cleansing, perfume, change of appearance, protection, maintenance in good conditioner correction of body odours".

The definition was officially established in 2006 by the Standardization of Textile and Clothing Industries (BNITH).

Cosmetotextiles, as the name showing, can be

defined as the textile materials have the same properties to those of cosmetic products. Like own cosmetic products, cosmetic textiles can also be divided into different categories according to their end use applications. In view of different application objectives, the type of Cosmetotextile is listed as the following items:

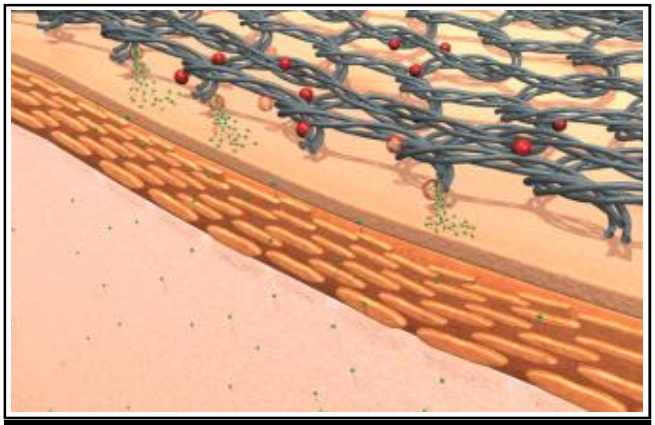

Fig. 1 : Cosmetic + Textile

- Moisturizing
- Whiten and anti wrinkle
- Aromatic and perfumes
- Slimming and keeping fit
- Antimicrobial and anti fungal
- UV protection
- Energizing and refreshing
- Relaxing and pressure release

Although wide range of cosmetics agents with different effects is available inform of creams, oils, and powders etc. but still textile is used to impart cosmetic effect over the skin as a medium due to certain reasons which are as following:

– Textiles cover a large part of the body for most of the day which provides a unique opportunity for the convenient transfer of cosmetics to large parts of the body.

– Continuous release of small doses of cosmetics may be more effective than single applications of large amount of cosmetic agent.

Evolution of cosmetic textiles :

Though the term Cosmetotextile is new but its origin lies in Ayurveda. Using fabrics and garments to deliver health solutions is actually a very old concept called *Ayurvastra*. From the ancient times *Ayurvastra* were being prepared by dyeing of yarn and fabric with herbs to obtain different shades over the fabric and different effects on the skin.

***Ayurvastra*: A miracle mediherbal cloth :**

Ayurveda is a treasure to mankind as it offers us a path to health. It promotes various methods for regaining and maintaining health with the use of herbs, food, massages, yoga, etc. Ayurveda works by balancing the three *Doshas* (*Tridosha*) *i.e.*, *Vata*, *Pitta* and *Kapha*, which govern the internal and external health of the body. *Ayurvastra* is a branch of this ancient form of medicine. *Ayur* is Sanskrit term meaning the health, *Veda* means the wisdom and *Vastra* is the cloth or clothing (Anupama, 2012; Dhingra, 2014 and Sharma, 2014). *Ayurvastra* involves an ancient technique of dyeing textiles using medicinal herbs. Ayurvastra clothing is made from organic cotton fabric that has been permeated with special herbs and oils that promote health and cure special diseases depending upon the blends of embedded herbs and oils.

Ayurvastra cloth is used by Ayurveda health clinics in the treatment of a broad range of diseases such as diabetes, skin infections, eczema, psoriasis, hypertension and high blood pressure, asthma, arthritis, rheumatism, and even some forms of cancer.

Methods of applying cosmetic effect over textiles:

Upon contact with skin, some skin caring materials are designed to transfer an active substance for cosmetic purposes. The idea is simply achieved by simply imparting the bioactive ingredient into wearable textiles so that with the natural movement of body, the skin is slowly supplemented and revitalised. Cosmetic effect of different agents can be obtained by different methods which are as following:

Dyeing:

It is an age old process in which fabric is dyed with different parts of plant like flowers, barks, seeds and roots etc to obtain the colour over the fabric. *Ayurvastra*, cosmetotextile of India is based on the similar concept. In this the organic cotton yarn or fabric is then dyed in a carefully controlled mixture of herbal dyes depending upon the disease or ailment being treated. Dyes for *Ayurvastra* cloth typically contain between 40 to 60 specifically blended and carefully prepared medicinal

herbs. The temperatures of the dyes, the duration and number of the dye soaks, the blend of herbs, and even the equipment used are carefully controlled (Bhargava and Jahan, 2012).

Fig. 2 : Dyeing of yarns with herbs

Microencapsulation:

To achieve this functional effect of cosmetic ingredients with textiles over the skin, microencapsulation technology appeared to be an alternative method for providing satisfactory performance. Microencapsulation is actually a micro packaging technique that involves the production of microcapsules which act as barrier walls of solids or liquids. The microcapsules are produced by depositing a thin polymer coating on small solid particles or liquid droplets, or on dispersion of solids in liquids (Cheng, 2010). The core contents are released under controlled conditions to suit a specific purpose. Structure of microcapsule generally consists of two major components:

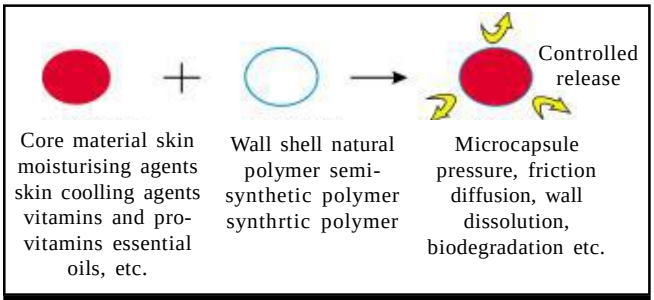

Fig. 3 : General structure of microcapsule

Active ingredient:

An active ingredient is substance that may be that may be in liquid or solid form. It also refers to the core contents, internal phases, encapsulations and fillers.

Wall shell:

A polymer coating that surrounds the active ingredients which may also be called as the wall, shell, external phase, membrane and matrix. It may be natural, semi synthetic polymer. The release mechanism of the core contents vary depending on the selection of wall materials and more importantly, its specific end uses. The core content is released by friction, pressure, change of temperature, diffusion through the polymer wall dissolution of the polymer wall coating and biodegradation etc.

Advantages of microencapsulation :

– One of the major advantages of using microencapsulation technology is its ability to protect the active ingredients from hazardous environments, *i.e.* oxidation, heat, acidity, alkalinity, moisture and evaporation.

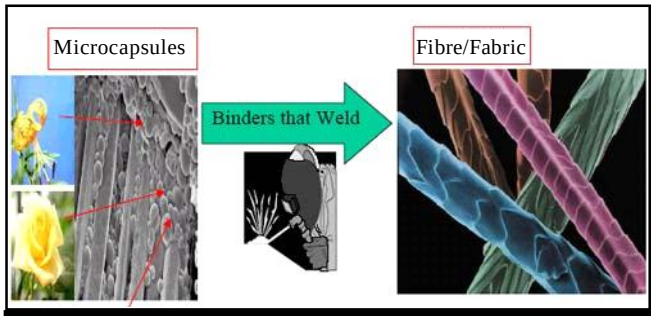

Fig. 4 : Procedure of microencapsulation

– It also, simultaneously, protects the ingredients from interacting with other compounds in the system, which may result in degradation or polymerization.

– Another important advantage of this versatile technology is controlled release properties that seem to be the best choice for increasing efficiency.

Cosmetic ingredients :

Generally, major cosmetic ingredients originate from inorganic and synthetic chemicals, animal derivatives and plant derivatives. People consciously avoid the use of inorganic, synthetic chemicals and animal derivatives for cosmetic applications because they are biased towards plant derivatives. Various scientific and medical researches have proved that plant derivatives are safer than chemicals and animal derivatives as cosmetics (Cheng *et al.*, 2008).

Synthetic and inorganic compounds :

Various inorganic and synthetic compounds are used to provide cosmetic benefits to the wearers. 1,2-ethanediol, Zn nanoparticles, iron oxide, zinc oxide, titanium oxide, carbon black, bi-reactive oxalic acid and dianitide derivatives are used to provide protection against UV radiation. Acetyl-glucosamise and D-glucosamide are used to provide a deodorant effect in textiles (Singh, 2002; Singh *et al.*, 2011 and Gupta *et al.*, 2002). Copper oxide is used to promote healing and antimicrobial functionality in textiles.

Animal derivatives :

Chitosan:

It is an animal derivative used for wound healing, as well as for antibacterial, blood clotting and deodorant effects. It is a natural product derived from chitin - a polysaccharide found in the exo-skeleton of shellfish like shrimps or crabs. Chitosan improves skin texture, nourishes and stabilizes moisture level, stimulates cell regeneration and forms a high molecular film for skin protection (Edwin *et al.*, 1987).

Squalene:

It is a fatty compound that is found in a number of vegetable oils, including palm oil, olive oil, but it usually extracted from shark liver, where it is found in high concentrations. Squalene is a natural antioxidant. Squalane chemically resembles the natural skin lipid called sebum. Squalane is well absorbed into the skin to support the skin's ability to regenerate and maintain hydration naturally. Its ability to penetrate into the skin also helps carry other ingredients into deeper skin levels. Squalane along with ascorbyl phosphate, vitamin E, and hyaluronic acid help to protect the skin against photo aging and the formation of brown age spots (Lim and Hudson, 2003).

Plant derivatives :

Plant-based cosmetic ingredients secured directly from nature are valuable essential oils and extracts. These ingredients are carefully derived from the cold press peel of herb plants and fruit by distillation from blossom and leaves.

Aloe vera*:*

Aloe vera is a semi tropical plant of the lily family. Over 250 different species are available, but only four have nutritional value, of which the Aloe Vera Barbadenis Miller group is prominent. The Aloe Vera leaf contains over 75 nutrients and 200 active components including 20 minerals, 18 amino acids and 12 vitamins. Scientific research on Aloe vera has proved that textiles treated with it are very pleasant to wear, having a significant effect on energy levels, which offers a feeling of well-being. Aloe vera is used to obtain antibacterial, antiviral, antimycotic, wound healing and anti-inflammatory effects (Eshun and He, 2004).

Ginseng*:*

Ginseng is promoted as an adoptogen, and root of the ginseng plant is the most valued form (Puvabanditsin and Vongtondsri, 2005). Ginseng extract can be used by way of the microencapsulation technique to protect the skin from cancer and inflammation. Ginseng extract is able to block carcinogens 12-OTetradecanoylphorbol-13-acetate (TPA), the cancer-causing enzyme ornithine decarboxylase, and the expression of cyclooxygenase-2 (COX-2). Ginseng expression led a reduction in the production of prostaglandin E-2.

Fruits:

Various fruit oils are used to provide aroma to the wearer for refreshment and relaxation (Kan *et al.*, 2005). Various chemicals are extracted and applied on fabric surfaces as a source of aroma by different techniques like citral (lemon scent), allyl caproate (rose scent), anillin (apple scent), cinnamaldehyde (Pineaple), prenyl Acetate (banana) and heliotropin (Cherry).

Essential oils:

There are various essential oils which have found their place in aroma therapy, providing skin glowing, moisturing, refreshing and other wellness effects. These oils are microencapsulated by covering them with a polymeric coating and then applying them on cotton, polypropylene, polyacrylonitrile and polyamide fibre surfaces. The prominent essential oils are lavender oil, thyme oil, sage oil, peppermint oil, eucalyptus oil, chamomile oil etc.

Flowers:

Some flowers find their way into wellness through the extraction of specific chemicals like innone (violet), cedar oil (Lilac), Hydroxycitronellol (Lily), Alpha-

hexylcinnamaldehyde/benyl alcohol (Jasmine) using various extraction techniques. Finally these well-being extracts can be added to textiles by the microencapsulation technique to achieve various cosmetic aims (Kan *et al.,* 2005).

Padina povonica:

Padina pavonica is extracted from the protective coating of a brown algae found in the Mediterranean Sea. Padina pavonica is believed to improve the firmness and elasticity of the skin. Cosmetil in collaboration with Variance developed cosmetically inspired fluid lingerie called Hydrabra to provide moisturising and firming effects. The bra has a specially designed lower cup with ultra-thin cloth impregnated with a lotion formulated with extracts of Padina pavonica.

Hinokitiol:

Hinakitiol is natural wood oil extracted from domestic Hinoki trees. It is effective in the prevention of bacteria, mould and insects. It gives an antibacterial effect against various micro-organisms like *Staphylococcus aureus,* Staphylococcus epidermidis (1, 7, 8, 13) and Schistosoma mansoni. It is effective in giving a relaxation effect due to its aromatic nature (Sakuma *et al.,* 1999).

Vitamin E:

Vitamin E belongs to the group of lipidsoluble vitamins and is available in nature in many vegetable oils. The chemical term for vitamin E is "α-Tocopherol", as shown in Fig. 5.

Vitamin E is used as an antioxidant and active substance due to its moisture binding ability in emulsions, creams, lotions, body and face oils and aliphatic cosmetics for dry skin care, as well as in decorative cosmetics like lipsticks. It is helpful in guarding against various skin diseases. Vitamin E is also a powerful antioxidant.

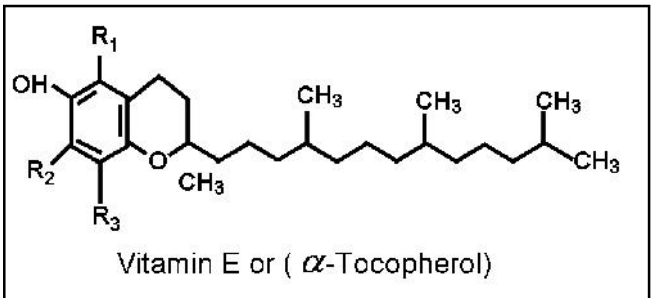

Fig. 5 : Structure of vitamin E

Certification standards for comsmetotextiles :

The ASQUAL published a certification standard relating to relating to cosmetotextiles in 2009. Its main requirements relate to the cosmetic product used, after ensuring that it is harmless, GMP (Good manufacturing practices) traceability and the cosmetic textile product itself, after ensuring that it is safe and monitoring claims made to consumers. He underlined that the requirement of the certification standard were in line with the technical report CEN/ TR 15917: 2009 regulating general characteristics safety, effects, wash-resistance and labeling, etc. "The guarantees offered by ASQUAL COSMETOTEXTILE certification ensure that the product will not affect the wearer's health, that the cosmetic effect has been demonstrated and that the claimed durability has been checked (Kadole *et al.,* 2013). Certification also offers the guarantee that all the above-mentioned information remains transparent and available," he added.

Commercially available products :

Microencapsulation technology offers many opportunities to enhance the properties of textiles. There are certain cosmetic textiles which are commercially available:

Cognis - skintex :

Cognis, a textile chemical company with headquarters in Germany, has developed a microencapsulation based cosmetic treatment for textiles, known as Skintex. The active ingredients are encapsulated by using chitosan (Bhargava and Jahan, 2012).

Anti cellulite wear by Reusters :

Anti cellulite fabric contains a combination of agents, such as caffeine, retinol, vitamin E which may reduce the outer appearance of cellulite. In addition, it was claimed that slimming effect persists even after the garment has been washed several times.

Devon chemicals :

It's another Europe based company which offers wide range of products like flame retardant, insect

control, anti microbial, moisture management and antibacterial textile products (Kadole *et al*., 2013).

Specialty textile product (STP)- Bio cap :

A United Kingdom based chemical company develops bio capsule products called bio caps using micro encapsulation. Active ingredients which provide various skin care benefits and promote a sense of well being. E.g. Vitamin A, D, E, K and Aloe vera, are used in bio cap textile products. This cosmetic textile treatment can be applied to the very wide range of fabrics for bedding, underwear, T-shirts, stockings and socks (Bhargava and Jahan, 2012).

Wool mark development international ltd. (WDI) - Sensory perception technology :

In this product the microcapsules contain various skin benefits, such as moisturizing skin, repelling insects, anti-bacterial and anti-fungal abilities, and treating cellulite. The microcapsules release their contents in a controlled manner and will only break through normal wear and tear. The performance can be retained over a long period of time and through multiple domestic laundering. It is compatible with all types of fibers and has a wide range of application potentials, including apparel, hosiery, interior textiles etc.

SWOT analysis of cosmetotextiles :

Cosmetotextiles- Strength:

– Cosmetotextiles can be used in all constructions; weave, knit and non woven.

– Trapped in microencapsules, sensitive cosmetic ingredients are protected from degradation (oxidation, polymerisation, etc.) and can withstand drying and heat-setting processes. Volatile ingredients (such as perfumes, essential oils and coolants) are protected from evaporation, which can increase their shelf-life.

– Cosmetotextiles need to be as safe as cosmetics. Qualified professionals make sure that toxicological data for the cosmetic ingredients and the textile auxiliaries used in the cosmetotextile's finish are available and their toxicological profile is satisfactory for use as a cosmetic ingredient. Risk assessments are made using end points including acute oral toxicity, dermal irritation, mucus membrane irritation, skin sensitization and mutagenicity.

– Cosmetotextiles are quite costly but mostly depends on the actual product.

Cosmatotextiles- weakness :

– Microcapsules' shells and their toxicity impact.

– Cosmetic encapsulation more preferred for applications that are not in direct contact with human body.

– Natural based micro-particles as cosmetic carriers instead of microcapsules, is slowly taking over the skincare field.

Cosmatotextiles- opportunities:

– Although still in its infancy, the market has exciting potential, and the textile industry is optimistic that further technical developments will open up new markets and create growing business opportunities. Some have estimated that the market for cosmetotextiles will be worth Euro 500 million (US$717 million) in 2013.

– Cosmetotextiles represent a significant innovation for both the cosmetics industry and the textile industry. For the textile industry, cosmetotextiles provide a way of increasing added value while satisfying consumers' growing demand for beauty and anti-ageing products.

– Furthermore, belief in the concept of cosmetotextiles is likely to be strengthened by the progressive involvement of high profile companies in the cosmetics industry as well as those in apparel, including major sportswear suppliers such as Nike and Adidas.

Cosmatotextiles- Threats :

– Some consumers remain skeptical about the concept of combining cosmetics and textiles, and many believe that the concept is merely a gimmick. It will be some time, therefore, before these consumers are convinced of the effectiveness of cosmetotextile products.

Future scopes and conclusion :

The development and co-operation among the various scientific fields have produced a good pace in innovations in the field of smart textiles. As one kind of the smart textile, cosmetotextiles will make good impact in the global textile market. At present, ADIDAS, NIKE and L'OReal also have strong interest on cosmetotextiles, which shows that the development of cosmetotextiles reflects the need of active textiles among consumers. Usage of nano encapsulation technology in manufacturing of cosmetotextiles is the new area of research and

development which would enhance the future prospects and effectiveness of the cosmetotextile products.

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