ejpmr, 2019,6(3), 269-272

SJIF Impact Factor 4.897

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Review Article

ISSN 2394-3211

EJPMR

NATURAL COLOURANTS AND ITS USES - A REVIEW

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Article Received on 10/01/2018 **Article Revised on 30/01/2019** **Article Accepted on 20/02/2019**

ABSTRACT

Natural colourants are derived from plant, animal and minerals and microbial. In India there are 500 species of plant which are suitable to give colorants. Natural colours are safe to use and no side effects. The market for natural colours in various fields continues to throughout the world on account of increased awareness among consumer of side effects associated with prolong use of some synthetic colouring compounds, and the current trend towards healthful, natural ingredients in products. Manufacturers seek natural colouring materials that offer additional multifunctional effects including UV protection anti-aging related functionalities. Presently, many Industries are manufacturing natural products using natural colorants as in eyeliner, lipstick, lip balm, hair colour, food, textile clothes etc. Here, we review the source of natural colours and its use in various field like cosmetics, pharmaceutical, food, textile industry and information about natural colouring pigment.

KEYWORDS: Natural colourants, Cosmetics industry, Pharmaceutical industry, Food industry, Textiles industry.

INTRODUCTION

Since prehistoric time, cultures of the world have used colours for a wide variety of purpose. The use of colours has a long history, dating back to the beginning of civilizations from ancient Egypt, India and China. Natural dye clothes were used to wrap mummies in Egypt. Use of blue indigo dye started from 7th century. Colours might be discovered accidently but we cannot imagine our present day without colours. Colours which influence the people and now people are get awareness about uses of natural dyes and synthetic dyes are carcinogen. Several synthetic colourants have been banned because they cause allergy-like symptoms or are carcinogens.[1]

The current preference for naturally derived colourants is due to their healthfulness and excellent performance. Now days, Natural dyes are commonly used in the cosmetic industry due to no side effects, UV protection and anti-aging properties. In India, there are more than 450 plants that can yield dyes.[2] Apart from their colours, a few of these plants are also contains medicinal properties. Every herb can be used to make dye and India is a major exporter of herbal dyes as it rich in bioresources.[3]

Natural colourants

Natural colourants derived from plant sources (root, berries, bark, leaves woods), insects (cochineal, beetles, lac scale insects), animals (some species of molluscs or shellfish) and minerals (ferrous sulphate, ochre, clay) without any chemical treatment and microbes *Rhodospirillum rubrum* (purple), *Chromobacterium violaceum* (violet), *Chlorobium tepidum* (green), *Staphlococcus aureus* (golden).[4]

Plants are the major source of natural colourants and almost all their parts such as stem, fruits seeds are used for extracting natural colour and they have anti-microbial, anti-fungal, deodorant, disinfectant and other medicinal values. Some important dye yielding leaf plant habitats are Henna, Teak, Malabar nut, Chikrasi, European lily, Glastum, Mango bark, Peach, Stinging Neetle, Fire flame bush, Sweet indrajao, Safed kikar, Neel, Jamun, Ber which yield colour like brown, red, blue, yellow, pink. Natural dyes are widely used in many industries like Food, Textiles, Cosmetics, Pharmaceutical, Leather, Paper, Paint.[5] Anthocyanins, betanins, carotenoids, chlorophyllin, curcumin are the pigments found in the plant source and it possesses natural anti-oxidants. Carotenoids are compound responsible for yellow, orange, red colours (annatto, beta-carotene, paprika, lycopene, luetin, carrot, saffron). Chlorophyllin is extracted from plants (grass, nettle, spinach) sources. Curcumin is responsible for vibrant yellow colours (turmeric).

Spirulina is blue green alga that occurs naturally in freshwater and marine habitats. It contains green chlorophyll and phycobilins which responsible for blue colours. Cochineals are natural anthraquinone red dyes

extracted from female cochineal (*Dactylopins coccus costa*) a cactus dwelling insect.

Pigment forming microorganism like *Rhodospirillum rubrum* (purple), *Chromobacterium violaceum* (violet), *Chlorobium tepidum* (green), *Staphlococcus aureus* (golden), *Xanthomonas campestris* (yellow), *Actinomyces sp.* (silver), *Serratia marcescens* (red).[6]

Advantages of natural colourants

Following are the advantages of using natural colourants,

1. Natural dyes are considered to be Eco-friendly as this obtained from renewable resources
2. Natural dyes will minimize the side effects
3. Using of natural dyes generates only Less pollution
4. Natural dyes are non-toxic and non-carcinogenic
5. Natural dyes has Health benefits
6. Natural dyes are biodegradable and the residual vegetal matter left over extraction of dyes can be easily composted and used as fertilizer.
7. Natural resources produce soft colours soothing to the eyes which are in harmony with nature.

Production techniques for natural dyes

Natural dyes are mostly obtained from plant parts and its dye-bearing materials contain only a small percentage of dye usually 0.5-5%. Extraction of natural dyes is essential process; the plant materials are first dried: either in shade or in a hot air drier at a low temperature at 40-50^{o}C for the reduction of about 10-15% of their water content. Dried materials are then powdered in a pulverizer to reduce particle size and to facilitate better dye extraction. Aqueous extraction, Alkali or acid extraction, Microwave and ultrasonic assisted extraction, Fermentation, Enzymatic extraction, Solvent extraction, Super Critical Fluid extractions are the extraction methods. The natural colours obtained by pressing, filtering, evaporating of filtered juice.

Natural colorants in pharmaceutical industry

Among natural dyes, plant based pigments have wide range of medicinal valves. Natural colourants like Turmeric, Annatto, Saffron, Paprika, Tomato, tagetus/marigold, Safflower (*Carthamustinctorius*), Henna, Beetroot (*Beta vulgaris*), Blood root (*Sanguinaria Canadensis*), Ginkgo biloba are used as anti-cancer, anti-inflammatory, antioxidant, carminative, appetizer. The colorants should approved by WHO (World Health Organisation), FDA (food and drug administration). Pharmaceutical preparations are coloured mainly for increase acceptability, for identification, standard preparation and stability purpose.[7] The elegance and eye appeal of a coloured product is valuable, especially for children whom it is used to treat with syrups, tablets or capsules, to avoid injections and allow treatment at home. For the further advancement of safer pharmaceutical formulations/dosage forms, there is a necessity for proper methods, to document and characterize the plants that yield dyes.

Natural colorants in cosmetic industry

From ancient days colouring the body parts is way of progress, is not only beautified the body but acted as the shield against any kind of external affects for the body.[9] Herbal cosmetics today, believe to help people build their good health with the help of natural sources. Many products like herbal lipstick, hair dyes, skincare, eye liner, etc.[10] Natural additives are the substances found in plant and it directly added to cosmetics products during processing as preservatives, colouring and stabilization.[11] The use of natural derived colourants in cosmetics not only minimizes the side effects but also improving health by having of medicinal compound.

Lipcare products

Natural colourants from plant (beetroot, annatto, rambutan, pomegranate, carrot, turmeric, sapponwood, red sandal wood, strawberry, papaya, tomato, grapes, blueberry, *H.polyrhizus*) contributes to natural colorants for lipsticks.[12] Formulation of lipstick from natural colourants is safe to use and even consumption of lipstick is not dangerous.[13] Many lipcare products are manufacturing lipstick, lipbalm, and lip-gloss by using of natural colourants to fulfil customer need.[14] The finding suggested that natural colourant (red) *H.polyrhizus* in cosmetic product was more preffered in comparison to synthetic colourants based on its color and pH preference.

Thus focus directed towards use of *H.polyrhizus* in cosmetic products due to higher stability and customer preference.[15] Those lipsticks show a good product with antimicrobial properties and it increase the acceptance of customer.

Haircare products

Hair colour is one of the oldest and most well-known cosmetics that have been used by many ancient cultures in different parts of the world. Since ancient time plant have been used for dyeing includes henna, chamomile, madder, beets, turmeric walnuts etc. Henna has been used as a colouring agent for over thousand years. In India henna has been used since around the 4th or 5th centuries as hair dye and art of mehandi.[16] Lawsone (brown pigment) is widely used in cosmetic for its dyeing properties, uses as hair and nail colour. Natural henna is an excellent conditioning agent. Beetroot (*Beta vulgaris*) is used as a haircolor and bleeching, shampoo.[17] Among them henna leaf and walnut husks were the most efficient natural hair dyes.[18]

Natural colourants in food industry

Natural colour added in food industry as food additives and use of colour derived from natural sources is that many are bioactive.[19] Among the natural dyes, plant-based pigments have medicinal values so are mostly preferred in the food industry but other sources such as insects, algae, cyanobacteria and fungi are used as well.[20] Colour of food and beverages often dominates over than other sources of information regarding the

flavour. Plant sources of natural colours in food industry, orange-yellow (Marigold, Lycopene, Saffron, Turmeric, Gentism, β- carotene, *Sanguinaria Canadensis*), brown colour *(Lawasonia inermis, Camellia thea*) red colour (Annatto, *Beet vulgaris*, Paprica, Grapes vitacea, *Alkanna tinctoria*), purple-blue colour (Centaurea cyanus, *Vaccinium myrtillus, Indigofera tinctoria*).[21]

Currently, 43 colourants are authorized as food additives by the EU and have been assigned an E number. Sixteen of these are of plant origin. For colouring purpose fruit juices containing Carotenoid and Anthocyanin pigment, gardenia extract, grape extract, green colour extract from spinach or alfalfa.[22] Today, spices are used mainly to promote flavour, colour and taste in food and they are present in nutritionally insignificant quantities.

Nautral colourants derived from animals that used in food industry are *Dactylopius coccus* (cochineal) which gives red colour and it extracted from this insect and its eggs is carminic acid (carmine). Carmine is used as food dye in juices, ice creams, yogurt, and candy but as food dye it has been known to cause severe allergic reactions and anaphylactic shock in some people. *Sepia officinalis L* (female cuttle fish) is rich concentrates of orange-red pigments in the accessory nidamental glands. Cephalopod from fishmongers is used in pasta and sauces as food coloring and flavouring.[23]

Monascus purpureus are fungus it gives red pigments and it used as food additives. Yeast- derived natural pigments; one of the latest studied in monascin, a secondary yellow natural pigment is produced by the genus *Monascus*.

Natural colourants in textile industry

Natural dye can be used for wool dying from a long time. Nowdays *Celosia*, *Nerium*, *Tagetus*, *Rambutan*, *Curcuma*, *Hollyhock*, *Hibiscus mutabilis*, *Caryatia* are used for wool dying. The textile material like cotton, silk fabrics, wool, pashmina wool, wool fabric the natural colourants as dying was applied. At present synthetic compounds are used for dying textile materials and they cause water pollution as well as waste disposal problems because these are non- biodegradable and carcinogenic. These problems can be solved by the use of natural dye and it enhance their eco-friendly characteristics.[24] Floral dye play an important role for dying of textile material because it provide colour as well as fragranace. Floral dye obtained from floral part of following plant African marigold, Bottle brush, Pink hollyhock, Night flowering jasmine, Saffron, Aparajita, Flame of forest, Yellow flaz, Scarlet cordial, and Cosmos orange, African tulip.[25] Natural dye obtained from plants such as *Black carrot, Hibiscus, Delonix, Plumeria*, *Combretum, Ixora, Bischifia* has been used for dying silk fabric. In addition to the environmental benefits, natural dyes absorb the ultraviolet light and therefore fabrics dyed with such dyes should offer good protection from ultraviolet light. Various companies are now marketing naturally dyed textiles as health and wellbeing textiles. All natural dyes expect those derived from a threatened species are recommended for coloration of organic textiles according to the latest version of (GOTS) Global Organic Textile Standard.[26]

Limitation of natural dyes

The natural colourants are eco-friendly and alternative to synthetic colourants but there is certain limitation of natural colourants in application process. The limited shade range, non-reproducible shades, Fastness properties (textiles industry), safety issues (exploration of new sources of dyes needed extensive research on the safety of the materials), characterization and certification issues, the avalibility of natural dyes is not desirable amount for industrialization (it lead to deforestation and environmental disaster). In future prospects, the avalibility of natural dyes can be increased to very high levels by biotechnological interventions such as tissue culture or genetic engineering resulting in mass production of the dyes by microbes at low cost, then only their usuage become sustainable for industrial application.

CONCLUSION

The global demand of natural product is increasing due to interest of consumers, as they are safer and more cost-effective than synthetic one. Natural and herbal products are now emerged as the appropriate solution to the current problem. Our traditional knowledge about the plant wealth as described in Ayurveda, Siddha, Unani of medicine, is of great help to identify the phytochemicals for body care preparations. Personal care industry is currently more concentrated on herbal products as now-a-days it is a fast growing segment. The colourants consistency is important as it allows easy identification of a medication and responsible for the dosage forms, aesthetic appearance in pharmaceutical industry, as it colour additive and beneficial in food and cosmetic industry. This review gives wide knowledge about natural colourants and its uses in various field, and promoting new ideas to applying the natural colourants in future prospects.

Conflict of interest

The authors have none to declare.

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