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Review Article

Environment Friendly Synthesis of Colour, Pigment and Dyes: A Review

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ABSTRACT

Many paints and pigments formed from chemicals have adverse effects on environment. Also dyes which are used for many applications need to be environment friendly. The paints are applied to households, not only for decorative purposes but also for their corrosion resistance. In food ingredients also colour imparts desirable pleasant look. Biocolours are nowadays used in majority of food items. Dyes are also becoming integral part of modern day life. There is no hair damage or scalp irritation because of dying the human hair by using plant derived formulations. Dye containing polymers are becoming a part of everyday life. There is need of novel non-toxic inorganic pigments in order to remove elements like lead, chromium, cobalt entering in the composition of usual pigments. Isolation of pigments with anti-bacterial activity from soil bacteria can also be carried out to obtain different colors such as yellow, golden yellow, red, pink, blue, green, purple and cream. Biocolours are mainly prepared from plant origins. They also work as antimicrobials, antioxidants. The current review summarizes research and studies on environment friendly synthesis of colour, pigment and dyes.

Key words: Paints, pigments, biocolour, formulations, disperser.

INTRODUCTION

Human life is full of different colours. Colour has aesthetic, religious and psychological importance in our life. Many festivals like holi are colorful cultural functions. The colour obtained from chemical formulation is harmful and can adversely affect skin. Many paints and pigments which are formed from chemicals, have adverse effect on environment. Also dyes which are used for many applications need to be environment friendly. The paints are applied to households, not only for decorative purposes but also for their corrosion and abrasion resistance. In food ingredients also colour imparts desirable pleasant look. Biocolours are nowadays used in majority of food items. The synthesis of colours, pigments and dye by using environment friendly methods is becoming increasingly important. Frequent use of synthetic shampoos and application of synthetic dyes having hazardous chemicals in the process of manufacturing and leads to graying and fall of hairs. Dyes are also becoming integral part of modern day life. There is no hair damage or scalp irritation because of dying the human hair by using plant derived formulations. The current review summarizes research and studies on environment friendly synthesis of colour, pigment and dyes.

COLOUR, PIGMENT AND DYES FROM ENVIRONMENTAL FRIENDLY SOURCES

Badgujar et.al. carried out studies on the application of interchangeable high speed disperser and bead mill techniques. [1] They prepared water based concentrates of organic pigment. They tried to provide stability to water based concentrate. They used interchangeable high speed disperser and bead mill system with optimum

operating parameters. By using colour strength, they evaluated effect of surfactants on the stability of dispersion characteristics. They observed that bead meal showed better dispersion than high speed disperser. According to Fleischmann et.al., the combination of polymers and dyes is a research field of great potential. [2] According to them dye containing polymers are becoming a part of everyday life. In their review, they pointed out the importance of dye-containing polymers. They focused on azo, triphenylmethane, indigoid, perylene and anthraquinone dyes.

Naishadham et.al.carried out an investigation on organic hair dye formulation by an environment friendly process. [3] Frequent use of synthetic shampoos and application of synthetic dyes having hazardous chemicals in the process of manufacturing, leads to graying and fall of hairs. They reviewed the use of natural products obtained from plant sources to replace the synthetic dyes. They tested plant samples for alkaloids, Quinones, Saponins and polyphenolic compounds. They found that there is no hair damage or scalp irritation because of dying the human hair by using plant derived formulations. Sameera carried out an investigation on inorganic yellow pigments for coloring applications. [4] Objectives in many investigations are replacement for more expensive and less stable organic pigments. According to them, in order to remove elements like lead, chromium, cobalt entering in the composition of usual pigments, there is need of novel non-toxic inorganic pigments. They synthesized a series of IR reflecting yellow pigments. In their work they analyzed crystalline structure, morphological, composition and optical characteristics, coloring and energy saving applications. According to Jangra, in printing and packaging industry, green printing and environment friendly techniques are vital for survival of the industry. [5] The reduction of hazardous chemicals like volatile organic compounds (VOCs) and gases emission during numerous printing processes can be facilitated by use of green printing. They elucidated significance of green printing on the environment. Das et.al. carried out investigation on low cost eco-friendly 'holi' powder. [6] The holipowder contains heavy metals, sand and soil. They explored use of tapioca (manihotesculanta). It is a high yielding annual crop requiring low agronomic input. They found that the product obtained from this raw material was acceptable based on colour brightness, texture and stickiness.

Gaffer and Khalifa carried out investigation on eco-friendly synthesis of thio-semicarbazones. [7] In their investigation they carried out solid-solid reactions of thiosemicarbazide with 4-formylantipyrine, 2-acetylpyrrole and camphor. They prepared diazo coupling of thiazole derivatives 4–6 with several diazonium chlorides. They used synthesized dyes as disperse dyes for dyeing polyester fabric. They found that the dyes obtained were having good washing, perspiration, sublimation and light fastness properties. According to Venil et.al. one of the significant challenge in pigment industry is extraction of bacterial pigments in relatively pure and concentrated forms. [8] They summarized the current technology status and challenges, economics, novel strategies for production of bacterial pigments. Tesitelova et.al. carried out investigation on influence of synthesis process on the colour properties of mixed oxide pigment. [9] For pigment preparation, they employed conventional solid-state reaction (SSR), suspension mixing (SM) and precipitation reaction (PR). X-ray diffraction analysis was used for characterization. They observed that PR method was most suitable for the formation of dark yellow shades in the ceramic glaze. Pakzad et.al. carried out investigation on production of oil colour from pigment of Staphylococcus aureus. [10] Methanol was used as extracting solvent for carotenoid compounds after isolation of S. aureus as a pigment-producing microorganism by them. They used FTIR

and UV-Vis methods for analysis. They observed that extracted pigment with linseed oil created Cadmium yellow on paper.

BIOCOLOUR FOR FOOD ITEMS

According to Sharma, synthetic colour could be harmful for health of a consumer. [11] Biocolour, according to her is any dye obtained from any vegetable, animal or mineral, that is capable of colouring food, drugs, cosmetics or any part of human body. Seeds, fruits and vegetables, leaves, algae and insects can be sources of biocolour. pH, heat, light, storage conditions and interaction with other ingredient are important factors in achieving suitable biocolour. According to Rymbaiet.al., one of the main features of any food item is colour. [12] According to them, biocolours are gaining importance as the consumers are becoming aware of health hazards due to synthetic colours. Biocolours are mainly prepared from plant origins. Biocolours also work as antimicrobials, antioxygens.

Gupta et.al. carried out studies on use of microbes as potential source of biocolours. [13] They observed that various pigments like carotenoids, melanins, flavins, quinones, prodigiosins can be obtained from microbes. They highlighted the role of microbes as a potential source of natural colours. Raju and Radha carried out investigation on production of extracellular pigment from microbes. [14] In their investigation, they isolated pigments producing bacteria from vegetable sample procured from local markets of Tamil Nadu. They isolated and developed red pigment bacteria into nutrient media. They found that the bacteria isolated by them were gram negative, cocci and biochemical characterization. According to Singh, food colouring is an important part of our lives from many the decades. [15] He listed limitations of biocolours sensitivity to low pH and heat sensitive properties, etc. Unique properties like its saturated absorption and properties like acylation of anthocyanins makes Anthocyanin most sought after biocolour material. Health promotion purposes such as obesity prevention, cardiovascular health, anti-inflammatory and anti-cancer effects can be served by use of Anthocyanin as biocolours. Boontosaeng et.al. carried out investigation on pigments production from bacteria isolated from dried seafood. [16] They found that many bacteria isolated from dried seafood were suitable for pigment formation. Chaitanya reviewed recent developments in technological advances of food colors. [17] According to her it is important to understand the effect of color on food choices and flavor perception. She expressed need for proper methods for extraction, documentation and characterization of dye yielding plants and animals.

Chattopadhyay et.al. explored natural food grade biocolorants for their biotechnological potential. [18] According to them, colour of food item is indicator of good aesthetic and sensorial values. Due to awareness of positive health benefit out of natural compounds, the demand for natural source of such compounds is increasing. Athira et.al. carried out investigation on synthesis of the pigment from Micrococcus sp. isolated from different polluted water samples. [19] Micrococcus sp. derived pigment showed the antibacterial activity against some of the pathogenic bacterial strains. Rashid et. al. carried out investigation on isolation of pigments with anti-bacterial activity from soil bacteria. [20] They isolated colonies of various colors such as yellow, golden yellow, red, pink, blue, green, purple and cream. They found that most of the pigments showed better anti-bacterial activity against gram-negative bacteria. Dwivedi et. al. carried out investigation on plum anthocyanins and its stability against different temperatures. [21] They extracted Cyaninidine-3-O-glucoside from pomace of the plum. They passed the plum pomace-water extract (1:1) through polymer resin in a column. Thereafter, desorption with ethanol was done. At high

temperature, they observed marked degradation of anthocyanins. The study indicated decrease in the stability with temperature and time.

CONCLUSION

The paints are applied to households, not only for decorative purposes but also for their corrosion and abrasion resistance. In food ingredients also colour imparts desirable pleasant look. The synthesis of colours, pigments and dye by using environment friendly methods is becoming increasingly important. Frequent use of synthetic shampoos and application of synthetic dyes having hazardous chemicals in the process of manufacturing, leads to graying and fall of hairs. Investigations by many researchers reveal that there is no hair damage or scalp irritation because of dying the human hair by using plant derived formulations. Current review summarizes research and studies on environment friendly synthesis of colour, pigment and dyes.

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