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Recent Use of Natural Animal Dyes in Various Field

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NATURAL dyes have been used for dyeing, painting, printing, and decoration since the dawn of time. However, with the manufacturing of synthetic dyes in the nineteenth century, it was revolutionised due to its extremely lasting properties and economic effectiveness. However, a new research highlights the negative implications of synthetic dyes, prompting people all over the world to reduce their use of synthetic dyes and focus on natural source colours, which have numerous advantages over synthetic dyes. These colours might be derived from animals, plants, minerals, or microorganisms. In this brief study, we will talk about natural colorants from an animal source and how to extract them using ancient and new methods that allow their counterparts to achieve equivalent properties.

Keywords: Natural dyes; Cochineal; extraction methods; lac; kermes sea snail; animal sources Sustainability.

Introduction

Natural Dyes

Colour is one of the natural factors that enhances the aesthetic and exciting aspects of human life around the globe. Plants, animals, and minerals have been utilised as primary sources of dyes, colours, and pigments since ancient times. [1]

Man is always struck by the beauty of nature, which is existed with wonderful and enchanting colours. A person cannot picture his existence without colour, and he believes he has no purpose in existence. A person's aesthetic worth is determined by their sense of delight. Many historical sources demonstrate their interest in using colour in a variety of ways, including wall design, caverns, body art, textiles, painting, and cosmetics. [1]

These colours were collected from natural sources such as plants, animals, and insects without the use of any special techniques. The Tyrian Lila is the earliest colour of the Phoenicians, belonging to the species Murex and Purpura. [2]

Egyptians typically colour their madder fabrics. Similarly, saffron yellow was used to dye garments for Chinese emperors, whereas gardenia was dyed in the same colour as sappron in Chinese clothing. However, when Percin inadvertently discovered synthetic dye "mauvine" in 1856, the end of natural colours has begun. This dye was discovered to have numerous benefits over natural dyes, including good fastness properties, the brightest colour, low cost, and time efficiency. [3, 4]

However, by the mid-twentieth century, their cancer-causing effects were understood, and their waste was not only harmful to the environment but also leads to serious health risks. Another concern is the increasing global warming due to using synthetic dyes, despite the fact that the widely studied structures are extremely resistant to light, heat, and oxidants. As a result, in several countries throughout the United States, Germany, and the European Union, calls for the return of natural materials in different industries. Because of these severe handicaps, the entire society was forced to reconsider natural colours. It is because

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of its ecologically safe, non-cancerous, and non-toxic properties, which have many beneficial functional properties, such as UV protection, anti-inflammatory, anti-microbial, and antioxidant properties. [5-7]

These colours biodegrade quickly, and their waste does not leads to any environmental risk. [8]

The Sustainability of Natural Dyes

In an area where there are environmental issues, the term "sustainability" is used for every new production or inventory. As it refers to the materials that will be applied to the global market, sustainability must be cost-effective, environmentally friendly, easily available and it must meet current consumer needs without any exposing to danger for the desires of the next generation. The textile industry is one of the most polluting industry by using synthetic dyes produced and used in massive amounts that known to be carcinogenic and detrimental to the environment. [9] Natural dyes must be return back urgently to reduce the quantity of effluents in order to preserve ecologically sound, cost-effective environmental sustainability for any country. Various natural dyeing factors have an influence on the sustainability of nature.

- ❖ It is possible to enhance the nation's economy by importing and exporting natural dyes from other countries. Many countries, including Pakistan, Iran, Sudan, Mexico, India, the United Kingdom, and the United States, are major suppliers of natural dyes.
- ❖ Natural dyes are also highly inexpensive since they may be generated from both the primary source (such as leaves like henna, neams, and eucalyptuses) and the secondary source, i.e. vegetables, fruit, and beverage waste, etc. [10]
- ❖ It is not only affordable, but it also allows farmers to work. [11, 12]
- ❖ Natural colours have several medicinal properties such as antimicrobials, antioxidants, antivirals, antibacterial, and many more. [13]
- ❖ Natural dyes are easily biodegradable and can reduce environmentally dangerous effluents by absorbing them, ensuring long-term global value. [14]
- ❖ These dyes also increase carbon fixation by increasing the number of plants that absorb dye as biomass. Because the dyes from the plant only contain around 5% of the pigment, the remaining portion can be used to seed as a fertiliser.
- ❖ Natural dyes, such as myrobal, tesu, and annatto, are renewable and have no detrimental consequences. [15]

Animal Based Natural Dyes

There are many sources of natural dyes, but a natural dye from animal source is unique.

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Cochineal

Cochineal is an old natural colour used by the Aztecs and subsequently by the Spaniards to get carmine dye. Because both colours have a similar chemistry, the carminic acid concentration is only twelve times greater and is hence referred to as Spanish. [16] This colour is derived from the dried body of female cockcacti, i.e., cockcacti that live on the cockcack pear (see **Figure 2**). It is also known as Nopal, Opuntia, or the Indian fig, and it is mostly found in Central and South America, mostly in Mexico and Brazil. [17] Peru and the Canary Islands, on the other hand, are the leading suppliers of this colour today. The skin of a female insect is brownish-rooted.

The cactus lives in sap and lay hundreds of eggs that contain the colour in a white liquid. Cacti contain it as well. The fluid contains 9-10% carminic acid in the form of glyceryl myristate (fat) and cochineal (cochineal wax) as a colourant (the structure is mentioned below). Carminic acid (CI Natural Red 4) is widely used in food, medicine, and natural fibre due to its strong firming properties. [18] Carminic acid is light and oxidising more stable, making it more resistant to degeneration over time. It gives a variety of colours to the cloth, including pink, crimson, scarlet and red, for a variety of purposes. Carminic acid dissolves with China clay as additions, but with alum it produces precipitality, carmine, carmine lake, and Florentine Lake, which are not actual colourants. It's basically calcium-aluminium chelate (see **Figure 2**), which is why it's sometimes referred to as "semi-synthetic colouring." Carmine was used to colour food, cosmetics, pharmaceuticals, and water.

However, before the fourteenth century, this dye was also made from Armenian and Polish cochineals (Porphyrophorahamelii). Weed roots, such as the perennial knawel (Phorphyrophorapolonica), survived (Scleranthusperennis).

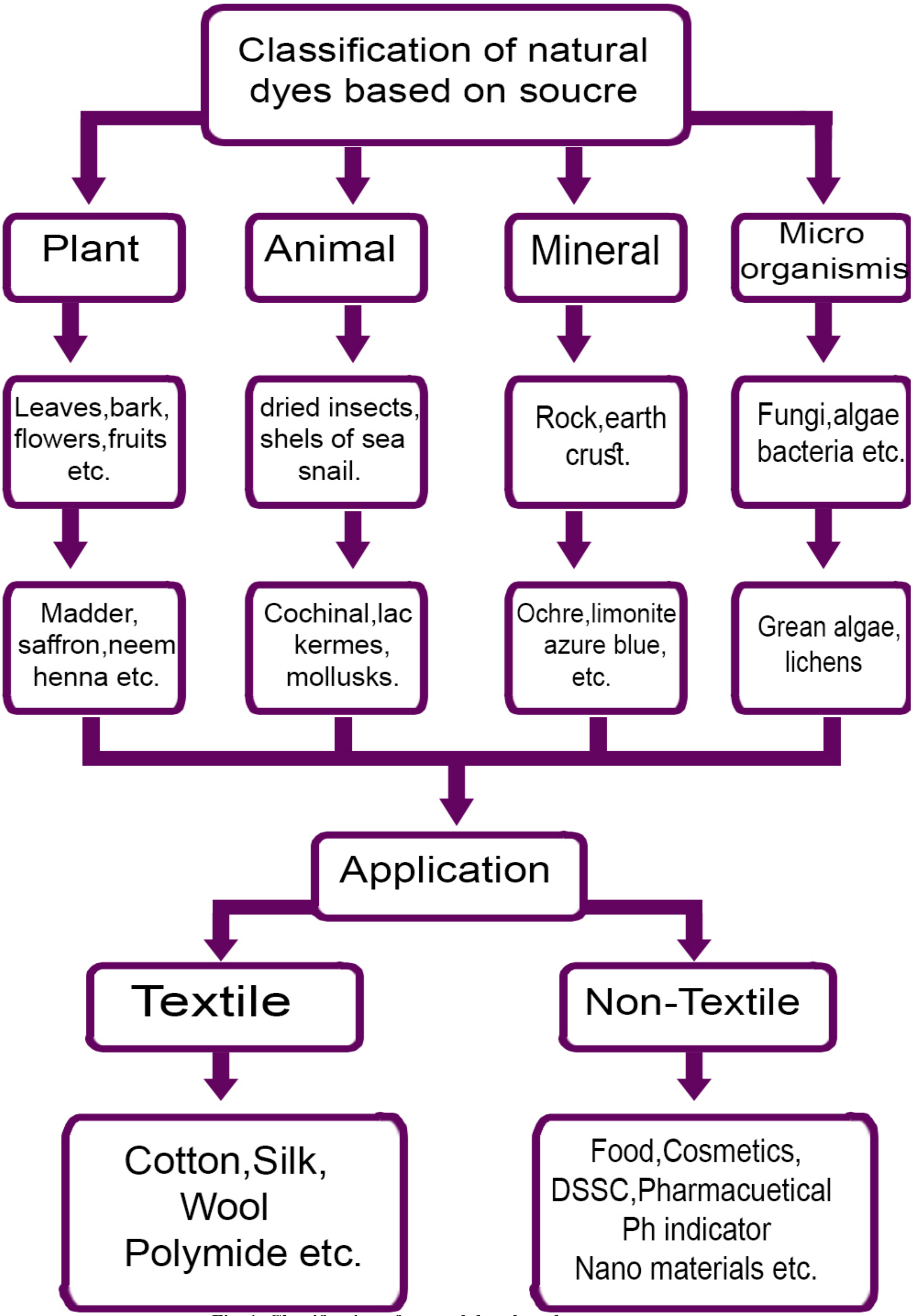


Fig. 1. Classification of natural dyes based on source.

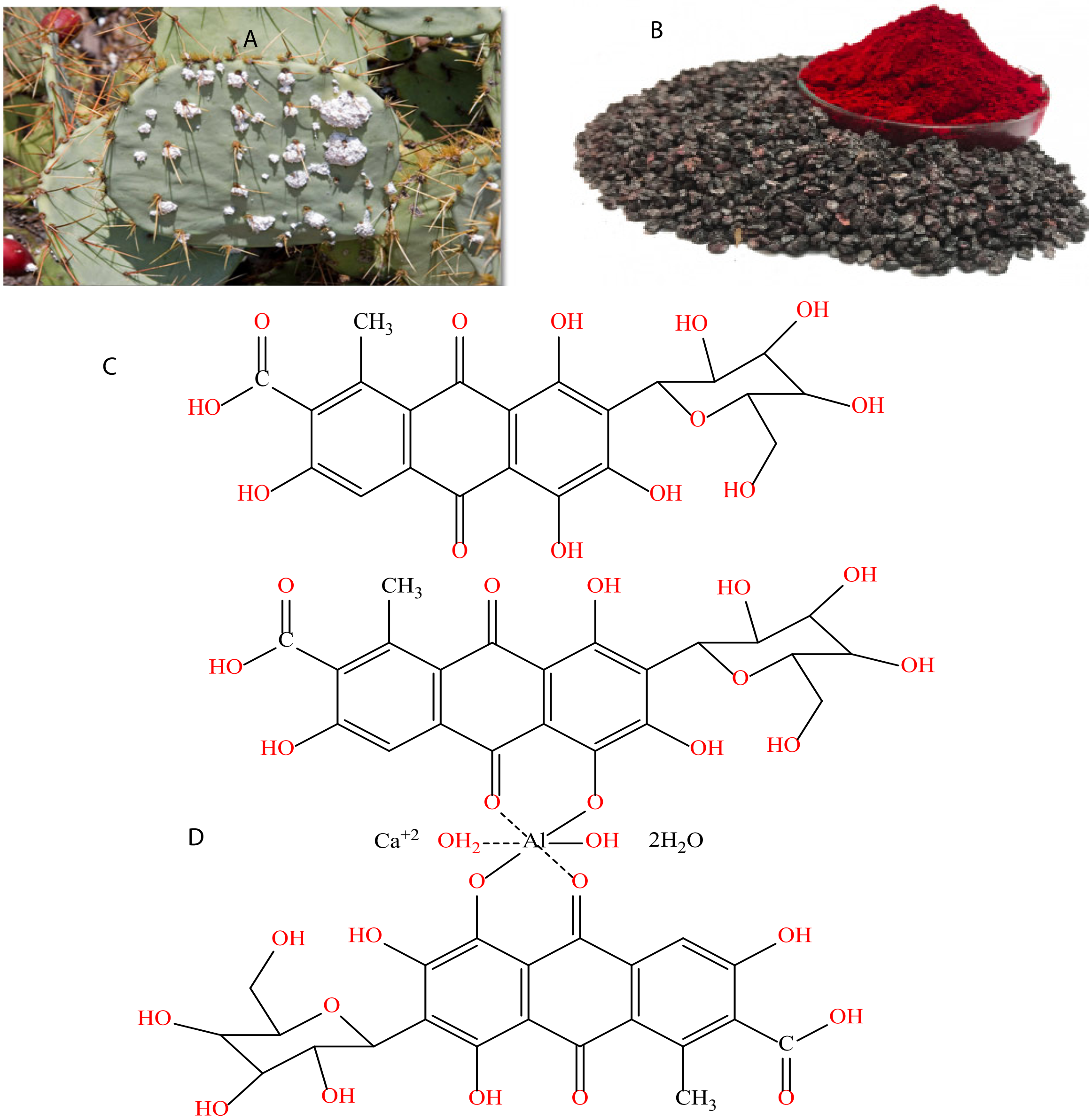


Fig. 2. Cochineal insect on prickly pear cacti (A) Cochineal dye powder (B) Carminic acid (C.I. Natural Red 4) (C) and Calcium-aluminium lake of Carminic acid (D).

Polish Cochineal

Polish cochineal (Phor phyrophorapolonica) is common in the Palearctic, Eurasia, and Central Europe. It is also known as polish vermilion scales or Saint John's blood. However, the application was cancelled at the end of the twentieth century since it was categorised as endangered. [19] Lech and Jarosz, identified as ancient Poland dyeing cochineal by high-performance fluid chromatography, and by distinct Polish cochineal with American cochineal.

While the colouring ingredients in the two dyes differ, kérmesic acid and flavocermesic acid were found in larger proportions in Polish cochineal than in American cochineal, and both give a red colour to the substratum. [20]

Armenian Cochineal

It is known as the Armenian River because of its origins in the Armenian plain and valley of the same name. Ara or Ararat cochineal is another name for it. [21] It is one of the oldest red colouring sources, dating back to 714 BC. The Middle East and Europe have used it in silk and wool fabrics. [22] Some of the species that offer the same colouration include Dactylopiusindicus green, D. tomentose, Anthracoccusuvae-ursi, and others.

Fig. 3. Polish cochineal insect (A) and American cochineal (B).

Kermes

Kermes is a little worm known as "kermes" because it resembles vegetable seeds. **Figure 4** depicts Kermes insect and Kermes medicine powder (a & b) It has been used for teasing cloth from ancient times in England, South France, Spain, Turkey, and Scotland. [23] The red colour is seen in dried-scale female insects of the Kermes genus. For example, the Vermilion thrives on Quercuscoccifera (scarlet oak) and the Kermes ilicis lives on Mediterranean and Asian dormant oaks (Quercus ilex). It is also present in oak leaves, stems, and fluids. After laying the eggs, the mother dies. Vinegar fumes harm the eggs because the colour is isolated while boiling in water. The colouring component is soluble in hot water and generates a red and yellowish dye via kermesic acid, an aglycon of carmine acid (see **Figure 4C**).

It does, however, include flavocermesic acid, albeit it is secondary to its use and produces a variety of colours, including red scarlet tin and blue cast alum in carmine. It is a less expensive colour than purple. [24, 25]

Lac Insect

Since prehistoric times, one of the first insect dyes, a red pigment is known as lacquer, has been discovered. [26] Lac is derived from the Indian term "lakh," which implies that it produces hundreds of thousands of insects from a small amount of pigment. This colour is generated from the resinous secretion of Coccuslaccae (i.e. Lacciferlacca and kerrialacca) (see **Figure 5**). Tachardiidae, discovered on remains of branches and saplings of several rainbows, including Samaneasaman, Pithecolobena, and others, in India, Thailand, Cambodia, Moluccas, and Sumarta. It is only moderately soluble in methanol, acetone, and acetic acid. It contains five colouring components, namely Laccaic acid A, B, C, D, and E (C.I. Natural Red 25) that are close to each other and have structure and red colour. It also gives the bite a bright crimson colour (see **Figure 6**). With the exception of Laccaic acid D, all structures have only one carboxyl component.[27] Wool and silk fabrics are coloured as a result of the acidic carboxylate compound. Terpenic acid, uric acid, erythrolacin, and other fatty acids are examples of major insoluble and minor compounds.

As a colouring material, it is also used in the manufacture of medications, food, and solar cells. Various studies have also shown that lacquer has both functional and antioxidant properties. The antioxidant activity was investigated using three different types of free radicals, namely DPPH, ABTS, and O_2, because of its good qualities that make it a natural colourant in the food industry. [28]

Sea Snails

Sea Snail has a violet colour (violet tyrant) from sea mollusks as well as blue colour (tekhtelet). It is made up of two genera: Murex, which belongs to the Thaididae family Muricidae, and Purpura. This preceding dye was discovered by the Egeans several thousand years ago, and it has been estimated that 1g of dye requires 10000 sea snails.[29] There are three recognised purple colour varieties.

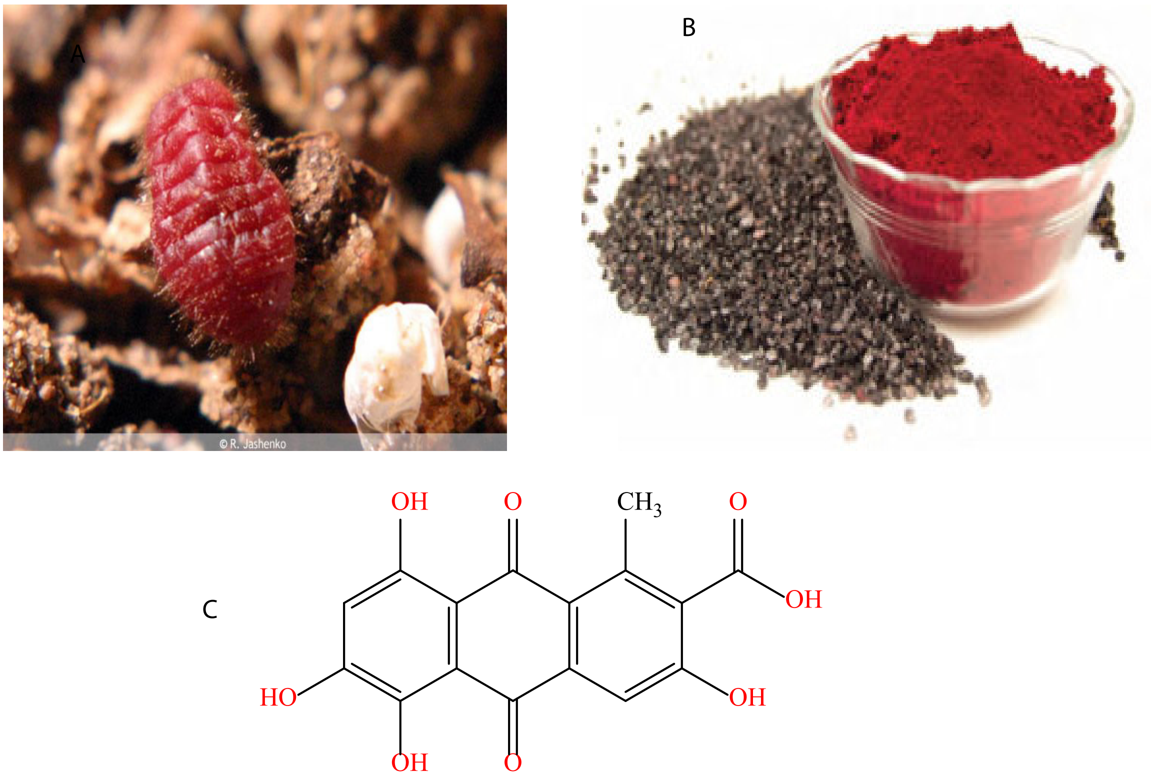


Fig. 4. Kermes insect (A) Kermes dye powder (B) Kermesic acid (C.I. Natural Red 3) (C).

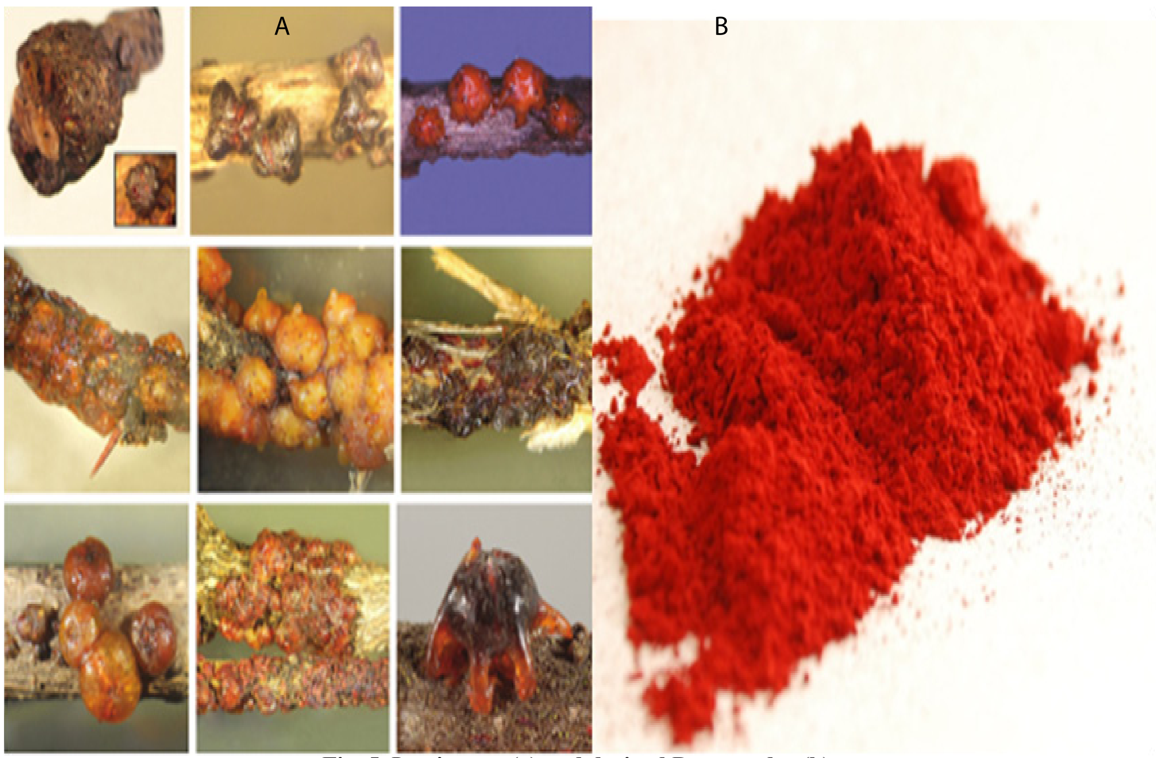


Fig. 5. Lac insects (a) and derived Dye powder (b).

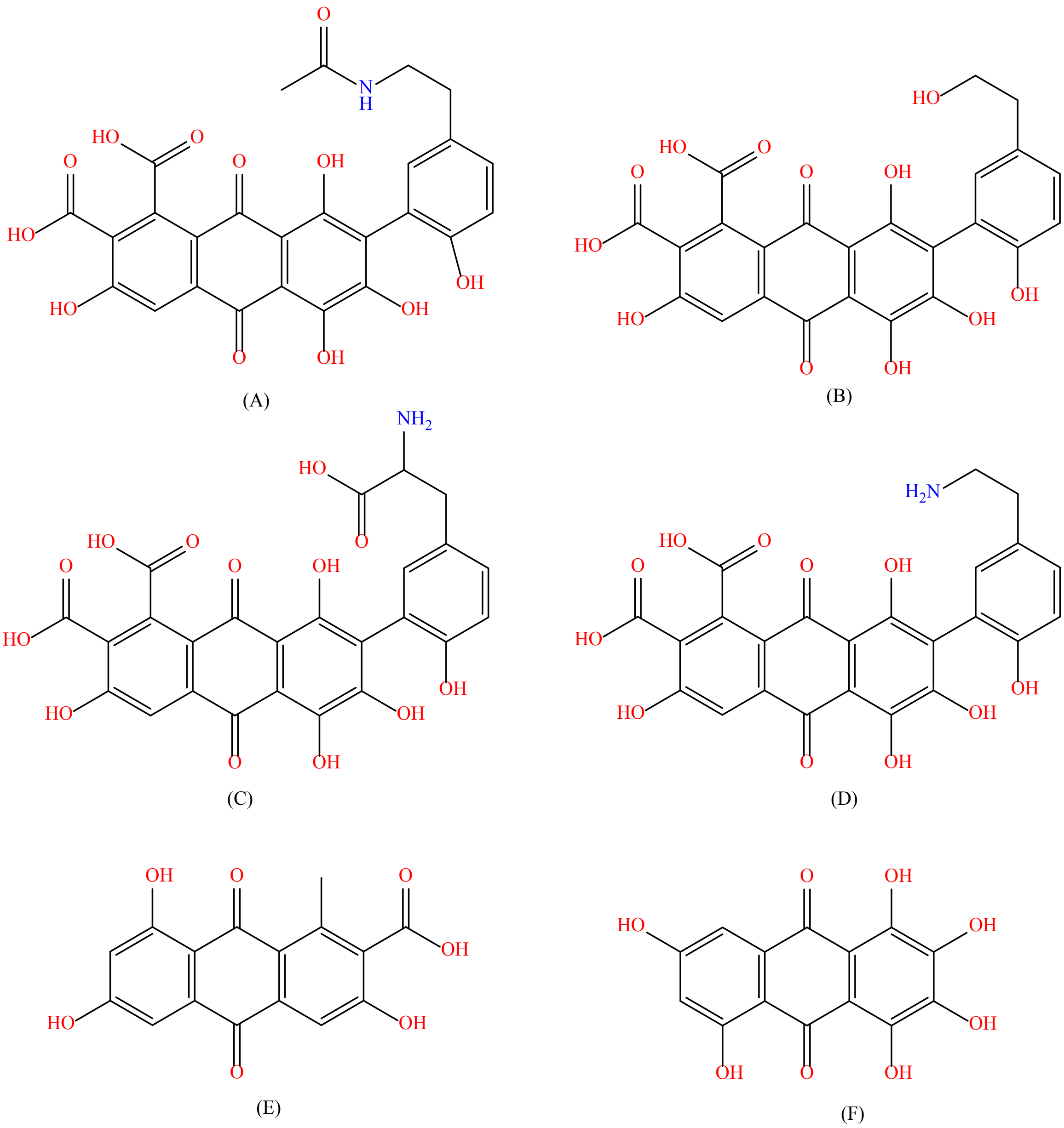


Fig. 6. chemical composition of C.I. Natural Red 25 in Lac insects powder.
(a) Laccaic acid A (b) Laccaic acid B (c) Laccaic acid C
(d) Laccaic acid E (e) Laccaic acid D (f) Erythrolaccin

Bolinusbrandaris

The Bolinas Brandaris is also known as the branders or bran daris in Murex and is also known as the brandaris Murex or the pigment (see **Figure 7**). It was described as a medium-sized meal 3.6-2.6 million years ago. The shell measures 60-90 mm in length and is golden brown. It is primarily found in the Mediterranean, Indian, and South Chinese Seas. [30]

Hexaplex trunculus

Murex trunculus, Phyllonotus trunculus, and Dye Murex banded are all names for Hexaplex trunculus (see **Figure 7**). This species was discovered on the Mediterranean and Atlantic coasts between 3.6 and 0.012 million years ago. It has a conical shell that is 4 to 10 cm long. [31]

Stramonita Haemastoma.

It is known as the Florida dog or mouth rock shell and ranges in size from 22 mm to 120 mm (see **Figure 7**). It is primarily found in the tropical, Eastern Atlantic, and the Mediterranean Sea regions. [32]

The colour derived from these species is divided into two categories based on their colour: 1) Tekhelet and 2) Tyrian purple

Tekhelet dye

Tekhelet dye, also known as hyacinthine purple, is a violet-blue dye. It was used by Jews to paint their chalets, although its use declined in the seventh and ninth centuries. [33]

Tyrian purple dye

The colourless liquid produced in the hypobranchial glands adjacent to the breathing cavities of molluscan species, namely the spiny dye murex (Bolinus brandaris), the banded colouring murex (Hexaplextruncule and the red rock mouthed shell, has been derived from the secretion of the molluscan species colourless liquid (Stramonita haematoma) [34].

Segregation is not a true thorax, but rather a precursor to thinning. By hydrolysis with the enzyme 'purpure' the colour shifts from yellow to green to blue and eventually develops into a stable purple colouring (see **Figure 7**).

Indigotin, indirubin, 6-bromoindigo, 6-bromoindirubin, and 6-dibromoindigotin, 6-dibromoindigotin, and 6,6-dibromoindirubin are among them (see **Figure 8**) [35]. Friedlander was the first person in the hypobronchial tissue to isolate 6,6-dibromoindigo (tyrinoxyl sulphate and tyriverdine) from chromogen.

It is also known as Tyrian violet, which indicates its origin [36]. **Figure 9** depicts the mechanism of action in the production of 6,6'-dibromoindigo. Other species that contribute to the purple colour are Nucelllapidus, Purpurapatula, and Purpurapansa.

Dolabella auricularia: It is identified as an Aplisian marine hare. It is also a marine sludge species, i.e., mollusks that produce natural purple ink. It is 46 cm long and can be found primarily in the Indian, Western, and nWP seas. Applyziobviolin, dolabellin, Auriside A, and dolastatin 10 (see **Figure 10**) are chemical components secreted by the maritime hare. [37]

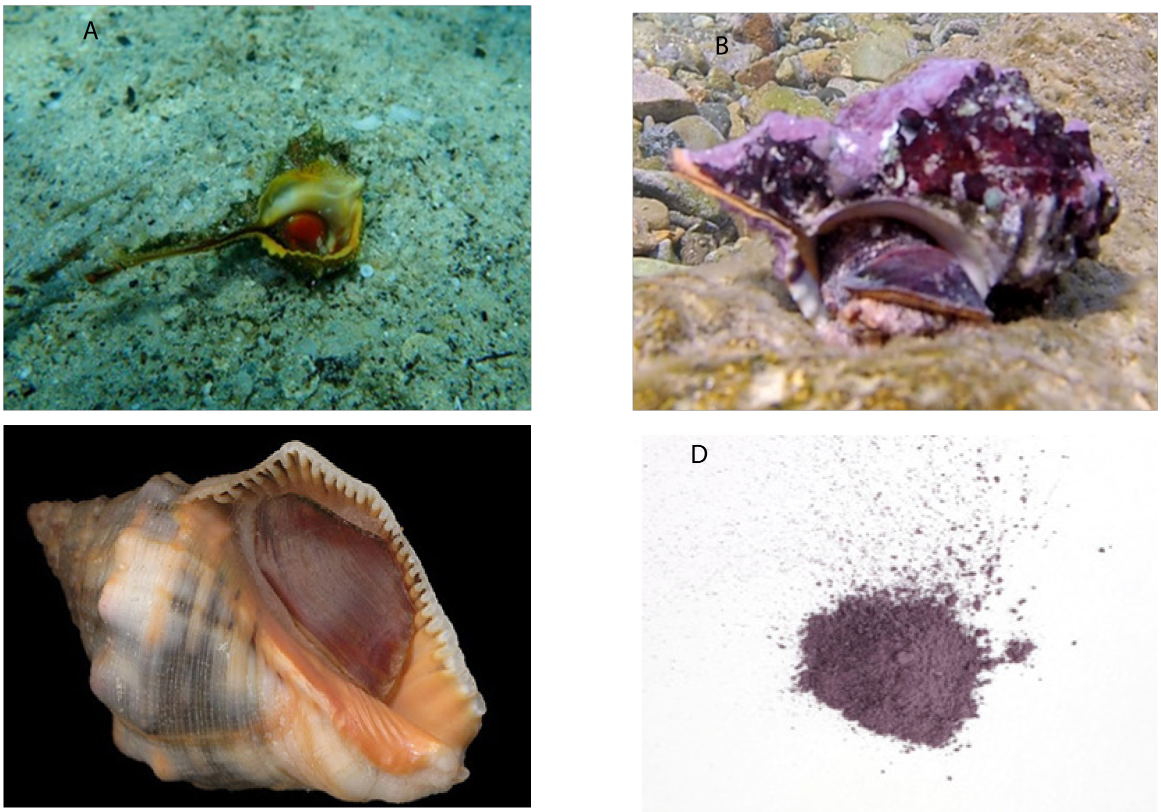


Fig.7. Bolinusbrandaris (A), Hexaplex trunculus (B), Stramonita Haemastoma (C) and Tyrian purple dye powder (D).

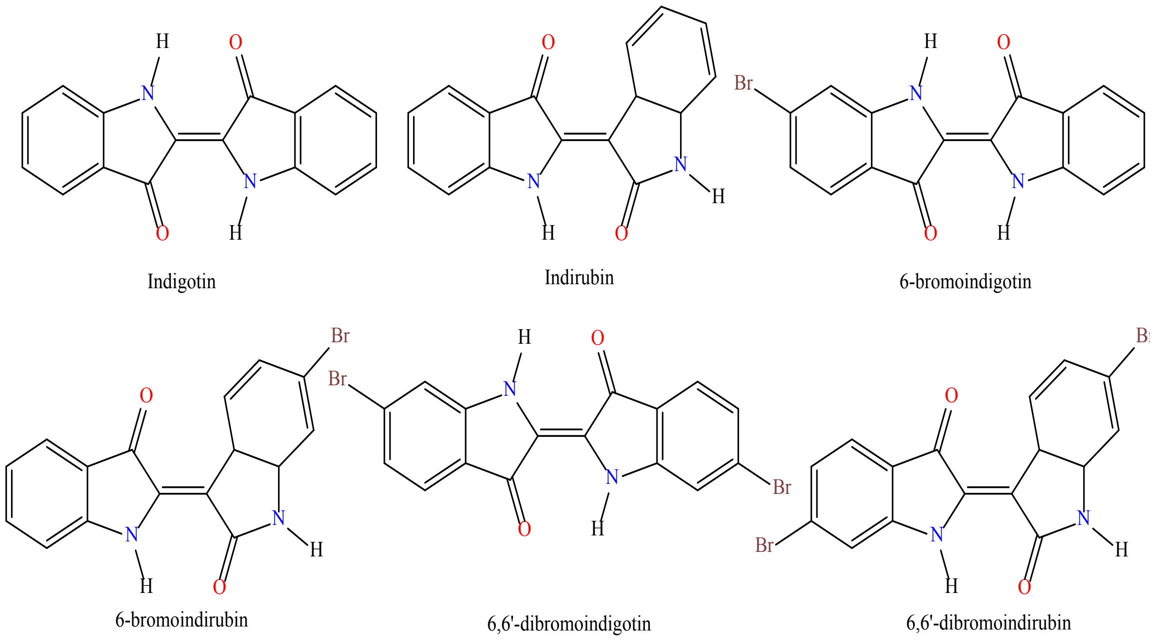


Fig. 8. Chemical structure of some Indigotin dyes.

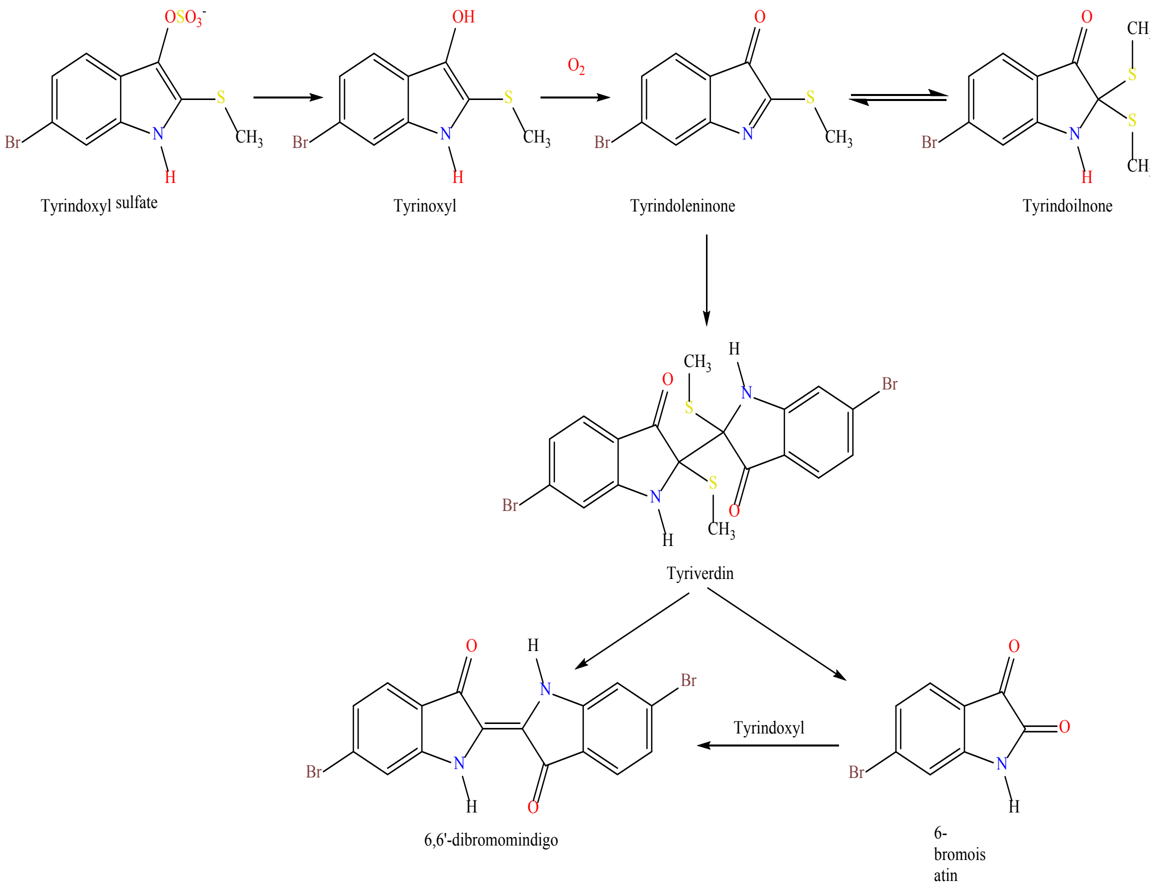


Fig. 9. Mechanism of producing 6,6’-dibromoindigo.

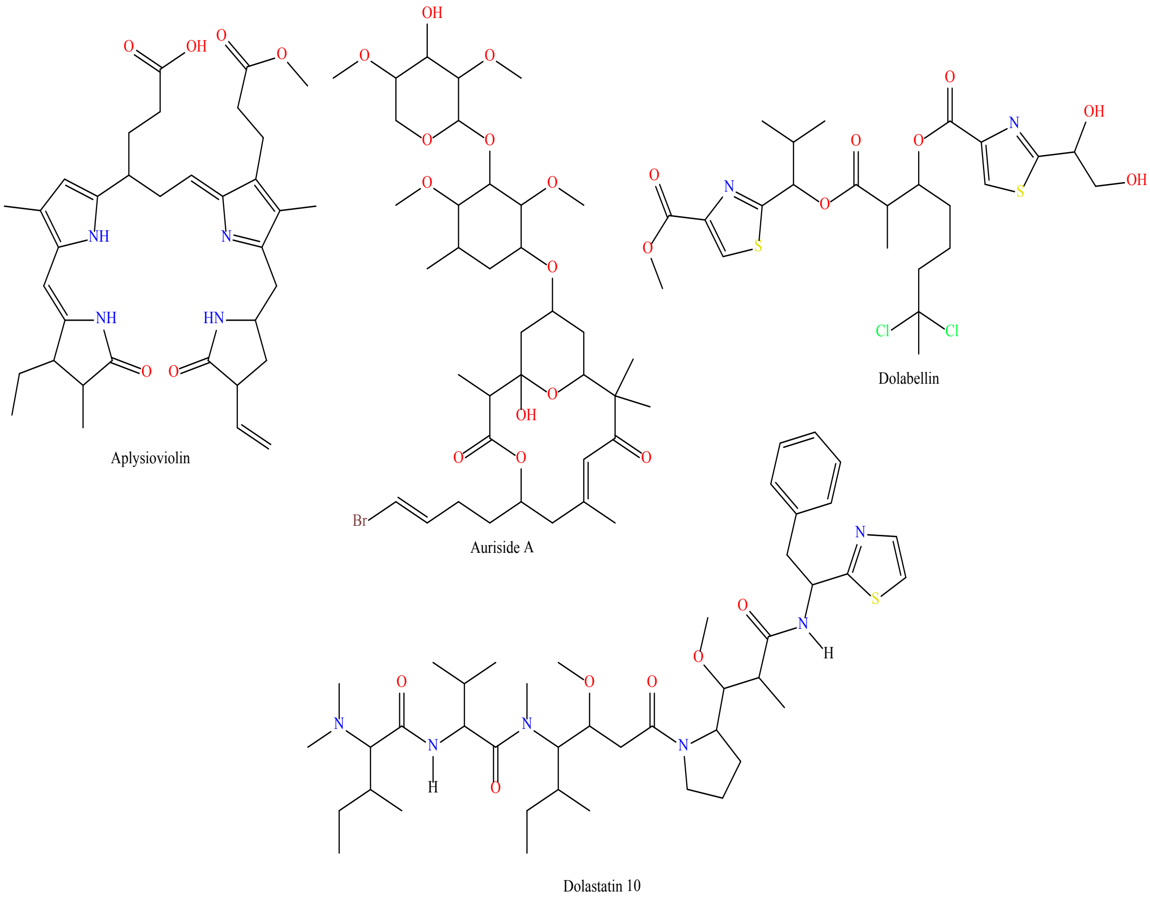


Fig.10. Chemical components secreted by the maritime hare.

Extraction Methodology

Extraction is a technique used to effectively separate the material and transfer it to the solvent. Extraction is one of the primary processes in the natural dyeing process, on which the colourant compound output is dependent. So far, researchers have used a variety of methods to extract dyes from natural sources. These include standard processes (such as the Soxhlet process, boiling technique, and solvent technique) and also there are some new extraction methods which will be discussed below.

Supercritical Liquid Extraction (SFE)

Supercritical Liquid Extraction (SFE) is a simple, water-free, and clean technique.The current method of SFE, is done by pulling out of pressured liquids, and so on[38]. Radiation-based extraction methods such as micro-ondes, gamma, plasma, UV, and ultrasound radiation are also used in modern technologies. These technologies are currently used in the extraction, thinning, and processing of materials[39]. Modern technologies are thought to be superior to older techniques due to their high efficiency, high colour yield, and mass transfer kinetics, as well as their lower energy, water, time, and cost consumption. These strategies are described in detail below:

The process includes dissolving the colouring material with SFE materials, which are then used for fabric. SFE has the ability to quickly penetrate the tissue, causing swelling and easy absorption of the colour molecule. After colouring, the residual dye and super critical fluid are reused, reducing water, energy, and colour resistance. Campaigns and al.[40] Carminic acid was extracted from cochineal bugs using a supercritical fluid and pLE approach, and the results were compared to standard methods. They discovered that current procedures produced more than previous ones. Likewise, Rudd and Benkendorff [41] Using the SFE process, a bioactivity component (brominated indole) precursor of Dicathaisorbita lilac dye was extracted.

UV radiation

UV radiation with wavelengths ranging from 200–400nm, electromagnetic radiation It has a high energy level, which is sufficient to change the surface of the fibre by forming free radicals and improving colour. UV light creates additional functional groups on the cloth surface, which provides colour value at low temperatures[42]. As a result, it saves energy, time, and money while also improving colour strength and ability to colour[43]. This type of radiation has been successfully used in the colouring of wool and cotton.

Plasma radiation

Plasma is a high-temperature, high-pressure mixture of ions, electrons, and free radicals. The safe, clean, water-free source has a high energy activation that can remove the hydrophobe layer from the fabric surface and introduce diverse groups of functions to the surface, such as carboxylate into the cellulose fibres and sulfonated to the proteinous fabric [44]. After treatment with the Hydrophil functional groupings, the Dure molecule can be attached to fabric via solid bonds, increasing the colour capability on fabric surfaces.

Plasma radiation not only increases the fabric's capacity to absorb the dye, but also reduces using chemical mordants and improves the dyed material's activity as an antibacterial agent. Ahmed and others. [45] Used in conjunction with US processing, air plasma for modifying polyester surface combined with cotton fabric and cochineal dye. Both radiations improved the colour rapidity, weight, and printability of the coloured material. Surfaces of silk fabric and lake dye with modified oxygen and plasma argon. They discovered that after plasma radiation treatment, the absorbing capacity of the dyeing molecule in the tissue was significantly increased. [46]

Gamma radiation

Gamma radiation has a high frequency (more than 1019 Hz) and high energy (100 kv). Gamma radiation enhances colouration and strength while decreasing colour concentration by changing the surface of the cloth. As a result, it has been identified as a potential source for more environmentally friendly extraction and dyeing technologies. Cosentino et al. [47] The influence of cochineal, another, and turmeric colouring on the stability of colour used as a food additive for gamma radiation was studied. They discovered that gamma radiation does not affect the intensity of cochineal colour.

Ultrasound radiation

Ultrasound radiation is more common than human audible band radiation. This method uses cavitation to create tiny bubbles in the liquid, which increases the activation energy of the dye molecules and allows the material to be penetrated through a strong bonding [48]. As a result, it speeds up the dyeing process by lowering the temperature and conserving energy. Kamel et al. coloured wool with ultrasonic radiation and wool fabric with lac dye and discovered that radiation increased dye absorption [49]. Similarly, The same result was obtained in lac dyeing with ultrasonic radiation of cationized cotton fabric. [50] also Cationized Solfix E, Quat 188 cotton cloth, and coloured cochineal dye. The dye was removed using conventional radiation and ultrasound. [51, 52]

Microwave energy

Microwave energy is a type of electromagnetic radiation that is used extensively in natural colour extraction and dyeing. The heating system is a surface heating system, whereas microwave heating is a heating volume that penetrates the entire material and provides constant energy. The cell wall is ruptured by rapid heating, and the transfer of the dye to the solvent increases. Microwave technology is the largest source of energy and heat, the strongest colour strength and shade are used to ensure its long-term viability.

Application of Animal-Based Dyes

Colour is used in a variety of applications, including textile materials and non-textile materials. It can be used in medicine, food, solar cells, electronics, cosmetics, and so on.

Textile

Textiles is one of the world's largest industries, and the use of synthetic dyes in the textile industry is significantly greater than in any other industry[53]. However, it has been established in recent decades that the use of synthetic dyes in textiles can cause human allergies, poisoning, and cancer [54]. This is why academics, traders, and industry advise people to purchase eco-friendly branded items that not only protect them from certain cancerous responses, but also provide them with health benefits. Natural colours based on animals are very significant in a variety of areas, particularly textiles. Lac, Cochineal, and Kermes are the most commonly used dyes in textiles [55]. Various researchers like Chairat et al. [56]used natural colour and man-made materials with insect-based dyes. The kinetics of absorption and dye rate on a silk fabric dyed with lac dye was observed. Liu et al.[57] The functional properties of lac-colored chitosan cloth were investigated, and an amazing antioxidant and deodorising effect was discovered. Li and Tang's research yielded similar results.[58] Chitosan fibres were first coupled to azridine to improve dye material absorption before being coloured with lac dye, which improved the antioxidant activity of the lac-coloured chitosan fabric.

In [59] Farmed wool cloth with acidic lac dye was discovered to have good colour depth. Yaqub et al. [60] They isolated laccaic acid from lacque in the presence of mordants and applied it to soy cloth. Mongkholrattanasit et al. [61] Using the padding process, they dyed silk material using lac dye and discovered that in the presence of various mordants, the fastness characteristics increased to an acceptable level.

The effects of NaCl and Polyethyleneimine (PEI) on the absorption and desorption of lac dye on the cotton fabric were investigated. [62] It has been discovered that the inclusion of NaCl and PEI increases lacquer absorption from cloth. Janhom et al. [63] PEI and bovine serum albumin pre-treated cotton, which increased lac colour absorption in cationized textiles.

The polyamide fabric was dyed using various cochineal dyeing techniques, and its fastness to light, wash, and heat was tested in the presence of iron sulphate and alum mordant. [64] Premordanted wool cloth with several mordants and teased with cochineal dye on a variable pH. They discovered not just good colours, but also fantastic colour speeds. [65] The colour stability was tested on a coloured fabric as well as a cotton fabric dyed with cochineal and Monascuspurpureas (a fungal species). Their comparative analyses revealed that Cochineal colours were darker after biting than fungal species. [66] To replace harmful metal mordants, the wool fabric was treated with the imin dendrimer hybrid chitosan polypropylene and dyed with cochinine. The dyeing characteristics of the dyed sample were tested by the free amino group, which is a dye sorbing site, were shown to be considerably enhanced. They helped to enhance absorption. [67] They investigated the increase in the functional properties of natural textiles. [68] Dyed wool carpet with cochineal dye in the presence of several metal mordants, which show that mordant significantly improved colour strength properties. [69] Other scientists treated wool to improve absorption and dyed it with madder and cochineal dye powder using enzyme protease. [70] They discovered that enzyme pre-treatment had a remarkable effect on wool fabric dyeing, improving colour strength (K/S) and the functions of the dyed material. Another method was used to extract cochineal colourant using protease enzyme and dye non-treated wool cloth with this extracted dye. The results indicated that protease leads to a considerable reduction in extraction temperature, water, and time consumption, as well as a greater output, giving the treated fabric a high colour strength. Sea snail is used to colour natural fibres such as silk, cotton, and wool. [71]

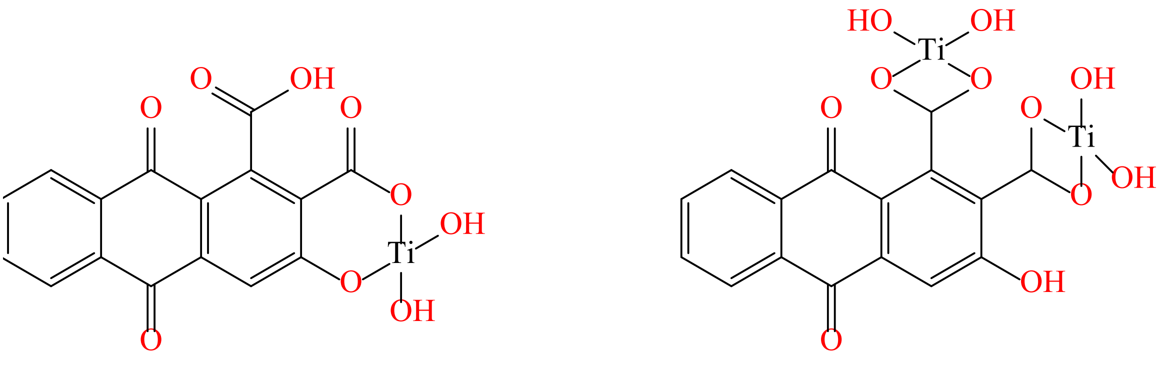
Dye-Sensitized Solar Cells

Solar cells are extremely efficient at converting light energy directly from the sun to electricity. As a result, many heavy metals, such as the Rh-complex, were utilised to transport electrons to the TiO_2 leading belt [72]. While these metals are fast enough to achieve the desired results, metal complexes have a disadvantage due to their high cost and toxicity to humans and the environment [73].

Later, synthetic organic dyes, which operate in a similar but more efficient manner than the earlier dyes, were used as a replacement for this mode. The need to employ environmentally friendly natural goods has made researchers to focus on green technology [74]. Natural colours include anthocyanin, anthraquinone, carrotenoids, chlorophyll, flavonoids, and other dry cell dyes [75].

Many researchers used natural dyes derived from insects, microorganisms, and plants on dye-sensitized sun cells and discovered remarkable results[76]. Sang-aroon et al. [77] used Natural dye obtained from cochineals and lakes, and a significant result was observed in the production of solar cells. They discovered that because of the presence of the OH and COOH groups, lac dyestuff may be bipolar and double-coordinated with TiO_2, and that electron transfer from a dye to a TiO_2 band is effective (see **Figure 11**).

Similarly, Park et al. [78] Cochineal insects produce carminic acid, which is used to convert solar energy into electricity. They discovered that because the OH group is present in Carminic Acid and the COOH Group, it forms a strong chelate to TiO_2, assisting in the enhancement of light power. Glowacki et al. [79] and Robb et al [80] used and employed tyrannical purple mollusks to make organic electronic goods (see **Figure 12**).



(A) (B)

Fig. 11. Bi-coordination of Lac dye with TiO_2 (A) and Double bi-coordination of Lac dye with TiO_2 (B).

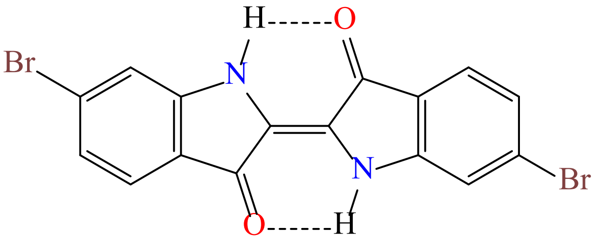


Fig. 12. Hydrogen bonding in tyrian purple.

Food

Food businesses not only supply the material to be used that is beneficial to health, but they also care about the interests of their customers. Coloured food makes foodies happy and enhances their appetite.

However, synthetic colours, particularly the use of sodium nitrite, which makes swallowing difficult and dangerous, increase the toxicity of the food product. To avoid environmental toxicity, there is a strong demand to use natural food colours rather than artificial flavours. Many studies have shown that the use of natural colours derived from plants and animals as food additives is acceptable [81]. Singh et al., [82] used lac dye as a food colourant in the meat product, which not only provides a bright red colour but also slightly increases antibacterial and antibacterial action. Because of the non-toxic properties of lac dye, it may also be used in a variety of food items such as fruit drinks, vegetable juice, fruit-flavoured items, and chocolate goods. Carmine, a lake of carminic acid calcium aluminium, is insoluble in water but may be used in meat, sausage, topping, dairy goods, desserts, and other products. [83, 84]. It was also used in the production of canned fruit such as cherries, jams, pulp, and so on [85]. Natural colours derived from animals are thus widely used in the food industry.

Pharmaceuticals

Several drugs have been introduced globally through time to reduce mortality from serious and chronic ailments such as cancer, cardiovascular problems, asthma, and renal failure, and so others. Natural dyes derived from animals also play an important role in the pharmaceutical industry and drug preparation [86]. In the pharmaceutical industry, carmines are used to colour tablets, capsules, cough syrup, and ointments[87]. These dyes are used to treat heart disease, cancer chemoprevention, lipid metabolism, Alzheimer's disease, and other conditions. These dyed products were also utilised. [88, 89]. Lac dye can be used to treat cancer cells in the human body, and it has been shown to be equally effective for treating the mixture of laccaic acids A, B, C, D, and E and human malignant cells, acting as a cancer anti-cancer agent. Dosio et al. [90] Dollabelaauricularia has isolated a bioactive component that holds promise for cancer treatment. Dolastatin 10 was also extracted from Dollabelaauricularia Senter and Sievers, which has been found to be antimitotic [91]. Bagratuni et al. and Zhao et al. [92, 93] They discovered that

6-bromoindirubin-3'oxime (BIO) derived from marine mollusks is a powerful kinase inhibitor that can be used as an anticancer, intrabrain, and neuroprotective inhibitor. As a result of their good functional properties, animal-based dyes have a lot of potential in the pharmaceutical industry.

Nano-Technological Image

Nanoparticles are molecules with extremely small particle sizes ranging from 1 to 100 nm. They have grown in importance due to their numerous favourable qualities, including strong optical absorption in visible regions and they are optical, chemical, electrical, and photochemical capabilities. These particles' antimicrobial, antitoxic, and therapeutic properties are also useful in the medical field. It can be synthesised in a variety of ways using a variety of decreases such as hydrazine, starch, formaldehyde and borohydride, ammonia, and so on. Noble metal nanoparticles, such as AgNPs, AuNPs, ZnONPs, PtNPs, and so on. [94]. Recent research, however, has suggested that green synthetic methods can be used to produce nanoparticles with good reducing properties [95]. Goudarzi et al. [96] For the production of nanoparticle silver, cochineal and pomegranate extracts were used, and the nanoparticle dispersion was well distributed. In the same way, Goudarzi et al. [97] Silver-alumina has a significantly high calibre efficiency. Cochineal powder has also been used to create nanocomposites. Kumar et al. [98] They were created using a cochineal colouring component (carminic acid) to turn silver nanoparticles green. Mousavi-Kamazani et al. [99] They created copper sulphide nanostructures using the carminic acid-cu combination and discovered that dye-sensitized solar cells are extremely efficient. These nanoparticles exhibit antibacterial and antifungal action, allowing them to be used therapeutically. Natural colours derived from animals are used separately from other sources in nanotechnology due to their long-term and environmentally friendly nature.

The Future Prospects

Natural dyes derived from natural sources are more environmentally friendly than synthetic dyes. It is widely accepted. The global demand for eco-labelled items has intensified the need to replace synthetic colours with natural colours [100]. Many scientists have identified and demonstrated their utility in the laboratory and industry. However, due to several limitations in comparison to natural dyes, this dye was unable to be commercially deployed. These drawbacks include slow speed, low colour yield, a large number of such sources for a brighter colour, and a global need for preparative colourants [101]. These concerns must be addressed to ensure their economic viability. A thorough investigation of natural colourants should be conducted to identify all of their conceivable sources and to enhance extraction and application methodologies. To fix this problem, scientists must investigate more insect species to utilise modern extraction technologies in a variety of sectors. The introduction of biotechnology - gene manipulation technology, biotechnological instruments, and so on - can also increase the number of natural dye sources. Similarly, advanced technology should be used to reduce not only dye demand but also time, energy, and chemical consumption, as well as increased colour rates and speed features [102]. The use of non-toxic chemical mordants or environmentally friendly chelating bio-mordants contributes to enhancing the colour's value and functional properties [103]. All of these things should be evaluated by scientists and researchers

Summary

Many merchants have welcomed the return of natural colours derived from diverse sources, particularly those that are animal-based because researchers are seeking to develop new ways to extract colourants as far as possible in fashion, textiles, electrical materials, and food. However, the widespread use of these approaches is problematic since thousands of animals are required to create a significant number of natural dyes. However, due to sustainability and cost, as well as time and energy efficiency, several modern techniques are being used to incorporate these hues into various ways of living. There is still an opportunity for exceptional solutions for fantastic results using few resources to reignite old culture and link life in natural colours, notably vibrant red colours from animal sources such as lacquer, cochineal, and scarlet.

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الاستخدام الحديث للأصباغ الحيوانية الطبيعية في المجالات المختلفة

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استخدمت الأصباغ الطبيعية في الصباغة والرسم والطباعة والديكور منذ فجر التاريخ. ومع ذلك ، مع تصنيع الأصباغ الاصطناعية في القرن التاسع عشر ، حدثت ثورة في هذا المجال بسبب خصائصه الدائمة للغاية وفعاليته الاقتصادية. ومع ذلك ، يسلط بحث جديد الضوء على الآثار السلبية للأصباغ الاصطناعية ، مما دفع الناس في جميع أنحاء العالم إلى تقليل استخدامهم للأصباغ الاصطناعية والتركيز على ألوان المصدر الطبيعية ، والتي لها مزايا عديدة على الأصباغ الاصطناعية. قد تكون هذه الألوان مشتقة من الحيوانات أو النباتات أو المعادن أو الكائنات الحية الدقيقة. في هذه الدراسة الموجزة ، سنتحدث عن الملونات الطبيعية من مصدر حيواني وكيفية استخلاصها باستخدام الأساليب القديمة والجديدة التي تسمح لنظرائهم بتحقيق خصائص مكافئة.

الكلمات المفتاحية: أصباغ طبيعية. قرمزي؛ طرق الاستخراج؛ لاك. حلزون البحر القرمزي مصادر حيوانية الاستدامة.