Applications of Natural Biological and Chemical Dyes-Pigments

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Abstract

Natural biological pigments are pigments or colorings derived from plants, invertebrates, or minerals. Uniquely, natural dyes are vegetable dyes from plant sources—roots, berries, bark, leaves, and wood—and other biological sources such as fungi. Archaeologists have found evidence of textile dyeing dating back to the Neolithic period. In China, the history of dyeing with plants, bark, and insects dates back more than 5,000 years. The basic dyeing process has changed over time. Typically, the dye material is placed in a bowl of water and heated to extract the dye compounds in solution with the water. The textiles to be dyed are then added to the pot, and kept hot until the desired color is achieved. Textile fibers may be dyed before spinning or weaving ("wool-dyed"), after spinning ("spun-dyed") or after weaving ("piece-dyed"). Balances Pages of Dyes Substances called mordants are used to bind the dye to textile fibres.

Keywords: Pigments of Plant, Bio-pigment, Dye of plant.

Introduction

Mordants (from the Latin verb "mordere", meaning "to bite") are mineral salts that can form a stable molecular coordination complex with both natural dyes and natural fibres. (Ferrous Sulphate of Potassium - Mineral Salt) and Iron (Ferrous Sulphate). The use of other salt materials has also been used, but is rarely used due to recent research evidence of environmental health, ecological health, or both. Of metal salts such as chromium, copper, tin, lead, etc. In addition, the use of certain mineral substances associated with natural dyes - including tannin from oak galls from other plants/plant parts, "false tannins", such as plant-derived oxalic acid, and ammonia from stale urine. Plants that bio-accumulate aluminum have also been used, including at a time when they are showing activity and returning to areas of Europe, now endangered in areas. The plant genus Symplocos, which grows in the subtropics, also bio-accumulates, and is still a common natural dye. Some dyes, and some of the dyes themselves, are powerful, and large-scale dye works are often isolated in their own areas.

Throughout history, people dyed their textiles using locally available materials, but rare dyes produced brilliant colors such as the natural invertebrate dyes, Tyrian purple and kermes, which became highly valued luxury goods in the ancient and medieval world. Plant dyes such as woad (Isatis tinctoria), indigo, saffron, and madder were raised commercially and became important trade goods in the economies of Asia, Africa, and Europe. Throughout Asia, Africa, and the Americas, patterned fabrics are produced using resist-dye technology to control color absorption in the piece-dyed fabric. Dyes such as cochineal and logwood (Haematoxylum campechianum) were brought to Europe by Spanish treasure fleets, and the dyes of Europe were carried by colonists to America.

Bb_banggie Man-made synthetic dyes in the 19th century led to a long decline in the widespread market for natural dyes. Synthetic dyes, which could be produced very quickly, soon replaced natural dyes for the commercial textile production they made available and, unlike natural dyes, were suitable for the indigenous fibers that followed. Artists of the Arts and Crafts movement favored the natural and complex colors of natural dyes, as they contain more natural colors in the natural dye as opposed to synthetic dyes which tend to rely on a single type of pigment. Composite, creating a flatter visual effect. This helped preserve ancient European techniques of dyeing and printing using natural dyes at home and artisanal dyeing. Natural dyeing techniques are preserved by artisans in traditional cultures around the world. The market for natural dyes in the fashion industry is experiencing a revival. Western consumers are becoming more concerned about disease and oversight of products that use synthetic dyes, the science of using toxic fossil fuel byproducts to produce them - in manufacturing and halting demand for products that use natural dyes. For example, the European Union urged Indonesian batik fabric producers to turn to natural dyes to improve their export market in Europe. Full image of the information in the original folder, original folder, main folder, original folder, real folder. Natural flooring, contains fast dye compounds (those with molecular structure) to form organic bonds in materials and fibres, good resistance to fading when exposed to light or exposed to normal rubbing/wear; found throughout history), are true compounds (those that dissolve quickly, lack the molecular structure to form bonds, or bonds at all, materials and fibres). Mordanting cannot fix runaway sources of fiber. Original items, red cabbage, beets, cabbage, opposite, beets, opposite, product, original product, derived from flowers.

Types of Biological Pigments

- American tincture (in Latin: Phytolacca americana)
- Phytolacca bogotensis
- Berry pigment (in Latin: Phytolacca acinosa) or stromal pigment (in Latin: Phytolacca esculenta)
- Abyssinian dye (in Latin: Phytolacca abyssinica)
- Phytolacca sandwicensis (Latin: Phytolacca sandwicensis)
- Phytolacca heptandra
- Phytolacca octandra
- Scientific pigment Stamens (in Latin: Phytolacca icosandra)
- Phytolacca pruinosa (Latin: Phytolacca pruinosa)
- Phytolacca heteropetala (Latin: Phytolacca heteropetala)
- River dye (in Latin: Phytolacca rivinoides)
- Phytolacca dodecandra

Technology for Manufacturing Biological Pigments

In Japan, dyes have perfected the technique of producing a bright red dye (known as cartamine) from dried safflower (Carthamus tinctorius) flowers. A cold bath solution is first prepared, to which the collected flowers are added. Soaking in cold water releases a yellow pigment (colouration) which is eliminated after filtering. The red petals are pressed again, the petals are rehydrated again, at which time an alkali made from red colored straw ash is added. Then he kneads the batch with his hands and shaves. Vinegar is then added to the solution, and the stained slices are absorbed from the distillery. Some gemstones are set in America and alkali is added back to the red color which it absorbs. Then the solution is poured into a separate container. A type of plum causes the dye to deposit on a piece of silk. At this stage it is colored with a fine red clay consistency. The color used as a dye can be diluted. 1.5 kg (3.3 lb) of dried fabric produces enough dye to dye a small piece of fabric. The dye color is fixed in the fabric with a mordant marker. The process of refilling is repeated several times. Morris saw the dyeing of wool, silk, and cotton as a necessary preparatory step for the production of woven and printed fabrics of the highest excellence; His period of continuous work in the dye bath (1875-1876) was followed by a period during which he became involved in textile production (1877-1878), and especially in the revival of carpets and tapestry as fine arts. Morris & Co. Also naturally dyed silk for embroidery a style called needle art.

Scientists continued to search for new synthetic dyes that would be effective on cellulose fibers such as cotton and linen, and that would be more stable on wool and silk than early aniline. Chromium dyes or sharp dyes produced a muted but very fast color range for woolen textiles. This was followed by acid dyeing of animal fibers (from 1875) and the synthesis of indigo in Germany in 1880. Work on indigo led to the development of a new class of dyes called vat dyes in 1901 that produced a wide range of fast colors for cellulosic fibers such as cotton. Dispersion dyes were introduced in 1923 to color new cellulose acetate textiles, which could not be colored with any existing dyes. Today, disperse dyes are the only effective means of coloring many synthetic materials. Reactive dyes for cotton were introduced in the mid-1950s. These petroleum-based synthetic dyes are used in both commercial textile production and in artisanal dyeing and have widely replaced natural dyes.

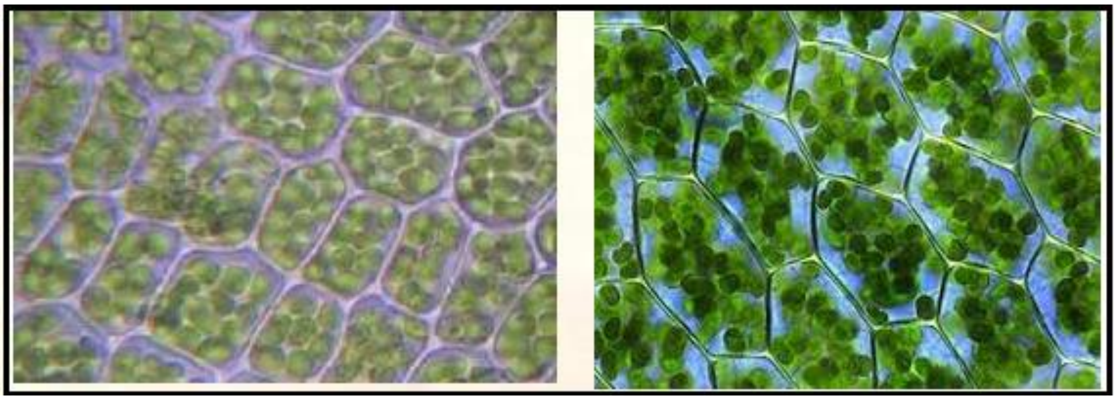

Photo.1: Natural- Biological Dyes

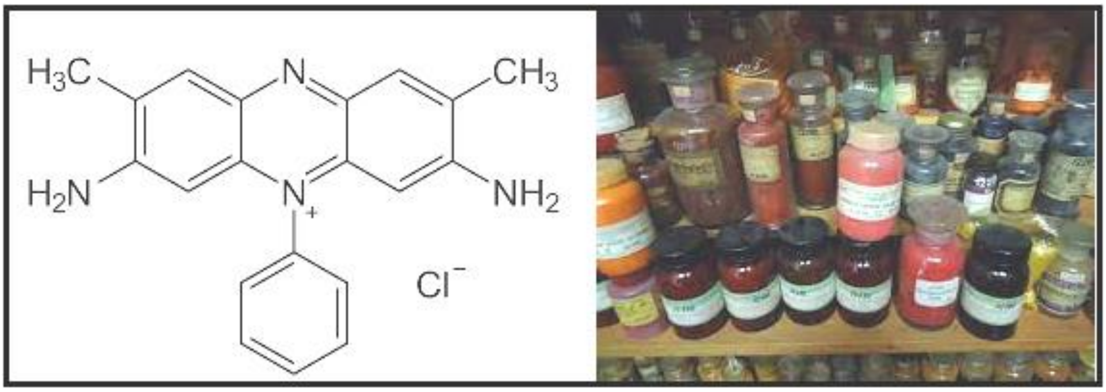

Photo.2: Chemical Dyes

Natural and synthetic dyes
In their laboratories, dyers prefer to use the applied classification of dyes. Dyes of similar application are classified together, regardless of their chemical structure. Thus all dyes within the same application classification will dye a particular group of fibers. Azo dyes and anthraquinone dyes can be found in most applied classifications.

Natural dyes: These are dyes from plant, animal and mineral sources. All dyes, until 1856, were extracted from plants, flowers, plant roots, insects, shellfish, and minerals. The problem with manufacturing natural dyes is that it is not possible under any circumstances to obtain two batches that are similar in shade and strength of color. Color stability also varies widely between natural dyes.

Synthetic dyes: These are dyes that are composed of organic molecules in dye factories. These dyes are subjected to different adjustment processes so that in the end they give an identical product every time for dyers and printers. The process of obtaining an identical color from one batch to another requires high skill, because the dye production process contains many variables that affect the absorption of the dye into the fibers.

Chemical classification and applied classification
Manufacturers classify dyes according to their consistency and chemical composition, which also indicates how they are manufactured. For example, azo dyes contain one or more azo groups (-N=N-). Anthraquinone dyes are characterized by two aromatic rings connected to each other by two carbonyl groups (-CO-). Each pigment molecule within these chemical classifications has a systematic name.

Chemical industrial dyes:
In 1856 AD, during an attempt by the British scientist William Perkin to prepare quinine to treat malaria by oxidizing some aniline derivatives extracted from petroleum materials, during the oxidation process a black substance was deposited, and when it was extracted and purified with some alcohol, its violet color appeared. By studying it, it was found that it had the same properties as the substances. Pigment: This was the first chemically manufactured dye and was called Mauveine. And then, as a result of the difficulty of extracting dyes from natural sources, which entails going through many stages that ultimately lead to small quantities, this, along with the progress in both practical and theoretical organic chemistry at that time, led to studying the chemical composition of these materials and trying to prepare them practically using methods. Different chemical. Industrial dyes are divided according to their applications into:

Acid dyes: They are anionic dyes that are soluble in water. They contain one or more sulfonic acid substitutes or other acidic groups, as is the case in Acid Yellow 36. They are used in dyeing silk, wool, nylon, and modified acrylic fibers. This type of dye is used in food colors. Industrial.

Alkaline (basic) dyes: This group was the first of the industrial dyes prepared from coal tar derivatives and used in dyeing leather, paper, wood, and straw. More recently it has been used successfully with some finished fibres, especially acrylic and also for dyeing wool, silk, linen, etc., without the use of a diluent or the use of dyeing auxiliaries such as tannic acid.

Azoic Dye: Those dyes that do not dissolve in water and are used for dyeing natural plant-based textiles such as cellulose.

Mordant Dye: These materials require some mineral salts during the dyeing process in order to be fixed on textiles. These salts act as a binding agent between the fibers and the dye, and these materials are usually used to dye cotton, wool, or other protein fibres.
Industrial dyes are also divided in terms of their chemical composition into three main types:

Azo dyes:
Which is characterized by the azo group (N=N). These dyes are used primarily in printing. This dye is considered insoluble in water, and therefore it is formed during the dyeing process from two small components that dissolve in water, and pairing occurs between them inside the fibers during their dyeing. This type is used for dyeing cotton materials and is characterized by its bright colors. Among the most famous of them is (Methyl Orange), which is used as a reagent for acids and alkalis to change its color depending on the medium in which it is found, and (Chrysoidine), which is used for printing paper and leather.

Nitro Dye:
This type of industrial dye is characterized by the presence of the nitro group NO2, which is responsible for displaying the color, in addition to some other groups such as hydroxyl OH and imino NHR, which increase its stability on textiles. This type of dye is mainly used for dyeing wool, and is used in the manufacture of coloring pencils.
The most commonly used food dyes are:

Red (Erythrosine 3): A crimson red color commonly used in candy.

Red (Allura Red 40): A dark red dye used in sports drinks, candy, condiments, and pills**.**

Tartrazine yellow 5: A lemon yellow dye found in candy, soft drinks, chips, popcorn, and cereal.

Sunset yellow 6: An orange-yellow pigment used in candy, sauces, baked goods, and fruit preserves.

Blue (Indigo Carmine 2): A royal blue pigment found in candy, ice cream, cereal, and snacks.

Conclusions
synthetic dyes became popular among a wide range of American textile artists; However, natural dyes have remained in use, with many textile collectors preferring natural dyes to synthetics. Today, dyeing with natural materials is often practiced as an aid to hand-spinning, knitting, crocheting and weaving. It remains a living craft in many traditional cultures in North America, Africa, Asia and the Scottish Highlands

References

1. Baeyer, A. (1971). "Ueber eine neue Klasse von Farbstoffen". Berichte der Deutschen Chemischen Gesellschaft. 4 (2): 555–558..
2. Ice, R. R.; Furedi-Machacek, M.; Satterfield, D.; Udumudi, A.; Vasquez, M.; Dunnick, J. K. (1998). "Measurement of Micronucleated Erythrocytes and DNA Damage during Chronic Ingestion of Phenolphthalein in Transgenic Female Mice Heterozygous for the p53 Gene". Environmental and Molecular Mutagenesis. 31 (2): 113–124
3. M. Oyama, K. Kirihara, Electrochimica. Acta, 2004, 49, 3801.

4. Ronald D. Kurp, "Ready to use spackle/repair product containing dryness indicator", assigned to Dap Products Inc.

5. E. Pramauro, A.B. Prevot, V. Augugliaro, L.Palmisano, Analyst, 1995, 120, 237.

6. Rafaat, J. G. (2022). Effect of pit and plastic bag methods and some additives on chemical composition of grass-legume mixture silages. Kufa Journal for Agricultural Sciences, 14(1), 11–20. https://doi.org/10.36077/kjas/2022/140102

7. E.H. Seymour, N.S. Lawrence, E.L. Beckett, J. Davis,R.G. Compton, Talanta, 2002, 57, 233.

8. Rulla Sabah, Ahmed saad abbas Fatin F.Al-Kazazz, Salam A.H Al-Ameri , Investigation on Glucose and levels of Zn and Cu in Sera of Iraqi Males addicted on Methamphetamine or Tramadol , Journal of Advanced Sciences and Engineering Technologies: Vol. 3 No. 2 (2020)

9. Hussain, M. A., Dawod. K. M .,Khether, A. A. (2021). Gene Action, Heterosis and Combining Ability in Maize Hybrids B- Using Line x Tester Analysis. Kufa Journal for Agricultural Sciences, 13(2), 30–40. Retrieved from https://journal.uokufa.edu.iq/index.php/kjas/article/view/3653

10. Jeric B. Gonzalez, Grethel M. More. Antibacterial Potential of Holothuria leucospilota, Brandt 1835 Extracts from Carmen Bay, Romblon, Philippines., Uttar Pradesh Journal of Zoology ., Volume 44, Issue 6, Page 12-22., DOI: 10.56557/upjoz/2023/v44i63449

11. Rani Sirisha Malkapuram, Rambabu Tanikonda, Bindu Madhavi Gosala, Rama Krishna Alla., Analysis of Multiple Usages of Protaper Rotary Instruments before Initial Signs of Failure: An In-vitro Study., Uttar Pradesh Journal of Zoology., Volume 44, Issue 6, Page 33-37., DOI: 10.56557/upjoz/2023/v44i63452

12. parna, J., Pillai, P., & Ampili, M. (2021). ANTIBACTERIAL ACTIVITY OF Clerodendrum infortunatum L. AND Vanda spathulata (L.) Spreng. AGAINST Escherichia coli AND Klebsiella sp. Uttar Pradesh Journal of Zoology , 637-644.

13. Mattigatti, S., & Datkhile, K. (2021). Synthesis, characterization and application of green synthesized ag nps in endodontic therapy to reduce microbial biofilm. Uttar Pradesh Journal of Zoology,42(12), 25-30.

14. Nahdema Abed Abass Jasim .,Mohamed Abed Al-abass .2023. Isolation and Identification of Copepods Indivuals from Kufa River Molecular Diversity Study. International Journal of Medical Research. 2, 5 (2023), 10–24., Available from: http://ijmr.online/index.php/ijmr/article/view/35

15. V. V. Vaidya. The Effects of Heavy Metal Contamination on Antioxidant Enzyme Activity and Oxidative Stress in the Earthworm Perionyx excavates . Uttar Pradesh Journal of Zoology,44(3), 59-65

16. V. H. Karambelkar., Gadre Girish A. 2023. Correlation between proliferative diabetic retinopathy in type 2 diabetes and hypertension, dyslipidemia, and diabetic nephropathy. International Journal of Medical Research . 2023 , 2(5):1-9. Available from: https://ijmr.online/index.php/ijmr/article/view/33

17. Jackman RL, Smith JL. Anthocyanins and betalains. In: Hendry GAF, Houghton JD, editors. Natural food colorants. 2nd ed. London: Blackie; 1996. pp. 244–309.

18. Vukosavljević P, Bukvić B, Janković M, Mašović S. Change of anthocyanins content during raspberry extraction. Journal of Agricultural Sciences. 2003;48(1):85–102.

19. Chigurupati N, Saiki L, Gayser C, Dash AK. Evaluation of red cabbage dye as a potential natural color for pharmaceutical use. International Journal of Pharmaceutics. 2002;241(2):293–299.

20. Dhuha Raheem A A., Zainab Abd A M. (2023). Biosynthesis, characterization, Antioxidant and Antihemolysis activity of Silver nanoparticles (AgNPs) produced using Cynophyta Alga Extract (Spirulina platensis)., Journal Alharf., Issue. November, No. 19

21. Widad H Y A., Jabbar A M A. (2023). Medicinal Uses and Comparative Activity of The Cordia myxa Plant., Journal Alharf., Issue. November, No. 19
22. Lebling RW, Pepperdine D. Natural remedies of Arabia. Saudi Aramco World. 2006;57(5):12–21.
23. Zhou H, Wu L, Gao Y, Ma T. Dye-sensitized solar cells using 20 natural dyes as sensitizers. Journal of Photochemistry and Photobiology A: Chemistry. 2011;219(2–3):188–194.
24. Clifford MN. Anthocyanins – Nature, occurrence and dietary burden. Journal of the Science of Food and Agriculture. 2000;80(7):1063–1072.
25. Kong JM, Chia LS, Goh NK, Chia TF, Brouillard R. Analysis and biological activities of anthocyanins. Phytochemistry. 2003;64(5):923–933.
26. Rossi A, Serraino I, Dugo P, Di Paola R, Mondello L, Genovese T, et al. Protective effects of anthocyanins from blackberry in a rat model of acute lung inflammation. Free Radical Research. 2003;37(8):891–900.