

Organic Paints and Pigments: A Sustainable Approach

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ABSTRACT

In the current world, artists are becoming more environmentally responsible and aware, switching to natural materials and colourants that are more useful while being less detrimental to the environment. The demand for natural paints and pigments has recently increased in response to the need for a safe and sustainable environment. Toxic to both human health and the environment are inorganic pigments. They harm the environment and persons who come into contact with these pigments in the short term as well as the long term. The natural and biodegradable organic pigments are superior to the synthetic ones because they are frequently environmentally friendly. This research emphasises the definition, types, history, extraction, and production of organic pigments. Health and the environment are endangered by inorganic pigments. Both the environment and the humans who come into contact with these pigments suffer short- and long-term effects. Organic pigments that are natural and biodegradable are far superior to manufactured ones because they are frequently environmentally friendly. The history, types, and methods of extraction and production of organic pigments are highlighted in this paper. The paper goes on to discuss the advantages of adopting organic colours for a sustainable present and environment as well as how inorganic pigments affect human health and the ecosystem.

Keywords:

INTRODUCTION

Paints and pigments are necessary to artists all around the globe. People's life are impacted by colours in a variety of ways, from uplifting depressing moods to persuading them to buy that new clothing. Different colour hues have various psychological and physiological consequences on people. Additionally, colours can foretell feelings and encourage one's own feelings. Colour is considered to be one of the most effective forms of communication. Paints and pigments have been used by artists to create colourful, eye-catching works of art that can evoke strong ideas and emotions in the minds of the viewers.

Nature has always made an impact on humans from the very beginning of the world. Dating back to the earliest times, natural pigments has always dominated the artificial, inorganic or the synthetic pigments. Organic pigments are being active since the pre historic times. Organic

material from plants, animals and rocks has been used by humans round the globe to create colour for applying to different surfaces in order to create forms that represented them or their thoughts in some way. Because of the natural characteristics of the organic pigments, they have started capturing the attention of the artists and paint makers, especially of those who are really concerned about their health and the ecology. Natural pigments are coming back to fashion with the modern need for sustainability. The organic pigments are getting the priority over inorganic pigments because of their natural and eco-friendly aspects.

Organic Paints and Pigments

Colour is widely regarded as the most engaging aspect of visual perception. Because of its profound impact on the viewer, it reveals a great deal about a work of art. Through the employment of pigment, the colouring ingredient in paint, it provides aesthetic appeal and evokes emotions (*Pigments and painting*). In the life of human beings colour adds an extraordinary value. Even the evolution and personification of life can be understood through the symbolic significance of colours. Colours are related with emotions and sometimes also used as a symbol or sign of any aspect/thing. The organic value or term can be understood in context to purity without any chemical or extra additions in to something. Even a small modification can make it impure or unnatural. The natural paints are those which have been directly sourced from nature without any mixing. Such colours can be seen from the time of prehistory where the rock shelters of caves have been painted through the use of natural colours. Even the theme of the subjects indicated the very life of those human beings in a very earthy way. The colours became a tool of their imagination and the most important aspect was related with the application of organic colours. Pigments are highly coloured powdered materials that are mixed with a liquid or a binder to produce colour. They can be either organic or inorganic, and are usually used to provide colour to other substances. Organic pigments are made from natural materials and have been developed for centuries. Inorganic hues are produced by basic chemical reactions, particularly oxidation (*Pigments and painting*). In general, inorganic paints are brighter than organic ones and also have longer-lasting qualities. The first civilizations to create pigments on a large scale were the Chinese and the Egyptians. They used minerals, plants, and animals to create new pigments. Minerals were used to create the vivid red hues of azurite, cinnabar, and malachite. Egyptian blue, a blue glass, was first created around 3000 BC using copper and sand that had been ground into a powder. The Egyptians were the first to create vegetable colorings (*History of pigments*).



Fig.1 . Colour pigments



Fig.2 Pigments

Fig.1 Source: <https://i.pining.com/564x/2a/e4/21/2ae4215abedcdb6964290d8ef592df15.jpg>

Fig.2 Source: <https://i.pining.com/564x/2c/18/52/2c1852acbe7bd6055887adabd215e45e.jpg>

Organic Pigments

An organic pigment is something that is found in a natural form and is powdered, filtered, washed, and in certain circumstances, fired to get the shades of the desired colour (*How natural pigments and dyes have been used in art*). The organic pigments were derived from plants or other carbon-based living forms. These pigments resemble small, translucent stained-glass fragments rather than tiny, opaque chunks like the inorganic pigments. When blended with a medium, they can be tricky and can't achieve the high pigment load something which the inorganic colours can. They are also translucent, which means they do not have the same covering power as inorganics. (Flanagan, n.d.).

Natural organic pigments have served a variety of creative functions for ancient societies and their artists all over the world since their origin. Such pigments and colours also contribute to sustainability as they are not at all harmful for the environment.



Fig.3. Natural colour pigments

Source: <https://5.imimg.com/data5/GV/LQ/MY-1211922/natural-pigments-500x500.jpg>

Earthen pigments have been used throughout prehistoric times, with the earliest documented record extending back to 5000 BC. Organic material from plants and animals has been brought in use by civilizations all over the world to generate colour that could be applied to variety of surfaces to create representational shapes (*How natural pigments and dyes have been used in art*). Colours were quite important in ancient times. Even before they were settled in dwellings and were interested in architectural design, prehistoric people started painting in caves. Many representations have been discovered on all continents that demonstrate their daily life. These cave paintings were made between 10,000 to 40,000 years ago, during the Stone Age (Karagiannidou,2018).Humans in the prehistoric times used organic colours obtained from different rocks, animal substances , leaves and flowers to create forms and drawings on the rocks and caves in order to communicate with their fellow members.

The earliest cave was located in 1875 at Altamira, Galicia (Spain), 30 kilo meters west of Santander. Many massive creatures were painted with black and red ochre in the cave's tholos. Charcoal which is an organic material was used to create the outlines and dark regions (Karagiannidou, 2018). The red was obtained from soil and animal blood. Yellow ochres and browns were obtained from different rocks and the earth. Blue and purple pigments were obtained from indigo and sea shells whereas whites were obtained from ivory and calcite.

Organic pigments were used as the base for oil paints until the nineteenth century, when synthetic and petroleum-based pigments became accessible. Artists started mixing the organic material and mineral based pigments with binders like egg yolk, saliva or animal fats and producing paints to create paintings and illustrations.

Extraction and Making of Organic Colours

Organic colours were being extracted from plants and animals since pre historic times. Nature has provided us with around 500 colour producing plant species. These plants' pigment compounds come from their roots, leaves, barks, trunks, and fruits. Many colours from red to yellow-orange and purple-blue to green are easily extracted from different parts of plants like beetroot, purple cabbage, berries, flowers of Ixora (producing red and violet shades), marigold, yellow flame tree, safflower (producing yellow pigments), roses, hibiscus (producing red and rich pink shades), woad, indigo, blueberries (producing blue pigments) and henna (producing brown and orange dye) (Kumar; Prabha ,2018). Green colour was basically extracted from the leaves of different plants. The colorants from these plants were extracted from their different parts either by collecting their juices or by drying and grounding them into fine powder.



Fig.5. Colour being extracted from berries

Source: <https://i.pinimg.com/564x/a2/09/1a/a2091aa69f8f55df7091378b0374bbc9.jpg>



Fig. 6,7,8,9.Turmeric and its impressions

Source: Author

Animal dyes are less common than the colours derived from plants and minerals. However, throughout history, numerous colours have been derived from insects. Cochineal is a red dye made from insects that reside on cactus plants. They were dried in the sun, grounded, and mixed with water to make a reddish powder by pre-Columbian Indians. Cochineal is still in use in many parts of Canary Islands. Carmine red is produced from the blood of Kermes insects. It refers to a wide variety of red hues that are somewhat purple but closer to red but not crimson. Tyrian purple is made from Murex, a predatory sea snail. It was extremely popular in Ancient Rome. Because the dye was extracted from thousands of snails and required a great amount of effort, it was highly prized and even referred to as "royal purple." Mummy brown, a very rich brown pigment was cultivated from the flesh of the Egyptian Mummies.

The coloured pigments, after being extracted were further processed and combined with binders like water, animal fat, saliva, and egg whites. Later on, these pigments were being mixed with oils like linseed, walnut and turpentine. The oil based pigments enabled the artists to work effectively as they would blend perfectly and would not dry easily.



Fig.10. Extraction of pigments from stone by grinding

Source: https://letmebreathe.in/wp-content/uploads/2020/07/IMG_3214-scaled-1-768x239.jpg

Inorganic Colourants and Environment

Inorganic Pigments

Organic and inorganic pigments are completely unrelated to one another. Inorganic pigments are recognised as artificial pigments all around the world. Inorganic pigments are metal compound crystals, often in the form of oxides (Interest, 2014). Inorganic pigments are produced using sulphides and oxides that contain all the necessary mineral components. Dry ground minerals, typically metals and their metallic salts, make up the majority of inorganic pigments. This results in perfect colour consistency at every stage. These pigments suit the needs for the chemical components used in the ink, paint, and other industries.



Fig.11. Inorganic ink

Source:<https://i.pinimg.com/564x/33/6a/69/336a691d8b9fbff87d7b0c21af96b529.jpg>

inorganic pigments are well-known for their long lasting and stable character (*What is an inorganic pigment? Advantages of inorganic pigment*) Inorganic pigments are typically more opaque and soluble than organic colours. Compared to organic pigments, inorganic pigments have significantly larger particles. When exposed to heat, light, and air, they do not quickly fade away. In contrast to biological colours, inorganic colours are frequently muted. They typically are cost effective as well.

Extraction and making of Inorganic Pigments

All across the world, rocks and soil may contain inorganic colours. Different minerals produce their own distinctive colours, some of which can be quite vivid. In order to improve the colour, many of them are even toasted. Ochre is one of the most widely used colour obtained from minerals. Ochre, a red or yellow pigment derived from ferruginous clay or iron ore, was often used in Aboriginal painting. A type of limonite clay obtained from ferric oxides yields Sienna, a dark earthy red pigment. It produces richer tints, from cream to brown. The highest oxidised portions of copper ore deposits produce azurite, one of the most important blue pigments used in Renaissance art. Ultramarine, a colour made from lapis lazuli, was frequently used in European paintings. Spinel is a hard, crystalline mineral that changes ions that heat up and combine with other minerals to form colours. They are available in a range of hues, such as yellow, orange, turquoise, and blue.



Fig.12.Lapis Lazuli

Source: <https://i.pinimg.com/564x/f6/a2/ab/f6a2ab76f3c3f29cf157066ef2fb50fc.jpg>



Fig.13. Extracted pigment from Malachite

Source: <https://i.pinimg.com/564x/96/02/5d/96025d1fc8db026135fe452ae5c2aba4.jpg>



Fig.14. Extracted pigment from Lapis Lazuli

Source:

<https://i.pinimg.com/564x/2f/4f/45/2f4f45160268735d8e332e848b94ac9c.jpg>



Fig.15. Extracted pigment from Orpiment

Source:<https://i.pinimg.com/564x/7a/74/b6/7a74b6d496190aa77e79cdf2f030ab88.jpg>

Effects of Inorganic Pigments on Health

There may be several advantages to inorganic pigments over organic pigments. They may be more reliable, strong, colourful, weather-resistant, and affordable, but they pose a serious health risk. Inorganic pigments contain heavy metals like lead, cadmium, and chromium,

which is why they are so harmful. The heavy metals found in inorganic paints and pigments have the potential to be quite harmful to people's general health. Hazardous metal pollutants and waste are produced in large quantities during the preparation of paints using inorganic pigments, which pollute the air and water. These metal toxins have severe negative impacts on one's health when inhaled or ingested through drinking contaminated water.

Effect of Inorganic Pigments on the Health of Paint Makers and Artists

A volatile solvent (often water), a binder (resin), and distinguishing ingredients make up the liquid form of paint. After application, the drying film's volatile components evaporate, but the pigment is kept in place on the surface by the binder, which maintains the pigment in the dry film. Paints contain a large number of chemical ingredients, mostly pigments, extenders, solvents, binders, and additives, which can be quite dangerous to the health of both painters and those who prepare the paints. (IARS, 1989).

Workers in the painting and paint industries face the risk of being exposed to chemicals present in paint products while applying and removing the paint materials. While painting or preparing the surface for painting, some hazardous chemicals like silica and diisocyanate are discharged into the air. If inhaled, these compounds can be highly dangerous. Solvent exposure is a common occurrence for workers applying paint. When removing paint by hand, they are often exposed to pigments and fillers. Manual handling processes like weighing ingredients (colourants, enhancers, binders, and preservatives), moving them into mixing equipment, adding solvents to grinders, and cleaning equipment (mixers, grinders, reactors, tanks, filters etc.) are the main sources of human exposure while manufacturing paint. When thinning and staining, filling processes, and filtering varnishes, further solvent exposure occurs. Numerous aromatics, including phenol, acrolein, hydrocarbons, glycerol, and lipids, as well as particles or vapours of maleic acid, phthalic acid, and fumaric acid, may be emitted during the filling of kettles and heating of varnishes. High levels of dust exposure from resin granules, colourants, hardening agents, and other components are associated with the manufacture of powder coatings. Although skin contact and inhalation appear to be the most common forms of exposure, ingestion related to specific job practises is in fact a significant concern. (IARS, 1989). When workers in the paint sectors had their blood and urine analysed, a high amount of paint chemical concentration was detected. Humans exposed to the chemicals and compounds generated during the manufacture and application of inorganic paints develop a number of serious illnesses and disorders. Dry pigments are significantly more dangerous than liquid paints as their particles are easily ingested and inhaled. Poisoning may result by ingesting or inhaling dangerous pigments. The main risk when painting is unintentional hand-to-mouth contact and accidental pigment ingestion from eating or drinking. When applying paint using procedures like spraying and heating, it is very easy to breathe in harmful pigments. White lead, which is found in inorganic pigments, can harm the kidneys and cause anaemia and other health issues. Different types of cancer may be caused by some inorganic pigments like chrome yellow, lamp black, carbon black, and others that contain benzene. Long-term inhalation of some pigments may result in brain damage, behavioural abnormalities, allergies, and irritations of the respiratory system (*Section 10: Painting and*

Drawing).

Inorganic Pigments and their effect on Environment

Inorganic pigments contribute to environmental pollution in addition to having an adverse effect on the health of paint manufacturers and artists. Sometimes, the pigments in the paints an artist uses are not even known to them. The artists employ poisonous pigments in their oil, gouache, watercolour, and watercolour paints, which severely harm the environment (Christensen, 2018). The paint industry releases a lot of dangerous chemicals into the air and water, polluting them and endangering both aquatic and terrestrial organisms. Inorganic pigment-based paints pose the greatest harm to the humans as well as their environment. Although non-toxic paints may be considered safe for humans, they are not always safe for the environment. Propylene glycol, for instance, has a catastrophic effect on aquatic habitats even though it is suitable for use in food and as a cosmetics. It implies that flushing acrylic garbage down the drain endangers aquatic life and water bodies. (Christensen, 2018).

Organic Pigments – A Safe and Sustainable Choice

Sustainability: According to one definition of sustainability, existing economic and environmental practises do not jeopardise the ability of future generations to enjoy similar wealth, usefulness, or wellbeing. By highlighting the unsustainable nature of modern civilizations, where resource usage, development, and consumption habits endangered the environment's balance and the welfare of future generations, the modern environmental movement helped popularise the concept of sustainability.

Organic Paints and Sustainability: The usage of organic paints and pigments can be intimately tied to a sustainable future. Compared to inorganic pigments, these pigments pose a substantially lower risk to both people and the environment. Alternatives to the harmful inorganic pigments that are harmful to the environment include organic pigments and paints. Sustainability is now a global issue due to the growing awareness of the negative effects of synthetic colourants and the products they colour. (Adeel et al., 2020). Environmental concerns about the use of the majority of inorganic colourants have prompted research and development academics around the world to look into new environmentally friendly options for reducing their detrimental effects on the environment as well as other aspects of bio-colorant applications (Yusuf et al., 2017). In natural painting techniques, it has been demonstrated that plant extracts are a more sustainable alternative to inorganic pigments. Due to a global community that is concerned not just about protecting their health but also the environment, natural pigments are making a comeback (Adeel et al., 2020). Utilizing natural pigments can help to lessen environmental pollution, which promotes sustainability. Many artists are gradually switching to organic and less hazardous paints and pigments as they become more ecological and health-conscious.

Conclusion: Although many painters, paint producers, and other household users may have favoured inorganic pigments, an increasing number of these groups are converting to organic pigments as a result of worries over the destruction of the environment and the health of aquatic life in particular. According to studies, organic pigments are much less dangerous and safe for aquatic

life, humans, and the environment. Many painters and the paint industry throughout the world have moved from using inorganic pigments to organic ones, which is a huge step towards a sustainable future. The majority of organic ingredients are readily available at home and have a lengthy shelf life. One of the organic materials among them is also plants. These plants' pigments are also used in a variety of artistic portrayals. Modern artists have shifted their medium and embraced chemically produced colours since they are more versatile and take less time to prepare than organic colours. Though, some of the art practices also include organic process and colours but they are very limited. There is an urgent need to return to the old practises of employing organic colours because synthetic pigment and extracts are more like a gradual poison that are harmful to both artists and paint makers as well as creating a serious threat to the environment. So that people are aware of the consequences that are either directly or indirectly related to environmental degradation and human health issues, awareness programmes should be launched.

REFERENCES:

1. "Pigments and Painting", <https://www.idesign.wiki/en/tag/natural-organic-pigment/>
2. "History of Pigments", <https://www.winsornewton.com/na/articles/colours/history-of-pigments/>
3. "How natural pigments and dyes have been used in art", <https://www.invaluable.com/blog/natural-pigments/>
4. Flanagan. J, (n.d.), "Important difference between organic and inorganic pigments in painting", <https://emptyeasel.com/2007/05/06/important-differences-between-organic-and-inorganic-pigments-in-painting/>
5. Karagiannidou. E.G, (2018, March 06). "Colors in the Prehistoric and Archaic Era", https://www.chemistryviews.org/details/ezine/10872110/Colors_in_the_Prehistoric_and_Archaic_Era.html
6. Kumar. V, Prabha. R, (2018). "Extraction and analysis of natural dye". *Journal of Natural Product and Plant Resources*, 8(2), 32-38.
7. "Inorganic Pigment Compounds- The Chemistry of Paint", <https://www.compoundchem.com/2014/03/21/inorganic-pigment-compounds-the-chemistry-of-paint/>
8. "What is an Inorganic Pigment? Advantages of Inorganic Pigments", <https://www.koelcolours.com/blog/pigments/inorganic-pigment-advantages-inorganic-pigments/>
9. Christensen. I, (2018, August 10), "Your paints may contain Toxic Chemicals. Here's how to avoid harming yourself and the environment", <https://www.artsy.net/article/artsy-editorial-paints-toxic-chemicals-avoid-harming-environment>
10. "Section 10 :Painting and Drawing", <https://www.baylor.edu/ehs/index.php?id=94372>
11. "Occupational Exposure as a Painter", <https://www.ncbi.nlm.nih.gov/books/NBK304433/>
12. Adeel et al., (2020, June 29), "Recycling from Waste in Fashion and Textiles: A Sustainable and Circular Economic Approach" John Wiley & Sons.
13. Yusuf et al., (2017, January 16), "Natural Colorants: Historical, Processing and Sustainable Prospects" , <https://link.springer.com/article/10.1007/s13659-017-0119-9>