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BHUTAN STANDARD

Mineral Pigment

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FOREWORD

This Bhutan Standard for Mineral pigment was drafted by Sub-Committee on Mineral Pigment SC 04 and adopted by Bhutan Standards Bureau after the draft finalized by the Textile and Handicraft Technical Committee TC 06 and approved by the Bhutan Standards Bureau Board (BSB Board) in July 2022.

This standard is subject to systematic review after five years to keep pace with the market trends, industrial and technological developments. Any suggestions and further information may be directed to the concerned Technical Committee.

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Mineral Pigment

1 Introduction

The BTS XXX:2023 standard outlines the production process for two categories of mineral pigments: earth-based pigments and stone-based pigments. This standard provides guidelines and procedures for sourcing raw materials, preparing the pigments, and conducting necessary tests for identification. By following these standardized methods, artists, conservators, and pigment manufacturers can ensure the quality and authenticity of mineral pigments used in various applications.

2 Scope

The scope of this standard encompasses the production process for mineral pigments, specifically focusing on the extraction and preparation of earth-based and stone-based pigments.

It provides comprehensive guidelines for material selection, cleaning, grinding, sieving, kneading, dispersion, sedimentation, decantation, fermentation, drying, pulverization, packaging, and labeling. Additionally, test methods for pigment identification are included to assist in determining the presence of mineral pigments in artworks.

3 Normative References

No normative references are cited.

4 Terms and Definition

For the purpose of this standard, the following definitions shall apply.

4.1. Do-tsoen (dz)

Term used to describe mineral pigment extracted from rocks.

4.2. Sa-tsoen (dz)

Term used to describe mineral pigment extracted from soil.

4.3. Sa-Tsag (dz)

Refers to red earth pigment

4.4. Sa-Nag (dz)

Refers to black earth pigment

4.5. Sa-Ser (Ngang-Pa) (dz)

Refers to yellow earth pigment

4.6. Sa-Kara (dz)

Refers to white earth pigment

4.7. Stone-based pigments

Pigments derived from rock minerals, typically obtained through processes such as crushing, grinding, and pulverization.

4.8. Earth-based pigments

Pigments derived from soil or earth minerals, obtained through processes such as extraction, drying, and pulverization.

4.9. Micronization

The process of reducing the particle size of a pigment to a fine powder, typically done through grinding or pulverization

4.10. Sieving

The act of separating particles of different sizes by passing them through a mesh sieve, used to collect the fine particles and remove any larger debris.

4.11. Kneading

The process of thoroughly mixing a pigment with water to achieve a uniform consistency and texture.

4.12. Dispersion

The process of diluting a pigment in water to create a suspension, allowing for easier application and integration into a medium.

4.13. Sedimentation

The natural settling of particles in a liquid medium, allowing the separation of solid pigment particles from the liquid.

4.14. Decantation

The process of separating the liquid portion from the settled particles by carefully pouring off the top layer, leaving behind the sediment.

4.15. Fermentation

A controlled chemical process in which microorganisms break down organic matter, often used to enhance the qualities of mineral pigments through aging or maturation.

4.16. Pulverization

The act of grinding or crushing dried pigment particles into a fine powder using tools such as a mortar and pestle.

4.17. Packaging

The process of properly storing the pigment powder in suitable containers to ensure its preservation and protection from external factors.

4.18. Labeling

The practice of affixing appropriate labels to pigment containers, providing essential information such as pigment type, color, batch number, and any relevant safety precautions.

5 Raw materials

5.1 Do-tsoen

Stone pigments can be derived from various raw materials, including minerals, rocks, and natural substances. Here are some commonly used raw materials for stone pigments:

Sl. No	Category	Colour
1.	*ST-001*	White
2.	*ST-06*	Dark
3.	*ST-07*	Dark blue
4.	*St-08*	Black
5.	*ST-10*	Dark brown
6.	*ST-011*	Dark orange
7.	*ST-014*	Dark yellow
8.	*ST-015*	Dark red
9.	*ST-016*	Red
10.	*ST-017*	Light green
11.	*ST-018*	Orange
12.	*ST-21*	Yello green

5.2 Sa-tsoen

Earth pigments are natural pigments derived from minerals found in the Earth's crust.

Here are some commonly used raw materials for earth pigments:

Sa-Tsag

Sa-Nag

Sa-Ser (Ngang-Pa)

Sa-Kar

6 Methods of preparation

6.1 Do-tsoen

6.1.1 ST-06-dark green, ST-08-black, ST-0015-dark red, ST-016-red, ST-018-Orange, ST-021-yellow green

a) **Sourcing or material selection:** Choose a stone/rock that contains pigment.
b) **Cleaning & washing:** Collect and wash to remove dust/dirt which could potentially dilute the texture of the mineral pigment.
c) **Grinding:** Crush into a small chips (gravels) using a hammer
d) **Micronization:** Crush it into a powder by using a iron Mortar metal and pestle
e) **Sieving:** Segregate particles by using mesh sieve and collect the fine particles
f) **Kneading:** Add water and knead the fine powder thoroughly
g) **Dispersion:** Add more water to dilute the powder
h) **Sedimentation:** Let the fine particles settle properly
i) **Decantation:** Separate the top layers from the settled fine particles. Drain the top water and collect the bottom deposit.
j) **Fermentation:** Ferment the collected deposits for 3 months to 1 year in an airtight container.
k) **Drying:** Dry the fermented deposit in the sun or dryer.
l) **Pulverization:** Make the dried deposit into fine powder using a mortar and pestle.
m) **Packaging & labeling:** Put the fine powder into an appropriate packaging and label it properly.

6.1.2 ST-001-white, ST-07-dark blue, ST-10-dark brown, ST-011-dark orange, ST-014-dark yellow, ST—017-light green

a) **Sourcing or material selection:** Choose a soil that contains pigment.
b) **Cleaning & washing:** Collect and wash to remove dust/dirt which could potentially dilute the texture of the mineral pigment.
c) **Abrasion:** Rub two same stones to get fine particles
d) **Kneading:** Add water and knead the fine powder thoroughly
e) **Dispersion:** Add more water to dilute the powder
f) **Sedimentation:** Let the fine particles settle properly
g) **Decantation:**Separate the top layers from the settled fine particles. Drain the top water and collect the bottom deposit.
h) **Fermentation:** Ferment the collected deposits for 3 months to 1 year in an airtight container.
i) **Drying:** Dry the fermented deposit in the sun or dryer.
j) **Pulverization:** Make the dried deposit into fine powder using a mortar and pestle.
k) **Packaging & labeling:** Put the fine powder into an appropriate packaging and label it properly.

6.2 Sa-tsoen

Sa-Tsag, Sa-Nag, Sa-Ser (Ngang-Pa) and Sa-Kara

a) **Sourcing or material selection:** Collect soil that contains desired pigment.
b) **Segregation**: Segregate soil from unwanted twigs, gravel and foreign matter.
c) **Mixing:** Add water to the soil and stir it properly.
d) **Filtration:** Using a muslin cloth, filter the solution and repeat the process at least 4 times. The 4th time should entail doubling the muslin cloth during filtering.

e) **Sedimentation:** Let the particles in the solution settle.
f) **Decantation:** Separate the top layer from the settled fine particles.
g) **Drying:** Drain the top water. Collect the bottom solid layer and dry it in the sun.

h) **Packaging & labeling:** Package the pigment and label it accordingly.

Note: After step 6, one may store the solution in an airtight container for fermentation, which will result in fine quality pigment.

7 Test

To determine whether a painting is made with mineral based pigments, you can perform the following tests:

1. **Visual Examination:** Mineral based pigments have earthy colors with distinct appearance compared to synthetic pigments. In-case of stone based pigments, they tend to have a grainy texture.
2. **Solvent Test:** Moisten a cotton swab with a small amount of solvent (e.g., water) and gently rub it on a canvas to test the fineness of the pigment. If the pigment dissolves or smears, it may indicate the presence of mineral-based pigments.

While the above tests provide initial indications, it's important to note that they are not definitive proof of the presence of mineral-based pigments. For more accurate findings, it is advisable to consult a professional conservator or art expert who can use techniques to identify the pigments used in the painting without causing damage

8 Tools and Equipment

The commonly used tools and equipment for the extraction process are:

1. Hammer: These tools are used to break down the stone into smaller pieces for further processing. A hammer is typically used for initial crushing, and a crusher or grinder can be used for more refined grinding.
2. Mortar and Pestle: A mortar and pestle are used for manually grinding the stone into a fine powder.
3. Sieves: Mesh sieves are used to separate the ground stone powder into different particle sizes.
4. Filtration apparatus: Muslin cloths are used to separate the liquid extract from solid residues after the extraction process.
5. Containers: Containers made of plastic, glass or steel are used to hold the stone and solvent. These containers should be chemically resistant to the chosen solvent.
6. Stirrers: Wooden stirrers are used to mix the stone and solvent during extraction. They ensure proper contact between the solvent and stone particles for efficient pigment extraction.
7. Dryer: A dryer can be used to remove any remaining solvent and moisture from the extracted pigments, leaving them in a dry form.
8. Safety Equipment: Safety equipment such as gloves, goggles, face masks, lab coats/apron and ventilation systems should be used to ensure safe handling of the chemicals and materials involved in the extraction process.

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