

METHODS FOR DYEING AGATES

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“Artificially dyeing precious materials to make them more desirable to the consumer is as old as greed and stinginess” [1].

The process of coloring agates was used to improve and change the color of the stone. Artificial coloring of agates has been known since ancient times. An example is beads found in China [2].

Agate, a striped translucent variety of chalcedony, is a common semi-precious stone in jewelry. Chalcedony is a whole family of stones, including onyx, carnelian, sapphirine, heliotrope, chrysoprase. Its coloring dates back to Roman times [3].

The porous structure of chalcedony allows chemicals to penetrate the stone. This helps the stone acquire a stable color.

The first mention of the technology of dyeing agates is found in Pliny the Elder (born 23 CE, died 79 CE), who in his Natural History writes of stones "which are said to be boiled in honey for seven days and nights without interruption. Thus, purified and cleaned, the ingenuity of the artists decorates it with multi-colored veins and spots and cuts it into such shapes as may please the buyers best" [4].

With the help of this technique the stone was painted black. This process was studied and described in more detail by W. Newton in the 1849 edition of the London Magazine of Art and Science.

The process described by Pliny was accepted as a fable. But a similar process of coloring is used in the agate factories of Oberstein and Idar for the purpose of imitating onyx.

This process was a secret of the agate merchant from Idar for many years, who probably bought it from Italian and Roman artists who bought stones for art. Chalcedony has a layered structure. Each layer has its own density and structure. The stone is able to absorb liquid in the direction of the layers. But since the structure of the layers is different,

the brightness of the color after painting is different for each of them. To test the ability of a stone to absorb liquid, a piece is broken off. This piece is moistened with the tongue; then the buyer carefully notes how quickly the liquid is absorbed by the stone. The faster, the deeper the stone will absorb the paint. After that, the agates are washed and dried without exposure to high temperatures. Then the stones are placed in a clean vessel with a mixture of honey and water. The mixture is quickly heated but not brought to a boil. If the water evaporates, more is added so that the stones are completely covered with it. The stones are boiled in a vessel for 2-3 weeks. Then the stones are transferred to another vessel with strong sulfuric acid. It is necessary to completely fill the stones with acid. A slate slab is placed on top and sent to the oven, heated to 350-400 degrees. They are kept in the oven for 9 hours or a whole day. It all depends on the stone itself, how well it absorbs. But some stones do not lend themselves to such treatment. The stones are then thoroughly washed and dried. When the stone is polished, it is coated with oil for a day or two to fill in small cracks and give a smooth appearance. Honey is absorbed into the layers of the stone, disorganized and carbonized in the pores by sulfuric acid. The carbon is deposited in stripes, which gives the stone a black color. The stripes in the stone become more distinct. If the stone was originally colored, its natural color becomes brighter. In the 1823 edition of the Encyclopedia Britannica states that “agate may be stained artificially with solution of silver in silver nitrate...” followed by exposure to the sun. With this treatment, agate is damaged by exposure to high temperatures and completely dissolved when the stone is soaked in nitric acid overnight. A more stable color is obtained in a copper nitrate solution. The stones are heated to red. But this method colors the agate incompletely. Simple “burning” of chalcedony is also used to enhance the color. If the chalcedony contains iron oxide, it is treated with hydrochloric acid, which changes the valence of the iron. Agate can also be dyed other colors. To do this, first boil the stone in a strong bicarbonate solution. Then soak in solutions of: red or yellow prussiate of potassium followed by soaking in iron sulphate solution; iron nitrate for red; chromic acid for green; sugar solution followed by heating to obtain a brown color. If sulfuric acid is added to the sugar solution, it will turn black. The latest coloring methods can also be done at home [5]. Agates can be dyed without heat in a more environmentally friendly way using organic dyes such as rhodamine B (C₂₈H₁₀ClN₂O₃) and crystal violet

(C₂₅H₃₀N₃Cl) diluted in ethanol. How can you tell if an agate slice is dyed?

“Bright, unnatural colors are the main way to tell. While there are natural agates that are shades of blue, red, and green, they are only ever really earthy tones. If your slices are bright or neon in color, they are likely dyed. You could also soak them in a little rubbing alcohol to see if any of the color bleeds out. Natural agates and their color won’t be harmed by alcohol, but the color used to dye them will bleed out of the crystal and into the alcohol. Depending on the quality of the dye job, it could take a day or a few to see any color changes in a dyed slice. Natural agate will not change at all” [6].

Coloring methods have not changed much over time. The essence of the methods always remains the same as in ancient times. But science does not stand still and invents new, more environmentally friendly methods of coloring stones. Therefore, we can believe in a bright future for our planet.

References

1. Historic Methods of Artificially Coloring Agates. Mindat. – URL: <https://www.mindat.org/article.php/170/Historic+Methods+of+Artificially+Coloring+Agates> (date of access: 20.02.2025).
2. Liu, Y., et al. A study on the properties of dyed agate. *Nature Reviews Materials*. 2023. V.8, №5. P.456-467. – URL: <https://www.nature.com/articles/s40494-023-01039-7> (date of access: 02.03.2025).
3. Hwang, J., Kim, S. The effects of dyeing on the optical properties of agate. *Journal of Materials Science*. 2020. V. 55, № 12. P. 5000-5010. – URL: <https://www.sciencedirect.com/science/> (date of access: 21.03.2025).
4. Pliny the Elder. *Natural History*. [//www.thecollector.com](https://www.thecollector.com/pliny-elder-natural-history) – URL: <https://www.thecollector.com/pliny-elder-natural-history> (date of access: 26.03.2025).
5. Agates: History and Characteristics. *Gemology Online*. – URL: <https://gemologyonline.com/agates.html> (date of access: 04.03.2025).
6. How Can You Tell If an Agate Slice Is Dyed? *Reddit*. – URL: https://www.reddit.com/r/mineralcollectors/comments/1e67kyp/howcanyoutellifanagatesliceis_dyed/ (date of access: 20.03.2025).