# Natural versus Artificial Dyes

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**Abstract**

The research and experimentation conducted is intended to compare the effects of a natural dye versus its synthetic counterpart on a group of four white-petal snapdragon flowers. Specifically, how the flowers were affected in terms of the color of the petals and health after the dye is applied. The group of flowers was split in half, with one receiving the natural dye and the other receiving its synthetic dye counterpart. Both groups had the same environment, including the addition of dye and water, which was done simultaneously. After two weeks of experimenting, the results showed that the experiment was a failure, as the flowers did not experience any significant coloration or varying degrees of health. While the experiment itself was a failure, its results can still be used to convey our message, which was that the difference between an artificial and natural product is negligible. This is intended to counter or debunk the bias most people have towards these buzzwords, as media and advertising have distorted the general public's perception of these words. The results also make way for further research, with larger sample sizes as well as a longer period of time given to the experiment, which would give greater, more accurate results. We believe that a continuation of our research would also support our conclusion, that being that the difference between natural and artificial products only exists in name, and to judge a product solely based on its designation as synthetic or natural is simply a cultural bias.

Keywords: synthetic dye, natural dye, flower, color, health

# Natural Versus Artificial Dyes

## Introduction

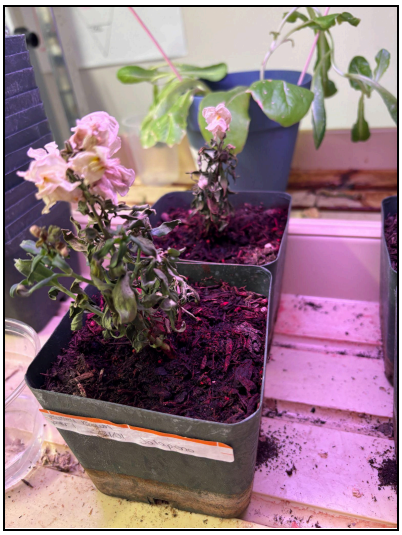
In this project, we hoped to highlight the differences in the effect natural and synthetic dyes have on plant health and color when absorbed, specifically flowers. The topic of artificial versus natural products is a polarising and controversial topic, especially considering that “the global shift toward sustainability” has only increased (Tanushri et al., 2024). Our experiment strives to show the differences between them, if any, when considering their usage on living organisms. While not meant to be seen as a defining study on the differences between every artificial and natural product, it is meant to clear up misconceptions and biases applied to these terms.

## Methods

We hypothesized that the natural dye would be absorbed and retained better if both dyes were applied equally. The independent variables in this experiment were the type of dyes given to the flowers, namely, a natural beet-based dye and an artificial red dye. Our dependent variables were the color of the flower petal as the dyes were applied. Our controlled variables were the amount of water, sunlight, and soil given to the flowers.

## Procedures

To start the experiment, we acquired common beetroot, McCormick red food coloring, and four white-petal snapdragon flowers. Then we cut the beet into 1-inch by 1-inch pieces and boiled it. After it boiled, we let it cool down, then added 100mL of dye to the plants. After regularly adding the dyes to the plants, we monitored the changes in the color of the flower petals.



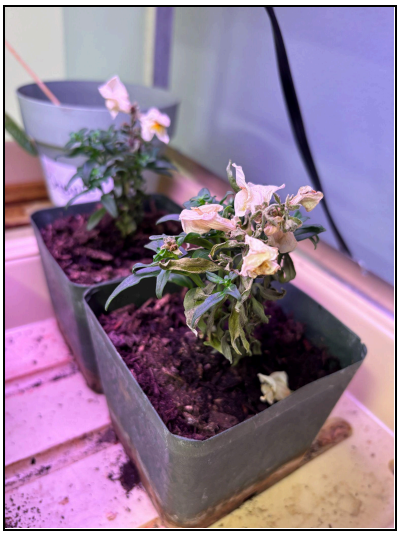
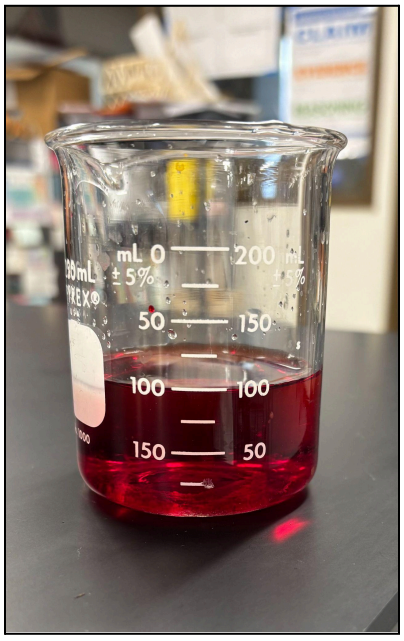


**Figure 1:** This shows the plants that were watered with artificial dye. **Figure 2:** This shows the plants that were watered with natural dye.



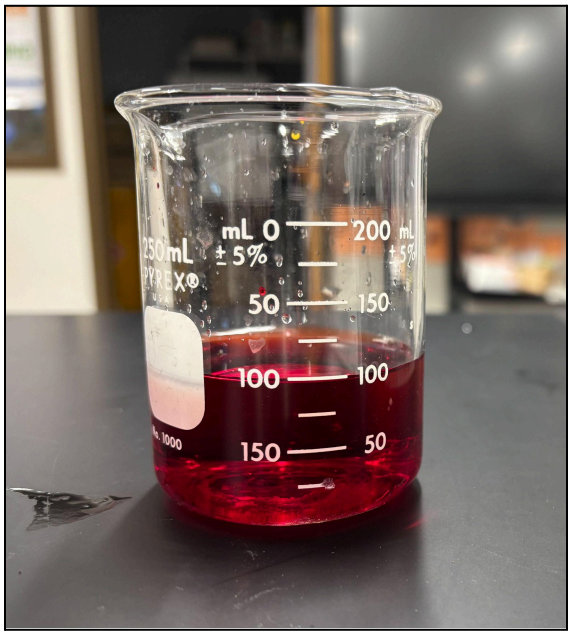




**Figure 3:** This shows how much of the food coloring was added to the artificial dye snapdragons. **Figure 4:** This is how much of the Beet dye was added to the natural dye snapdragons.

## Results

**Figure 5:** This shows what was visible of the Artificial dye (food dye) on the snapdragon.

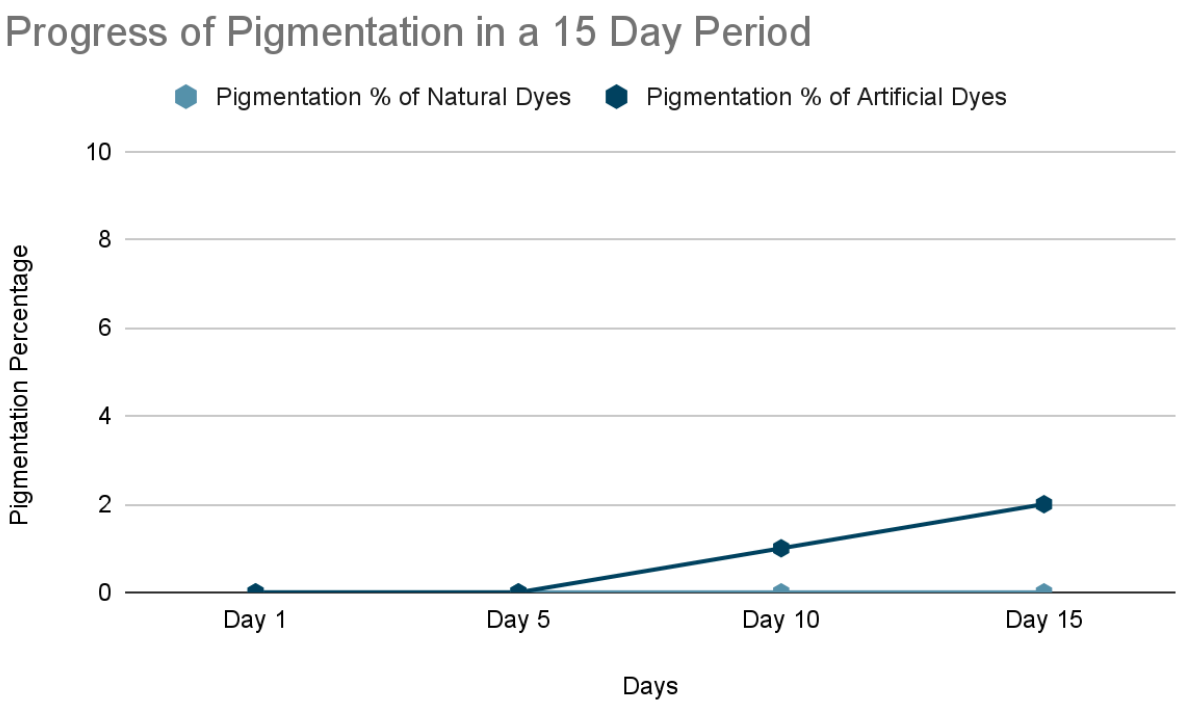



**Figure 6:** Our results were relatively lackluster, with the plants showing very little or no pigmentation. Natural Dyes is the group given the natural beet dye, and Artificial Dyes is given the artificial dye. The small pigmentation that was shown was on one plant, which did have some visible red coloration after being fed the artificial dye. The two applications of dyes proved not to be enough for the plant color to change significantly.

**Conclusions**

The hypothesis that a synthetic dye would be absorbed faster than a natural dye was not supported by the results, as the only pigmentation shown was insignificant, with a maximum pigmentation of 2% by the artificial dye, with the natural dye showing none at all, and can't be used to sustain a tenable conclusion. Neither plant absorbed enough dye to cause any visible color change, nor did they show significant growth. The only observable difference was that the plant receiving natural beet dye appeared somewhat healthier than the plant receiving synthetic dye. The lack of results likely occurred because soil-grown plants do not absorb pigments easily, environmental or experimental conditions may not have allowed for measurable dye uptake, and the time used to experiment wasn't enough to allow for results to manifest. Future experiments, such as those using cut flowers or hydroponic setups, higher dye concentrations, or longer observation periods, may yield clearer results.

**Discussion**

We set out to evaluate the difference in effects between artificial and natural dyes on a plant to confirm whether the cultural biases people have towards these words are justified or not. While our experiment wasn't successful, we still found that the dyes themselves didn't have any significant differences in terms of the health of the plant. This illustrates that the assumptions the general public makes about words such as "natural" and "artificial" aren't reasonable, but rather products of their representation in the media. Our research had various limitations, such as the relatively short time period the experiment was conducted, as well as its lack of definitive results. While keeping in mind these limitations, it is still reasonable to say that the differences

between natural and artificial dyes are negligible, as they did not show to be any healthier or more effective than the other to a significant extent.

In the current landscape of scientific discussion around artificial and natural products, there has been a notable increase in the attempts to mass-produce natural products by industries. This is due to the "raised personal health awareness and social environmental responsibility put pressure on the agri-food industry" that has proven to reduce waste, stimulate conservation, and regenerate resources and energy (Chervenkov, et al. 2024). This also highlights the importance of consumer awareness, which shouldn't be swayed by labels pushed by these corporations, but instead opt to raise their knowledge about what they're consuming. As technology makes this knowledge even more accessible, people should also be wary of non-trustworthy unverified information that further blurs the truth and the cultural biases people have grown with.

Research has also shown that some of these biases do have a scientific basis that support the wariness around these labels. With studies showing that certain artificial food colors and plant-based foods "have a role in ADHD that can both worsen or improve symptoms" presenting the fact that in the modern day, things you consume can unknowingly change your brain chemistry (Eagle, K. 2014). While the long term effects of these changes are still being researched, any changes at all shouldn't be tolerated. This doesn't mean that judging something by a simple label is recommended, but that further research in the things you consume could help both you and your community if there are any questionable or dangerous factors found.

It is also important to note that synthetic material is used for many different reasons, with a specific purpose usually not being expressly stated by their manufacturer. There is uses such as coloring food, which "is supposed to increase its aesthetic value" such as when companies use it to restore a products natural color which is lost due to preservation, the enabling of identification

by its color, mask unfavorable discoloration, and reduce the loss of vitamins sensitive to light (e.g., the intense color of drinks in clear glass bottles prevents deeper penetration of sunlight and the breakdown of nutrients contained in it) (Lis, K. 2023) The usage of these artificial dyes isn't for the same reason, but they all have the same label, which is yet another reason to be wary of hasty judgement by consumers.

## References

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