No Time to Dye:
Simulating Dye Recipes with the "Test Tube Method"

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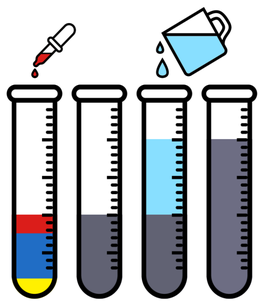
Objective

Custom-dyeing support fabrics to match textiles in need of treatment is standard practice for conservators, however the process can be time-consuming and resource-intensive, requiring multiple rounds of trial and error.

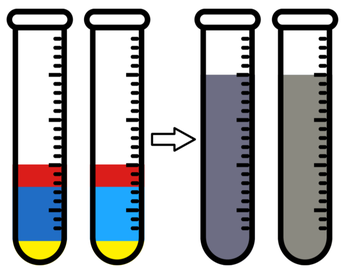
This study intends to economize custom-dyeing by approximating dye recipes in test tubes and visually comparing the tubes to a target textile prior to undergoing a dye process.

Methodology

In order to make a test tube, ten drops of dye from pre-prepared stock solutions should be dispensed into a tube using an eye-dropper, then diluted. The ten drops can be made from up to 3 different colors.



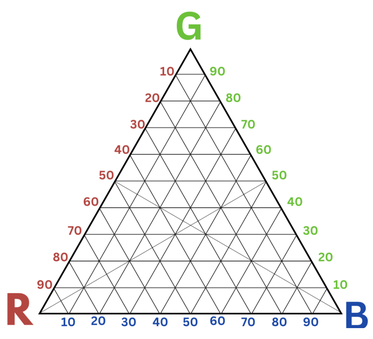
Tube creation illustration



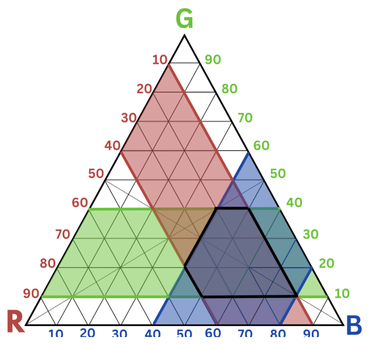
Dye Comparison

The most important part of custom-dyeing is determining which colored dyes to use. When making purple, should scarlet red be mixed with royal or navy blue? The Test Tube Method's (TTM) biggest strength is the ability to efficiently determine which dyes are most appropriate.

Once specific dyes have been selected, recipe formulation begins with a dye triangle, which is used to plot different ratios between three colorants. The triangle helps visualize the give-and-take of different dye-ratio combinations.



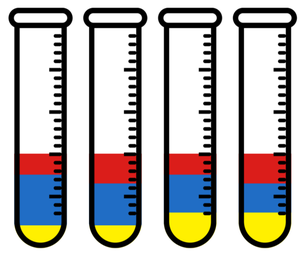
Blank dye triangle



Dye triangle with established boundaries

Due to drop-by-drop color administering, recipes may only be determined in 10% increments. For this reason, the TTM is best suited to establishing boundaries on the dye triangle for recipes to be formulated within.

After boundaries are established, tubes with different ratios of colorants within the set boundaries should be made.



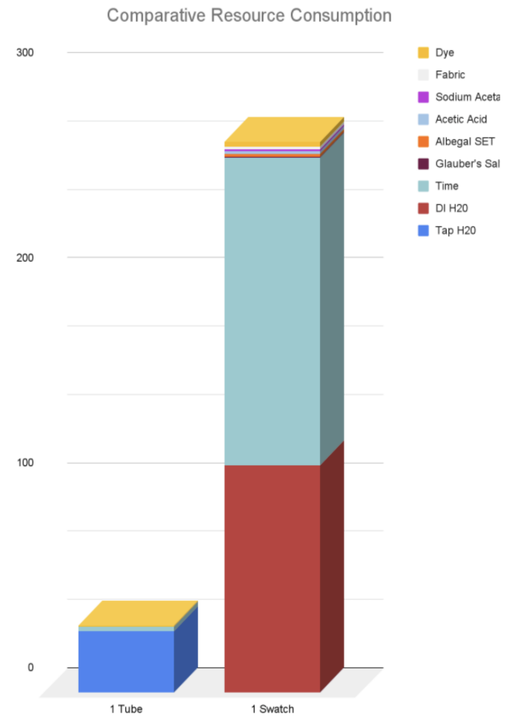
Tubes with differing ratios of the same three dyes

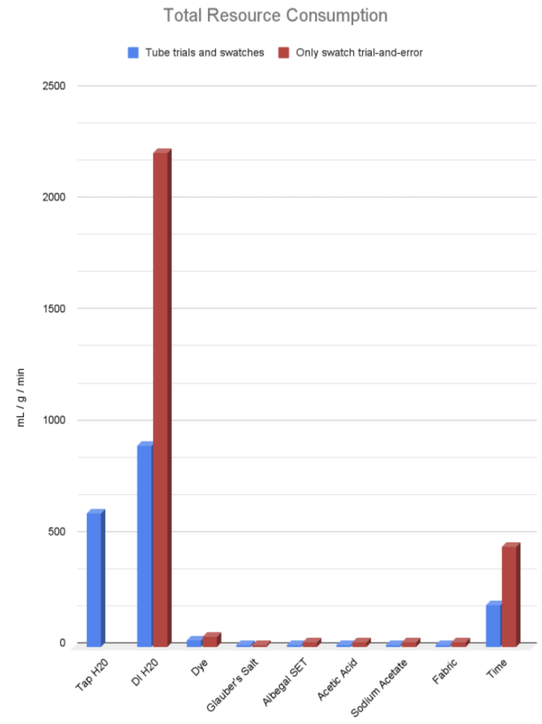
Visually compare the tubes against the target textile. Make adjustments accordingly in new test tubes.

Once a suitable range of recipes has been identified, proceed with the dye process.

Tubes compared to target textile

Resource Data





Data based on a real-life trial evaluating 20 tubes before selecting 8 recipes to make swatches. Swatches were made from 4x4 squares of taffeta, with a liquor ratio of 1:100 and dyed to have a depth of shade of 1. The trial-and-error data is estimated based on the number of discarded tubes and the resources that would have been consumed had swatches been made for those recipes.

Findings

Creating a swatch with a potentially inaccurate recipe uses **464% more physical resources** than testing the recipe first with a tube. Using the TTM can expedite custom-dyeing by 236%.

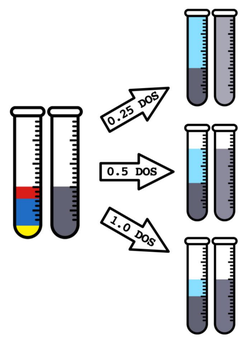
Considerations

Half-Step Values

Some target colors may require more nuance than 10% increments. As such, in certain cases 5% (half-drop) increments may be utilized. The most controllable "half-drop" method tested is to squeeze the dropper until almost all solution is out. The residual solution should be considered a "half-drop." Note, this is highly irreplicable and should be utilized only once a specific region on the dye triangle has been determined.

Depth of Shade (DOS)

DOS is the strength of the color, measured by amount of dye to fabric weight (the higher DOS the more intense the color). Varying relative dilution levels can allow differences in DOS to be understood.



DOS illustration

Critically, diluted tubes *cannot* consistently be used to accurately gauge *which* DOS is most like the target, however, the tubes can accurately reflect the relative difference between the varying depths.

Conclusions

The TTM effectively streamlines the custom-dyeing process by eliminating imprecise dye processes during the preliminary stages of determining a recipe. This approach vastly cuts down on resources wasted and offers a more environmentally friendly approach to custom-dyeing.

Scan this code to access an annotated photo gallery of tubes and swatches from across The Test Tube Method trials

Acknowledgements
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