VIABITY OF WOOD CHAR AS ATERNATIVE PIGMENT IN PEN INK

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Science Research Honors Pinnacle Project

Research Question

How do synthetic and lampblack pigments, compare with ink pigments made from wood char in terms of value (darkness of a black pigment or brightness of a white pigment) by measuring absorbance (how well a substance absorbs light of a certain wavelength)?

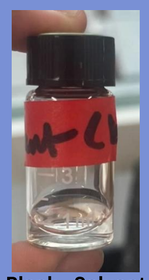
Samples

Synthetic

Lampblack

Hardwood

Softwood

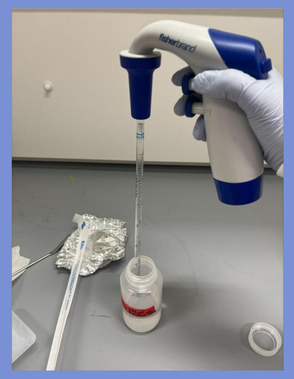


Blank - Solvent

Results

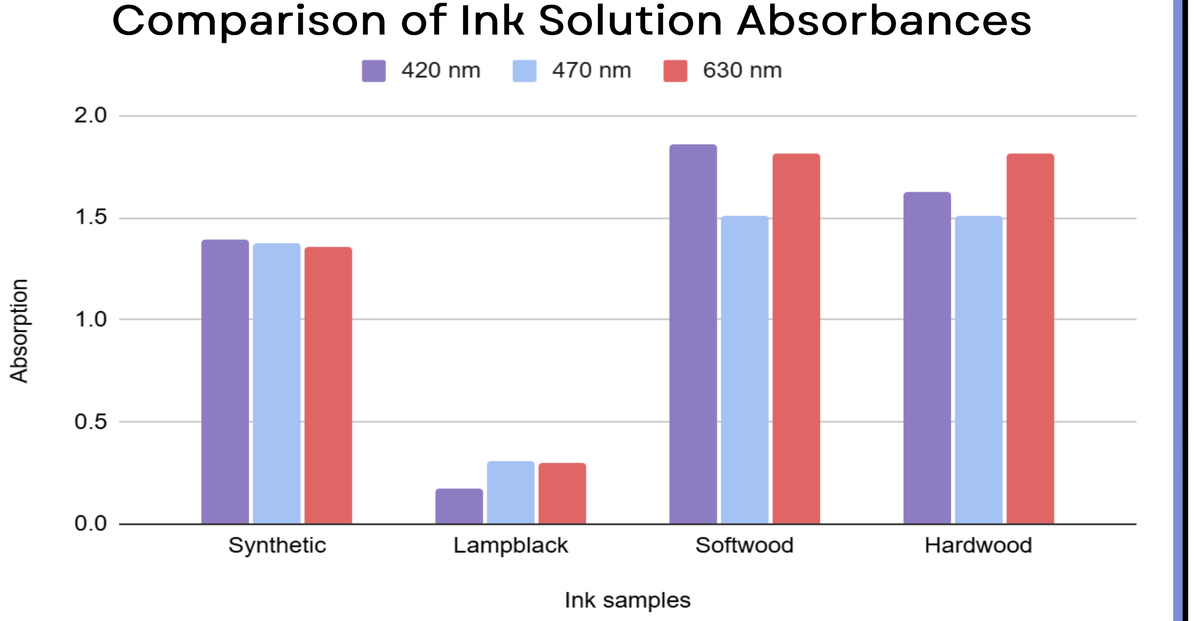
- The absorbance of wood char inks had a significantly higher absorbance than synthetic and lampblack ink
- The lampblack absorbance values were much lower than expected for all the wavelengths tested compared to the other three ink solutions.
- Since lampblack consists of the same carbon make as other organic material like wood, it was expected that the wood char and lampblack absorbance would be similar to one another.
- The lampblack ink is inherently oil based which causes some level of separation of the pigment and water-based solvent that was used in all the ink solutions.
- Using an oil-based solvent or emulsifying the solution could have produced higher absorption results for the lampblack samples.

Snapshots of Experimentation



Preparing Ink solutions

Finding Sample Absorbances



Darkness of the tested ink solutions under 420, 470 and 630 nm wavelength

References:

Works Consulted

132 Kuhn

Background

Ink has a long history of production by humans. While in the modern day we rely on synthetic inks, which are inks that are made chemicals synthesized in a laboratory made to have the qualities needed in the ink, the first inks were made from materials found in the natural environment or produced as by products when humans used the materials in their natural environment. These materials ranged from the oil-ash leftovers that were left over from lit lamps to extracts from salt and acids as pigments.

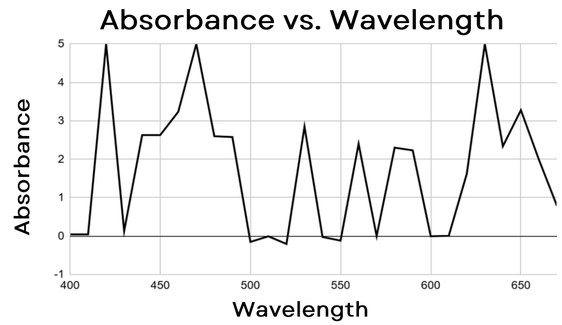
Methods & Materials

Preparing Ink solutions

- 23.330 ml of solvent solution and 300 mg of synthetic mica, lampblack, softwood char, and hardwood char pigment.
- Solvent solution was comprised of 966 mg of gum arabic, 2.1ml of 70% ethyl alcohol (diluted from 95% ethyl alcohol), and 94.92 mL of distilled water.
- The preparation of ink solutions was conducted under a flame hood to safeguard against fire hazards.

Finding Wavelength

- Control sample cuvette of synthetic mica ink solution, and a bank sample of solvent solution used
- Both samples were placed in a spectrophotometer and the absorbance was noted down for every 10th wavelength from 400 to 670 nm.
- The three wavelengths at the peaks of the collected absorbance data chosen



Finding Sample Absorbances

- 10 cuvettes samples of each type of ink solution were prepared.
- All the samples were diluted to be 25% ink solution 75% distilled water.
- Each sample was placed in a spectrophotometer with a blank sample.
- Then the wavelength was set on the blank cuvette, and the absorbance was recorded after shifting to the ink sample.
- This process was repeated for three different wavelengths for 10 samples of each type of ink sample.