



Examining wax chemistry through encaustics

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Abstract

Chemically, waxes are composed of mixtures of esters in that the acyl and alkyl groups are non-branched and usually have a dozen or more carbon chains. Waxes have been used since 100 AD to create encaustic paintings, also known as hot wax paintings. During this exercise, properties of waxes will be explored and through this process, the student will be able to create their own, unique art piece. This lab is well suited for an introductory chemistry course; thus, students would require a high school understanding of chemistry. Students will coat a glass jar in gesso and paint the container with coloured hot waxes. This activity takes 1 hr and can be completed individually. The exercise allows students to learn the chemistry of waxes, while simultaneously handling and designing a unique piece of art which they can take home. In this workshop, there will be a short presentation regarding the overall exercise and then participants will have the opportunity to complete part of the lab exercise.

Introduction

Encaustic art is based on a Greek word “enkaustikos” (to burn in) in which colored, hot wax is painted on to an object usually wooden, or glass. This art form is over 2 millennia ago with starts in the original Roman Egyptian wax portraits. The colored wax is applied quickly by using a paintbrush so that the wax will not cool down too quickly and solidify. The bases for the wax to adhere to the bottle in this experiment, is gesso. The gesso for this project is home-made and it last longer and is less expensive than the gesso you buy in the store. Gesso serves as the primer for the hot wax. Once you have painted the bottle with gesso, you air-dry the gesso with a hair-dryer, coat a second time, and then allow to dry till next class period. The last part of the experiment, is to paint your bottle with various colors of hot wax. You apply the colors to your bottle by either painting with the hot wax, or “splashing” it on by flickering the tips of the paintbrush dipped in the colored wax. The wax paint is hardened more by the addition of to the colored wax. Do not let your artwork sit directly in the hot sun, since it is made of wax, heat is this case is the enemy.

Materials and Methods

Materials:

Soap and/or ethanol, Gesso (white or black), Paint brushes (not nylon), hair-dryer, and various colored waxes (hot)

Experiment:

Week #1: Wash your glass with warm, soapy water or ethanol to remove any dirt. Paper towel dry. Stir the gesso with a stir-stick to make sure it is evenly dispersed and stirred. Paint your bottle with the gesso making sure you have covered all the spots of the glass with gesso. Once painted with the gesso, dry with the hair-dryer until the gesso is dry to the touch. Do another coat, and hair-dry again. Allow to set till next laboratory.

Week #2: Inspect your glass to make sure the entire area is covered with the gesso. (If not, touch up now, dry, and wait till the spots are dry). Choose a hot wax color, and paint the surface of your bottle the way you want. Let the color wax “dry”, and then apply more colors or the same. Let each color dry before you apply the next one. Once completed, please dispose of the papers you placed under your bottle in the wastepaper can. Clean up your area, and wash your hands before you exit the lab.

Results



Figure 1: An example of a completed student project.

Waxes belong to a class of organic compounds that are lipophilic, malleable solids, and are near ambient temperature. They are insoluble in water, but dissolvable in nonpolar solvents such as toluene, and hexane. Most waxes contain long alkyl chains with functional groups such as fatty acids, aldehydes, and primary and secondary alcohols. Synthetic waxes usually have long chains aliphatic hydrocarbons (alkanes or paraffins) that lack functional groups. Paraffin is one of these waxes, and is used exclusively in this experiment.

Figure 2: The worksheet provided to students during lab activity.

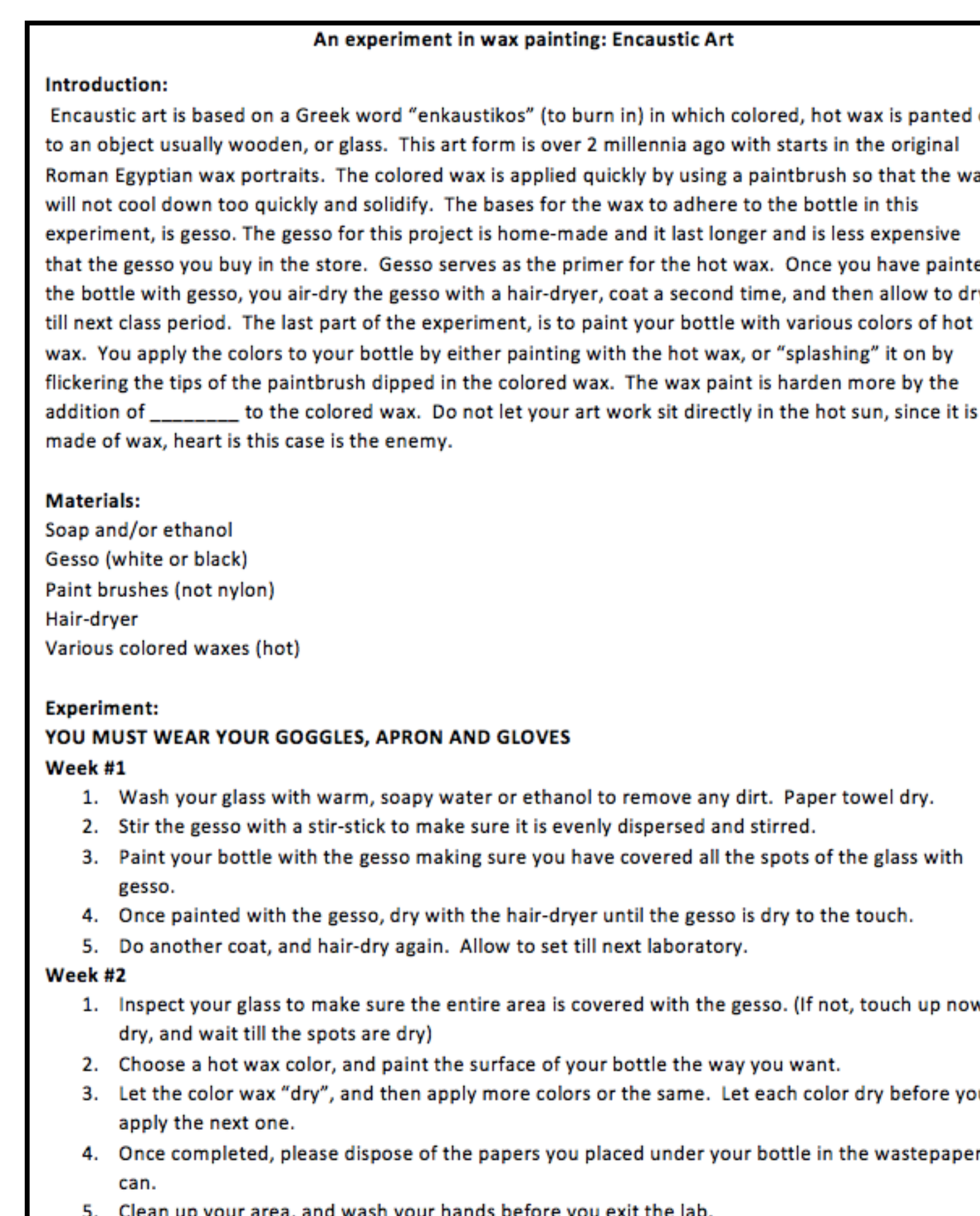


Figure 3: The worksheet provided to students during lab activity.

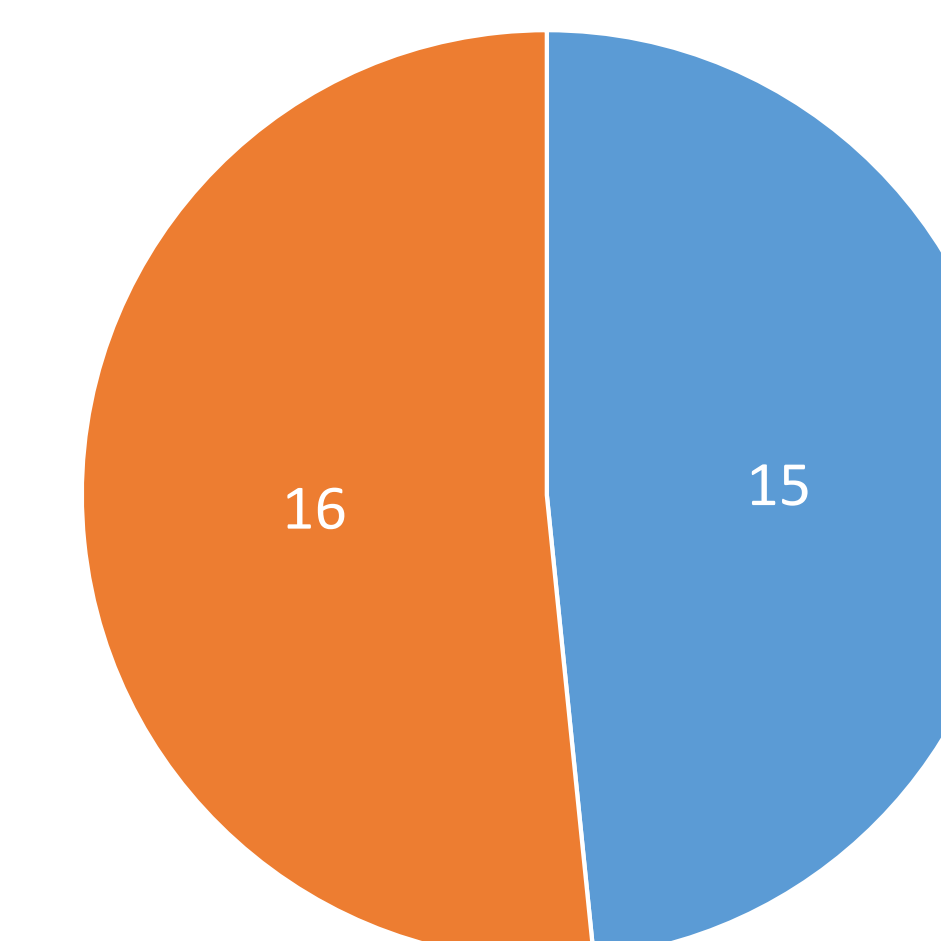


Figure 4: Students were able to answer 16 (orange) of the 21 questions relating to the encaustic project.

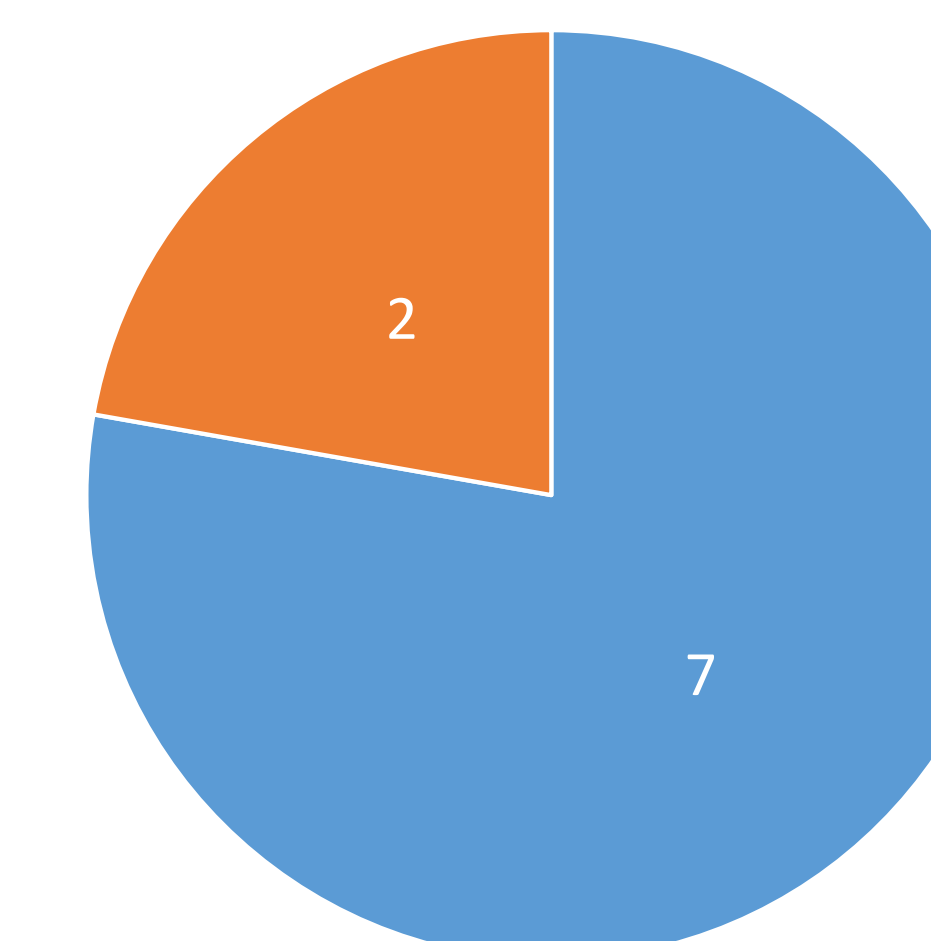


Figure 5: Of the 9 questions asked in the survey, students scored higher on 7 (blue) of the questions after completing the project.

Discussion

This activity was completed in a first-year introductory science course for nonmajors. The course, Drugs and Society, may be taken concurrently with CHEM 0187. Students will be introduced to instrumentations used by medical chemistry and forensic sciences and will be instructed in the synthesis of drugs (e.g. aspirin). Most of the students have taken high school chemistry. The majority of the students are non majors and are seniors. If they have taken college courses, it depends upon their majors. For example, with the math majors they have taken Chem 101, and Chem 102, plus all the college MATH.

Overall, students completed content questions before and after completing the encaustic project. Figures 4 and 5 illustrate the improved scores on question when comparing the before and after results. This demonstrates that the simple encaustic art project is a successful way to community chemistry concepts relating to waxes and esters to students in a nonmajors introductory science class. After reviewing the student feedback, suggestions were made regarding how to improve the activity. One suggestion, involved adding another layer of complexity to the technique, to provide a greater artistic challenge for students.

Acknowledgements

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References

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