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Refractive Index of Glass Fragments — Center and bold lab report title

M. DiSano
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Introduction: — Bold headings

One source states that refractive index is a physical property that is employed to characterize glass fragments. For example, the refractive index values of glass fragments found at the scene of a crime and those associated with a suspect can be compared. If similar values are determined then this data suggests that the glass samples may share a common source. It should be noted that this property is a class characteristic and is not used as the only criteria to individualize glass to a common source. However, if refractive indices of glass samples are dissimilar this indicates that the glass samples came from different sources and can be excluded from consideration (1).

1" 1" 11"

To compare refractive indices, Saferstein explains that glass samples may be immersed in a liquid where the refractive index of the liquid is modified until the refractive index of the glass and liquid are equal. To determine this equality, the observer looks for the disappearance of the Becke line. The Becke line can be described as a bright halo along the perimeter of the glass piece when it is submerged in a liquid having a different refractive index. When the refractive indices of the glass and liquid are similar, the bright halo disappears (1). A refractometer can then be used to determine the refractive index of the liquid to give the refractive index of the glass indirectly. The Becke line also indicates whether the liquid or glass has the higher refractive index. For example, "...the BECKE LINE MOVES TOWARD the medium of HIGHER refractive index if the focus of the microscope is RAISED and TOWARD the medium of LOWER refractive index if the focus is LOWERED (2)."

The purpose of this laboratory experiment is first to familiarize oneself with the appearance and movement of the Becke line. Next, refractive indices of glass samples will be determined, using an immersion method and refractometer, to see if there is a possible match.

Main Reaction:

No reaction

Use 12 pt Times Roman for text

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Detailed description: The diagram shows a rectangular page layout for a lab report. The page is 8 1/2 inches wide and 11 inches high. A 1-inch margin is shown at the top, bottom, and sides. The title 'Refractive Index of Glass Fragments' is centered and bolded. The author's name 'M. DiSano', course 'CHE 136', and date 'June 8, 2006' are in the top left. The section 'Introduction:' is bolded. The text describes the refractive index and the Becke line. The 'Main Reaction:' section states 'No reaction'. A note at the bottom says 'Use 12 pt Times Roman for text'. Dimensions are indicated with arrows and labels: 1" for margins, 8 1/2" for width, and 11" for height.

Table of Compounds:

Compound	Use	Amount used	Refractive index
Clove oil	Standard immersion liquid	Drops necessary to submerge glass sample	1.5430
Ethanol, 95%	Cleaning	-----	-----
Olive oil	Standard immersion liquid	Drops necessary to submerge glass sample	1.4667
Glass samples	Given samples to determine their refractive index	One small piece	-----
Sodium chloride	To practice determining refractive index	1-3 crystals	1.544
Castor oil	Standard immersion liquid	Drops necessary to submerge glass sample	1.4620

Tables use Times Roman 10 pt

Data contained in table are from reference 2

Safety Description:

Clove oil: irritating to eyes, respiratory system, and skin, According to NFPA rating: Health: 1, Flammability: 1, Reactivity: 1 (3).

95% Ethanol: Highly flammable, irritating to eyes, respiratory system and skin, target organs: nerves, liver, According to NFPA rating: Health: 2, Flammability: 3, Reactivity: 1 (3).

Experimental Procedure:

To familiarize oneself with observing the Becke line, place 1-3 NaCl crystals on a microscope slide, add 1-2 drops of castor oil and observe under a microscope. The procedure for Part A found on page 34 was then followed (2). A few changes to Part A were made such as do not use a cover slip, manipulate the microscope per your instructor's instructions, and skip steps seven and nine.

The procedure for Part B found on page 35 (2) was followed next with these changes: standard solutions were previously made by the instructor, cover slips were not used, and instructor's directions when using the microscope were followed. Once the refractive index of the glass has

been determined to be between two standard solutions, record the refractive indices of these two solutions separately using the Abbe refractometer per the instructor's instructions.

Results/Observations:

Part A:

NaCl immersed in castor oil:

Becke line appeared bright

The Becke line moved toward the castor oil when the stage was moved upward (distance between objective and slide was decreased).

Becke line moved toward the NaCl when the stage was lowered (distance between objective and slide was increased). Thus the refractive index of NaCl is higher than the castor oil.

NaCl immersed in clove oil:

When the stage was lowered (distance between objective and slide increased), the Becke line moved toward the NaCl.

When the stage was raised (distance between objective and slide decreased), the Becke line moved toward the clove oil.

Part B:

Suspect 1: Refractive index = 1.4774-1.4857

Suspect 2: Refractive index = 1.4857-1.4975

Suspect 3: Refractive index = 1.5098-1.5244

Crime Scene: Refractive index = 1.5098-1.5244

Discussion/Conclusion:

The bright halo appearance of the Becke line and its movement toward the higher or lower refractive index medium, depending on the direction the microscope stage was moved, was clearly observed when using NaCl, clove oil, and castor oil. When the distance between the objective lens and stage of the microscope was decreased, the Becke line moved toward the medium (castor and clove oils) having the lower refractive index. When the distance between the objective lens and stage of the microscope was increased, the Becke line moved toward the medium (NaCl) of higher refractive index. To conclude, it was found that the refractive index of

NaCl is greater than both the refractive indices of castor oil and clove oil which is in line with the literature values of refractive index noted in the table above.

The results also indicate that the glass taken from the Crime Scene and the glass from Suspect 3 have comparable refractive indices. Based on the results, one can conclude that Suspect 1 and Suspect 2 can be excluded, because their glass samples most likely came from different sources.

However, as noted above, refractive index cannot be used solely to determine if two glass samples have a common origin since this physical property falls under the heading of a class characteristic and not an individual characteristic. Further testing should be performed. For example, density determination can also aid in the possible matching of two glass samples (1).

References — Bold and center

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1. Saferstein, R. *Criminalistics: An Introduction to Forensic Science*, 8th ed.; Pearson/Prentice Hall: Upper Saddle River, NJ, 2004; pp 99-102.
 2. Melon, C. E.; James, R. E. *Lab Manual: Criminalistics: An Introduction to Forensic Science*, 8th ed.; Pearson/Prentice Hall: Upper Saddle River, NJ, 2004; pp 31-36.
 3. SIGMA-ALDRICH. <http://www.sigmaaldrich.com> (accessed June 2006).