Trace Evidence: Fibers

Introduction

Fibers, strands of thread that make up yarn, are all around us. Fibers make up thousands of products, including clothing, upholstery, carpet, rope, and building components. As you interact with these products, loose fibers become attached to your body and clothes. When you enter a room, you pick up some of the fibers present in the room. You also drop some of the fibers you are carrying. Therefore, fiber evidence can often provide information about where people have been.

Fibers can be divided into two large groups: natural and man-made. The earliest people wore animal skins and furs for clothing. From these plant and animal products, people learned to form individual threads that could be woven into large pieces of cloth. By the time of the Industrial Revolution, weaving was a mechanized process that produced plenty of fabric for a growing population and its needs. However, the fabric industry still depended on nature for its raw materials. Drought, flooding, disease, and cold weather could badly damage the fiber crops and reduce the amount of cloth available. After the Industrial Revolution, scientists worked hard to develop man-made fibers.

Materials

Safety Glasses Compound Microscope Microscope Slide Cover Slip Forceps White Paper Candle Match Unknown Fiber Suspect's Fiber Wool Rayon Silk Polyester Cotton Flax

Safety

All students and teachers should be wearing safety goggles and gloves. Practice caution while burning fibers.

Scenario

There was an attempted kidnapping near the park, while walking home from playing nine-year-old Billy Marshall was approached by a white van and a man in a blue coat asking to help him find his puppy. The man grabbed the young boy but luckily the boy was able to fight back and escape. Upon examination several blue fibers were collected on the boy's jacket, which are believed to be able to be traced back to the man. A suspect matching the description has been found and the police are trying to build a case against him. Your job is to analyze and identify the fibers to determine if they are a match to the suspect or not.

Procedure

1. Collect an "unknown" fiber from the "victim" by carefully lifting the fiber with a pair of forceps. Do not touch the fiber with your hands

to avoid contamination. Place the fiber on a piece of white paper, then fold the paper in half twice.

- 2. Carry the fiber to your lab station. Prepare a wet-mount slide of the fiber by placing it on the slide, adding a drop of water, and covering the fiber and water with a cover slip.
- 3. Examine the fiber under low, medium and high magnification with your microscope. Sketch what you see. Note any pits or striations on the fiber. Place the sketch and notes in your data table.
- 4. Repeat this procedure with the samples of wool, rayon, silk, polyester, and cotton. Sketch each of these samples at low, medium and high power. Place your sketch and notes about the fibers in your data table.
- 5. Light your candle and perform the following procedure with each of the fabric samples, including the "unknown".
 - a. Holding the fiber in the forceps, bring it close to, but not touching, the flame. Describe the fiber's behavior as it approaches a flame: does it begin to melt, ignite, or curl?
 - b. Holding the fiber in forceps, touch the fiber to a flame. Does it ignite quickly or slowly? Does it sputter, drip, or melt?
 - c. Remove the fiber from the flame and describe how it behaves. Does it self-extinguish, continue to burn, or continue to glow?
 - d. Note any odor associated with the fiber in the flame. Does it smell like vinegar or hair?
 - e. What kind of residue is left after the fiber is removed from the flame? Does the fiber leave a white, fluffy ash, a hard bead, or a melted blob?
- 6. Once you are finished analyzing data clean up your work space and answer the analysis questions at the end

Examination of Fibers Under a Microscope

m.m. of	Colon and	Low	Medium	High	
Type of		Magnification	Magnification	Magnification	
Fiber	Iuster	Sketch	Sketch	Sketch	

Wool		
Rayon		
Silk		
Polyester		
Cotton		
Flax		
Unknown Fiber		
Fibers from suspects coat		

Behavior of Fibers in a Flame

Approaching Flame In Flame f	Removed from Flame Odor	Residue
---------------------------------	----------------------------	---------

Wool					
Rayon					
Silk					
Polyester					
Cotton					
Flax					
Unknown Fiber					
	Approaching Flame	In Flame	Removed from Flame	Odor	Residue

Fibers from			
Suspects			
Coat			

Analysis

1. From your observations what type of fiber do you think most closely matches the fibers found on the victim? Describe at least three similarities of these two fibers.

2. From your observations what type of fiber do you think most closely matches the fibers taken from the suspects Jacket? Describe at least three similarities of these two fibers.

3. What does this tell you about the likely guilt of the suspect? Think about whether this would be class or individual evidence.

4. From the burning tests, which type of fiber is most similar to the unknown fiber taken from the victim? Describe the characteristics they have in common.

5. Why might an investigator want to identify unknown fibers from a crime scene?

6. What must scientists be able to do in order for fiber evidence to be useful in a crime scene investigation?

7. From where do we get the materials to make natural fibers?

8. How are synthetic fibers classified? Give examples of each type.

9. You investigated the properties of five different types of fibers in this lab. What are some other characteristics of these fibers that we could have analyzed? Why would it be important to know the characteristics of these fibers that you just listed?

10. Judging from this lab and your own personal experiences, describe the types of products made from the five fibers you analyzed. Why would you use that particular fiber for the products(s) you listed? What are the pros and cons of that fiber's use for the product you listed?