Super Glue - A Modified Method

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Introduction:

A number of articles have recently been published (2,3.5) concerning the development of fingerprints by fuming with cyanoacrylate esters (Super Glue®-type adhesives). While a number of techniques and conditions have been described, it was decided to make a more basic study of the process starting with some of the physical properties of the chemicals involved to see if a more efficient technique could be obtained. It was noted that cyanoacrylate esters are relatively volatile. It would seem reasonable that if the cyanoacrylates were heated it would produce a higher concentration of vapors which would react more rapidly with any fingerprint residue, although as previously noted, higher temperatures could cause undesirable polymerization. The use of a retardant and temperatures higher than the listed boiling point (at reduced pressure) of the esters produced latent impressions in a relatively short amount of time with a minimal amount of cyanoacrylate.

The following is a detailed description of the procedure used.

Materials Required:

A. Fuming Chamber
1. Glass chamber, a small glass aquarium for small items, a larger aquarium for larger items.
2. Chamber sealant: standard foam rubber weather stripping, %" wide x 3/16" thick with adhesive on one side.
3. Piece of plate glass slightly larger than the aquarium dimensions.
4. A weight to place on top of the plate glass to give the chamber a good seal.

B. Vapor Source
1. A metal block heat source approximately 2" x 3" x 3" aluminum worked well) with a hole drilled halfway through the center to accommodate a thermometer.
2. A laboratory thermometer to record the temperature of the metal block.
3. A laboratory hot plate to heat the metal block.
4. A roll of aluminum foil, used to make a shallow aluminum foil pan measuring approximately 1¼" wide by 2½" long with the bottom of the pan as flat as possible.
5. Cyanoacrylate adhesive (preferably methyl monomer such as Scotch Weld® CA-7 by 3M).

Procedure:

Fuming chambers, as suggested by Frank G. Kendall' were set up utilizing a glass aquarium with foam rubber weather stripping to seal around the top edge. The bottom of the chamber was lined with aluminum foil. The chamber was placed inside a fuming hood to avoid unnecessary exposure to the cyanoacrylate vapors. A heat insulating pad was made consisting of several folded paper towels wrapped with aluminum foil.

Next, the metal block is heated to approximately 100"C on a laboratory hot plate. While the metal block heats, the items to be fumed are placed in the chamber, either on the bottom or on a rack. When the desired temperature is reached, the thermometer is removed from the block. The block is then placed in the chamber on top of the insulating pad with a pair of tongs or a heat resistant glove. The aluminum foil pan is placed on top of the metal block and the cyanoacrylate glue is distributed evenly in the pan, dropwise, using only 2 drops per gallon of aquarium volume (e.g., a 10 gallon aquarium needs only 20 drops). A plate glass lid is quickly placed on top of the chamber and a metal weight is placed on top of the lid.

Latent prints were observed in 5 to 10 minutes, although 30 minutes was routinely used since it was noted that the metal block would maintain a temperature sufficient to volatilize the cyanoacrylate for a period of 30 minutes.

Since an excessive amount of white residue on the walls of the chamber was found to retard the effectiveness of the systems, the chamber should be cleaned whenever residue is present. Acetone is effective and steel wool impregnated with soap works just as well.

Observations:

Several factors are important in this procedure: the rate of volatilization, the rate of polymerization, and the amount of residue remaining from the reaction. The rate of volatilization appeared to be the most important factor. It is necessary that this occur before the polymerization of the methyl monomer takes place. The polymerization could be retarded by several different substances including maleic acid[3], p-Toluenesulfonic

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acid[4], oxalic acid (each at a concentration of less than 0.1%), and free aluminum metals. The aluminum was found to be the most convenient of the substances tested because, not only did the aluminum foil provide a container for the glue, but acted as a polymerization retardant. The heated metal block provides a rapid means of volatilizing the adhesive as well as generating convection currents within the chamber to distribute the vapors evenly. Other Super Glue®-type adhesives were tested but the methyl monomer types appeared to volatilize more rapidly. It was also noticed that the fumingtechnique could be used before or after conventional processing techniques such as fingerprint powders or Magna Brush®. The Magna Brush technique appeared very effective following the fuming of the latent prints with cyanoacrylate adhesives, and the prints have greater contrast and are more easily lifted.

Conclusions:

Elevated temperature and the use of a retardant increased the rate of latent print development. This procedure was develped in hopes that cyanoacrylate fuming could be used more effectively with a minimal amount of time, equipment and material. Some modification, including temperature changes, may be necessary depending upon the type or size of metal block used. Although this technique appears to be an opposite approach to the rapid methods, it is noted that the various techniques do involve temperature/volatility in some way, e.g., the sodium hydroxide on cotton which chemically produces heat and the evaluated chambers which reduces boiling point.

Additional experimentation may be performed on the cyanoacrylates, different retardants, and different compounds resembling cyanoacrylate adhesives so that the fuming process could be further understood and enhanced.

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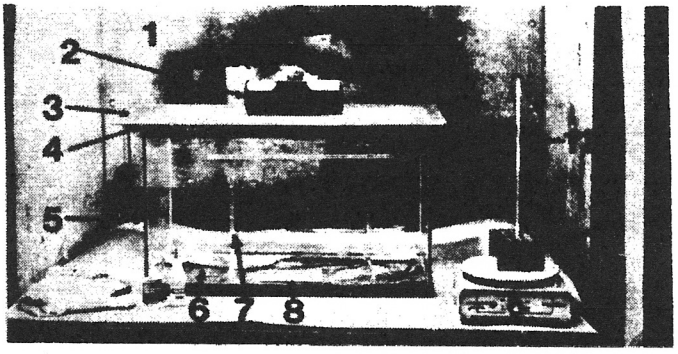

ILLUSTRATION:

1. Fuming hood
2. Weight
3. **Plate glass cover**
4. **Weather** stripping
5. Aquarium **chamber**
6. **Aluminum** foilliner
7. Frame to **support material to be furned**
8. **Heat** insulating **pad**
9. **Laboratory hot plate**
10. **Metal block**
11. **Thermometer**
