



# *Applying Artificial Nails*



## **Health and Safety And Toxics Use Reduction**

*Produced by  
Western Massachusetts Coalition  
for Occupational Safety and Health  
Funded by  
The Toxics Use Reduction Institute*

*Spring 2001*

# Five Types of Artificial Nail Applications

- Acrylic\*
- Porcelain\*
- Gel
- Wraps
- Tips\*



*\* This presentation will focus on these applications*

# Five Types Of Artificial Nail Products

## *Acrylic Systems*

- Powdered polymer and liquid monomer are mixed together.
- The powder and liquid react to form a plastic paste.
- This paste is formed onto the nail or nail tip.
- The paste cures, or hardens, at room temperature.



# **Five Types Of Artificial Nail Products**

## ***Porcelain Nails***

- **Porcelain nails are considered to be acrylic nails, except that they can use a finely ground, glass-like material in the powder, or a crystal material.**
- **Porcelain nails were popular many years ago, but became illegal when methyl methacrylate was banned. Since then, new formulas without methyl methacrylate have been designed, and porcelain nails are regaining popularity.**

# Five Types Of Artificial Nail Products

## *Gel Systems*

- **There are several different kinds of gels that use:**
  - layers of different resins
  - layers of a single resin
- **These premixed layers of resin are applied to the nail and combine to form a solid nail.**
- **Light is used to harden all types of gel:**
  - The original formulas were hardened with ultraviolet light.
  - Newer formulas harden under ordinary room lighting (called white light).



# Five Types Of Artificial Nail Products

## *Wraps*

- **3 types:**
  - **Fiberglass**
  - **Linen**
  - **Silk wraps**
- **All applied the same way:**
  - A fabric mesh is fixed in place with an adhesive
  - A sealant is applied to help keep out moisture and discourage lifting.



*Fiberglass*



*Silk*

# Five Types Of Artificial Nail Products

## *Tips*

- Nails can be extended by applying plastic nail *tips* of varying lengths to the natural nail plate using a glue.
- Acrylics, gels, or wraps may then be applied to smooth and strengthen the final form.
- The entire shape is then sanded and filed to the desired shape and length.

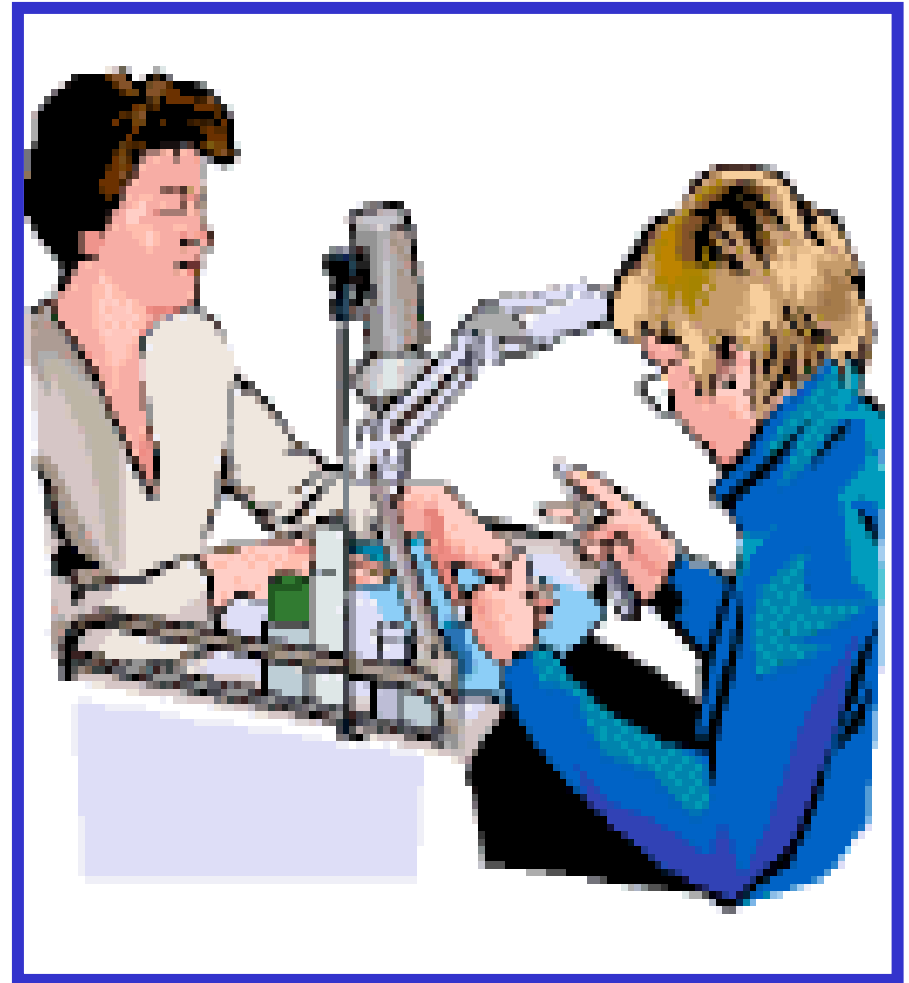
# *Acrylic Nail Application*

- **Step 1: Prepare the nail bed**
- **Step 2: *Sculptured* - Apply acrylic primer basecoat on nail**
- **Step 2: *Using Tips* - Attach nail tip or extension**
- **Step 3: Mold Acrylic Compound onto nail, nail form or artificial nail extension (*TIP*)**
- **Step 4: File acrylic nail**
- **Step 5: Prep acrylic nail**
- **Step 6: Apply acrylic nail finishes**



# Step 1: Prepare the Nail Bed

- **Natural nails:**
  - Remove polish with solvent.
  - Clean nail.
  - File lightly.
- **Previous acrylic nail applications:**
  - When possible, leave old applications, and clean both the acrylic and natural nail.
  - When removal is required, sometimes old applications are removed by soaking nails in solvent or drilling.



# Step 1: Prepare the Nail Bed

## Hazardous Ingredients – *Solvents*

- **Acetone** – is used on natural nails and to dissolve acrylic nails.
- **Toluene** – more hazardous than acetone. Is used in place of acetone when removing a finish from an acrylic nail that you want to remain intact.

## Possible Routes of Exposure:

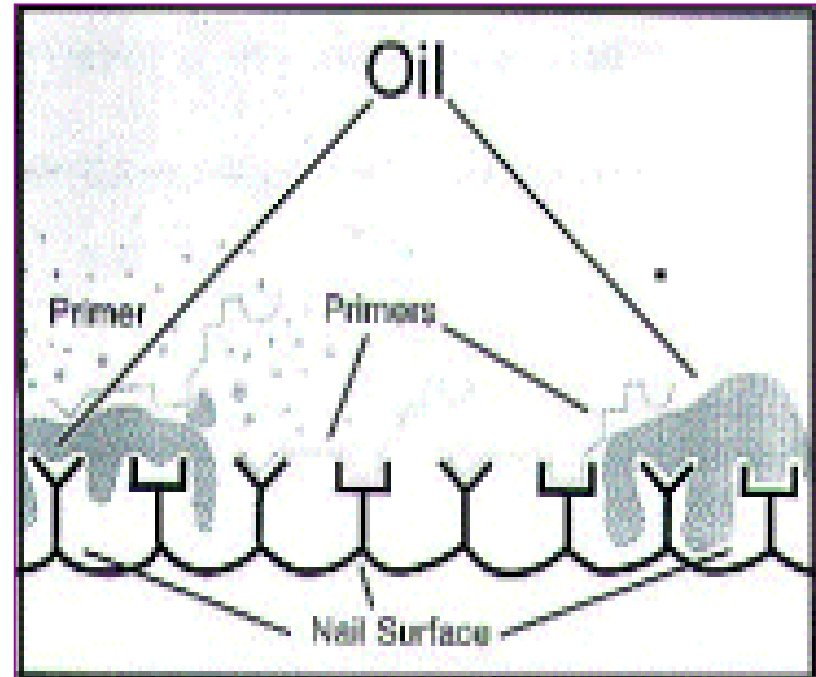
- **Breathing fumes**
- **Absorption through skin, eyes, and nails**



## Step 2: Apply Acrylic Primer Basecoat to Nail Surface

“Chemically, primers are like doublesided sticky tape.”

They use the forces of nature to adhere the product.



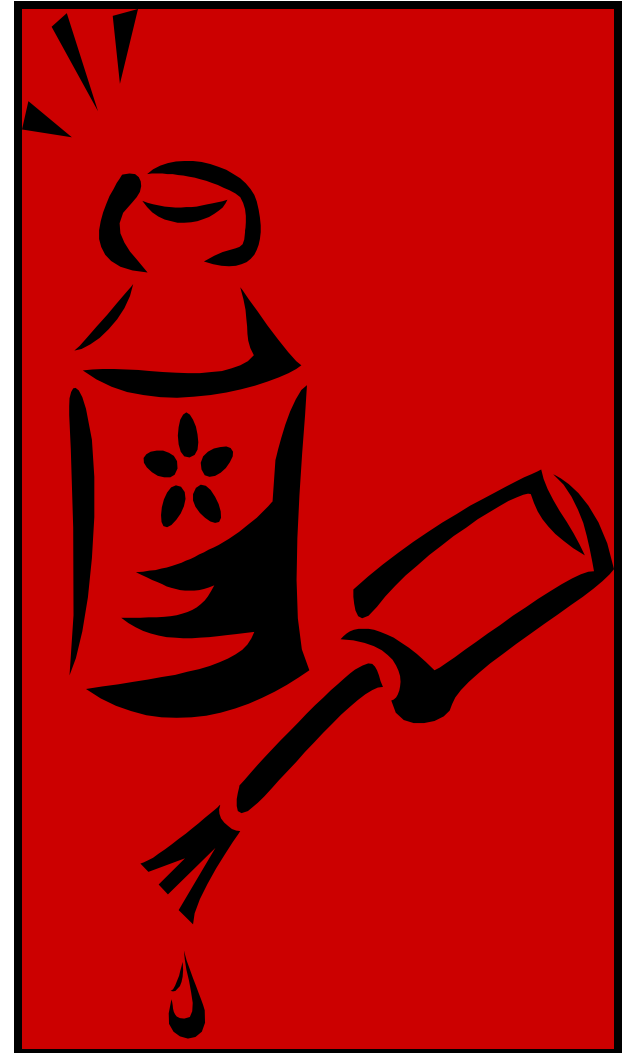
# *Primer Safety*

## *Chemicals of Concern:*

**Methacrylic Acid (MAA)**  
is used as the primer.  
It is corrosive, which can cause  
irreversible skin damage.

## *Possible Routes of Exposure:*

- Absorption through skin, eyes, and nails
- Breathing fumes





# *Primer Safety: Avoid Skin Contact*

**MAA Primers can cause serious burns.**

*Should accidental contact occur:*



- **Immediately wash the area with plenty of soap and cold water. Soap is alkaline and will help neutralize the acid. Cold water will cool the area.**
- **If skin redness persists or there's obvious damage, consult a physician immediately. The damage may worsen if not properly treated.**

# *Primer Safety: Avoid Contact With Eyes*

If primer is splashed in the eyes:

- Call a doctor *immediately*.
- Use a sink hose or eyewash station to flood the eyes with tepid water for 15 minutes while holding the eyelids open.



SE-480 **SPEAKMAN**  
Eye/Face Wash

## *Primer Safety: Avoid Spilling on Clothing*

MAA Primer can burn the skin *through* clothing.  
*If you spill primer on clothing:*

- **Remove the affected items at once.**
- **Don't wear the clothing until it has been thoroughly washed.**





# *Alternative Product That Does Not Use a Primer*

- ***Retention*** brand acrylic, by Creative Nail Design, does not require the use of primer.
- Instead, the nails are scrubbed with an alcohol-based cleanser.

## **Step 2: Attach Nail Tip or Extension**

- **Nail tips and extensions are adhered to the nail using a glue.**
- **Ethyl Cyanoacrylic is one of the chemicals of concern often found in these glues. When the Ethyl Cyanoacrylic becomes exposed to tissue, the heat from the tissue creates a toxic by-product through heat-up and breakdown to formaldehyde and cyanoacrylate.**

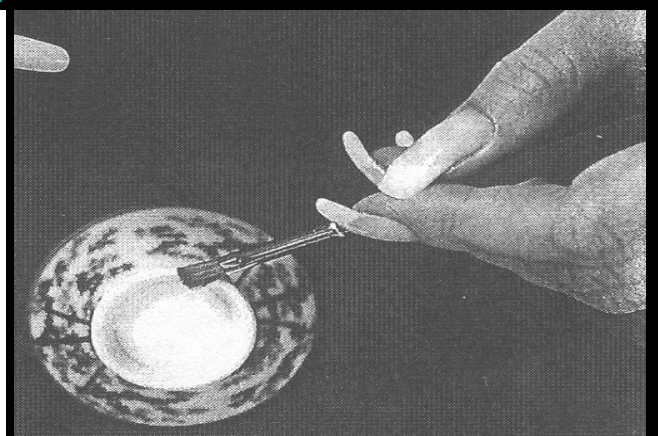
## **Step 2: Attach Nail Tip or Extension**

- **There is no established exposure limits (TLV, PEL, or REL) for Ethyl Cyanoacrylic .**
- **Health effects can include:**
  - **Eye and mucous membrane irritant**
  - **Skin dermatitis**
  - **Asthma**

## Step 3: Mold Acrylic Compound Onto Nail or Artificial Nail Extension

**Mix**  
*Liquid Methacrylate Monomer*  
**with**  
*Powdered Polymer*

**Mold mixture onto to nail**



# **Chemicals of Concern**

## ***Methyl Methacrylate* in Acrylic Nails**

- **MMA is an industrial material used to make Resins, Plastics, Dentures, etc.**
- **It is listed on the Hazardous Substance list by the Occupational Safety Health Administration, Environmental Protection Agency, and ACGIH.**
- **The Federal Drug Administration banned MMA in 1974 for use as a liquid monomer in nail applications, and has taken action against industry when used in this capacity.**
- **Massachusetts has banned its use as a nail product.**

# *MMA – Current Illegal Use*

- It can cost \$125 - \$350 to test a product sample if sample is sent to a laboratory.
- OPI sells a kit that is less expensive.



***OPI MMA Detection Kit***  
**Costs \$24.95**

# *Salons in the News*

## *Investigative Reports*

### **Nail Issues in the News:**

- **current widespread use of MMA**
- **lack of proper disinfection of nail equipment**



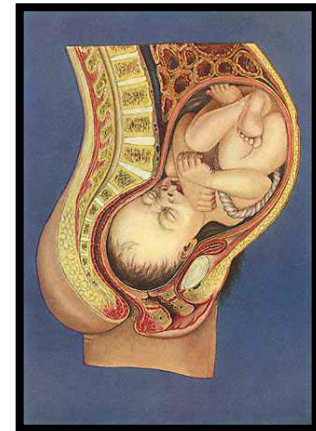


# *Worker*

## *MMA Health Hazards*



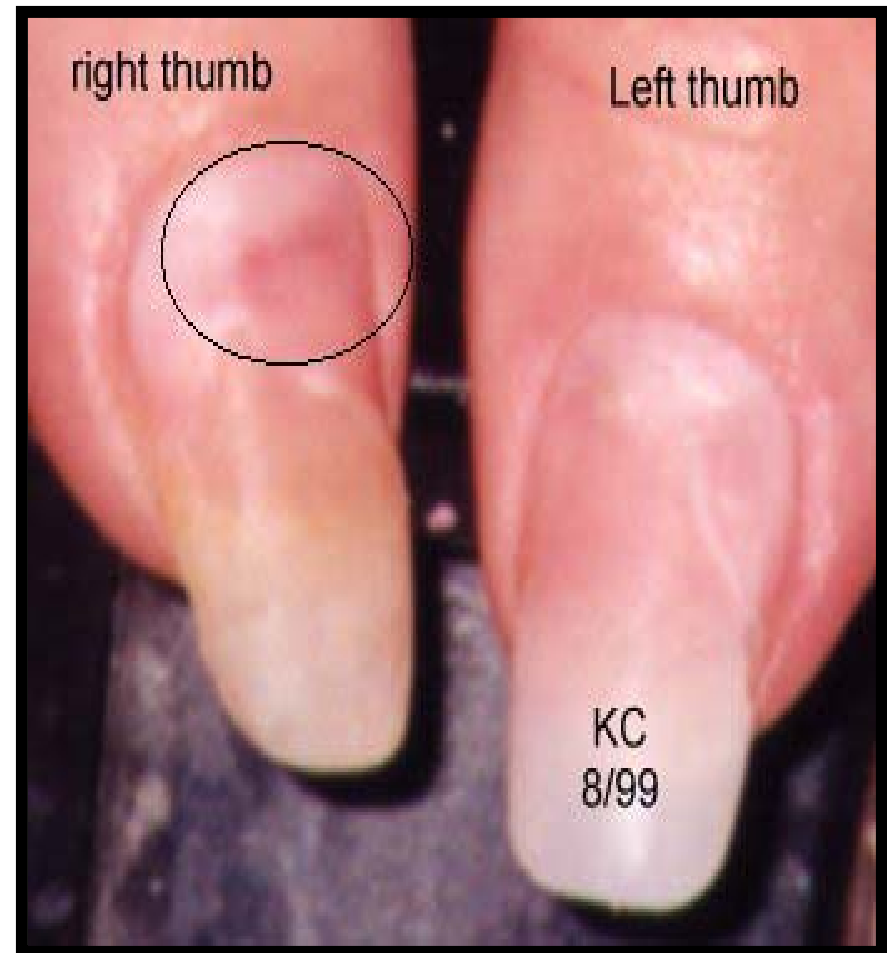
- *Acute*
  - Irritant to eyes, skin, respiratory system
  - Central Nervous System effects
  - Allergic reaction
  - Lung damage in animals
- *Chronic*
  - Teratogen – damage baby in womb
  - Heart problems
  - Central nervous system damage
  - Legions on kidney and liver
  - Asthma





## *Customer MMA Health Hazards*

- **Allergic reactions**
- **Nail infections**
- **Broken nail beds**
- **Permanent nail deformities**
- **Tingling and numbness of fingers**
- **Lifted nail and nail dislocation**
- **Deterioration of nail plates**



# *Nail Damage From MMA*

**"This woman ...visited local mall chop shop and got what she thought was great nails that lasted forever. I think she continued to patronize this shop for about 2 months, maybe 3. She decided she wanted her pink and whites again and soaked off the nails from this other shop, to find out her own nails had turned to jelly, complete with circles of fire and 2 or 3 lifted off the nail plates."**



# **The Alternative:** *Ethyl Methacrylate*

- **Used to replace MMA.**
- **Used industrially for paints, coatings, automotive, aerospace, dentures, etc.**
- **NIOSH is concerned that EMA has similar health effects as MMA. Industry disagrees.**

# *EMA Health Hazards*

**EMA is a larger molecule than MMA and it doesn't penetrate the skin or nail bed as readily. Can cause:**

- **Eyes, nose, and throat irritation**
- **Asthma**
- **Central nervous system effects**
- **Skin irritation and dermatitis**
- **Sensitization**

# Comparison of MMA and EMA

| <i>Property</i> | <i>Adhesion</i>                         | <i>Toughness</i>             | <i>Strength</i>            | <i>Ease of Removal</i>                  |
|-----------------|---|------------------------------|----------------------------|---|
| <i>MMA</i>      | <b>Nail needs to be heavily abraded</b> | <b>40.9% higher than EMA</b> | <b>25% higher than EMA</b> | <b>&gt; 190 minutes soak in acetone</b> |
| <i>EMA</i>      | <b>47% greater than MMA</b>             |                              |                            | <b>30 minutes soak in acetone</b>       |

# Comparison of MMA and EMA

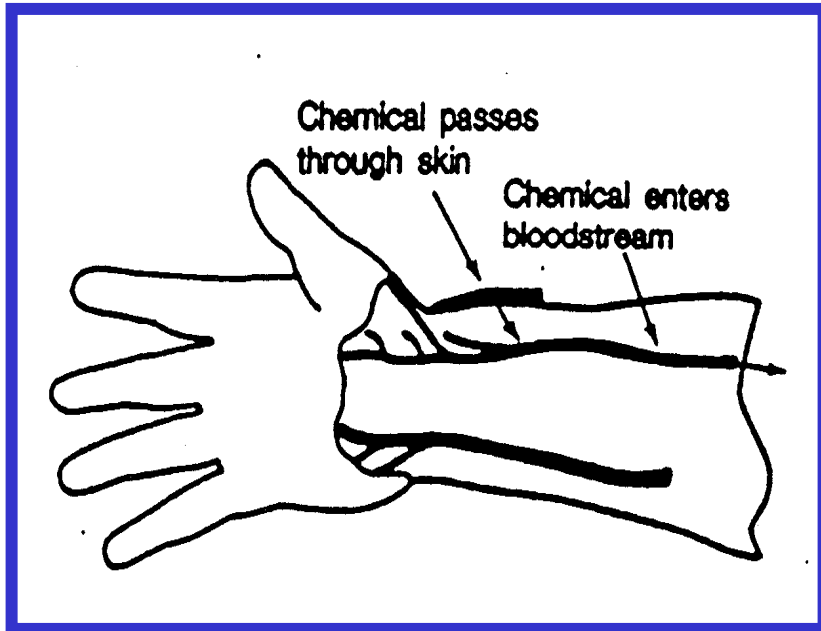
|            | <i>Hazard Characteristic</i>  | <i>Cost</i>                   | <i>Permissible Exposure Limit for an 8 Hour Day</i> |
|------------|---|-------------------------------|---|
| <i>MMA</i> | <ul style="list-style-type: none"><li>• <b>Flammable</b></li><li>• <b>Explosive</b></li><li>• <b>Reactive</b></li></ul> | <b>\$10 - \$22 a gallon</b>   | <b>OSHA – 100 PPM<br/>EPA – 100 PPM</b>             |
| <i>EMA</i> | <ul style="list-style-type: none"><li>• <b>Flammable</b></li><li>• <b>Explosive</b></li><li>• <b>Reactive</b></li></ul> | <b>\$189 - \$220 a gallon</b> | <b>None determined</b>                              |

# *How You Can Tell if its MMA?*

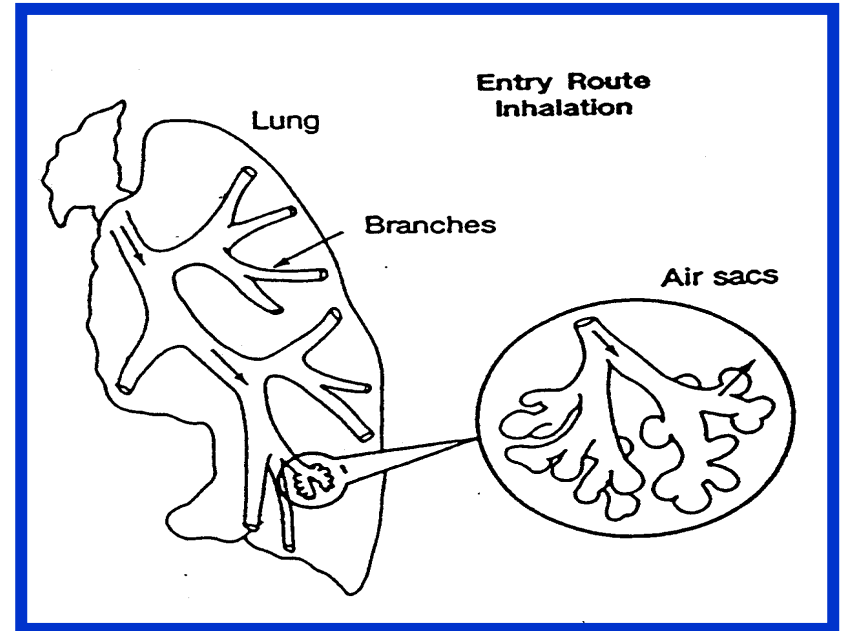
- More durable
- Harder to get off
- Stronger smelling
- Less expensive to purchase service
- Need to heavily rough-up surface of the nail to make the MMA stick



# *Routes of Exposure for Client and Worker* **During Application of Methacrylates**



**Absorbing Methacrylics  
through  
nails, eyes and skin**



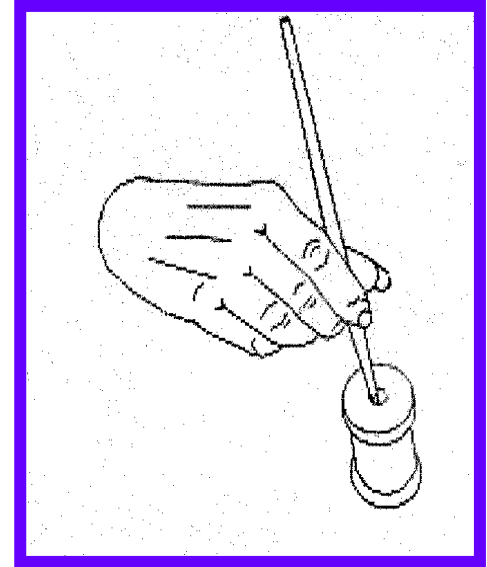
**Breathing  
fumes**



# **Application of Methacrylates:**

## *Reducing Exposures From Fumes*

- **Use a small mouthed dispenser with a pressure-sensitive stopper and a small opening just large enough to fit the applicator brush into and for the applicator to hold the nail liquid.**



- **Keep the container closed when not in use.**
- **Mix only the amount you need per application.**

# **Chemical of Concern in Acrylics**

## ***Benzoyl Peroxide***

- **Sometimes benzoyl peroxide is included in the acrylic to make the plastic harden faster.**
- **A tiny amount (1% to 2%) of the liquid monomer remains unreacted after curing. In sensitized individuals, this remaining monomer can cause the allergic reaction of the fingernail.**

## **Step 4: *File Acrylic Nails*** **With Electric File or by Hand File**



*Symptoms of a drill  
used incorrectly.  
Referred to as a  
“Ring of Fire.”*

# *Clean Electric File*

**Between each customer:**

- **Use a Wire Cleaning Brush to clean file bits or soak in a cleaning solution to dissolve the acrylic material.**
- **Submerge in a disinfecting solution.**
- **Both the cleaning solution and the disinfectant contain hazardous chemicals that can be absorbed through the skin.**



**Wire Cleaning Brush**

# *Exposures From Filing Acrylic Nails*

*Dust*

**Eye and  
Respiratory  
Irritant**



# Reducing Technician Exposures From Nail Filing Dust: *Procedures that do not work!*

- Spreading towels on work table to collect acrylic and nail dust.



- Using ill fitting dust masks to prevent dust or fume inhalation.



# **Reducing Technician Exposures From Nail Filing Dust**

- Wear personal protective glasses, long sleeves and gloves.**
- Wash hands, arms, and face with mild soap and water several times throughout the day.**

# Reducing Technician Exposures From Nail Filing Dust

*No food and drinks in the salon area  
which could:*

- collect dust and cause accidental ingestion
- pose a skin exposure from hands to face causing a dermatitis reaction



Jerico Sanders, a nail technician and manager of Body Color Tanning, Jason Easterly/Staff, Bonita Dailey News, 5/2001



# Step 5: Prep Acrylic Nail

**1. Apply cuticle oil  
over nail and  
cuticle.**

**2. Buff nail.**



## **Step 6: Apply Nail Finishes**

- 1. Apply base coat of primer.**
- 2. Polish with color enamel.**
- 3. Protect with a final layer of topcoat.**



# *Some Chemicals of Concern in Nail Finishes*

- **Phthalates**
- **Formaldehyde**
- **Solvents**



# Uses of Dibutyl Phthalates (DBP)

## AKA:

- Butyl Ester
- Plasticizer

## In Nail Products, it:

- Adds flexibility to nail polish.
- Reduce brittleness and cracking of the film left on the nail after the solvents have evaporated.



# *Products Containing Phthalates*

- **Nail Enamel Polish\***
- **Nail Base**
- **Nail Top Coat**
- **Nail Hardener\***
- **Nail Strengthener**
- **Nail Thickener**
- **Nail Fortifier**



- \* *Found most often in these products.*
- *A third of all nail polishes contain DBP.*

# *Phthalates*

- Regulated for use in industry by OSHA and out in the environment by the EPA as a:
  - **Hazardous waste**
  - **Air pollutant**
  - **Water pollutant**
- Unregulated by Federal drug Administration in:
  - **Food**
  - **Cosmetics**



*Procter and Gamble has the most products on the market with DBP*


# Phthalates:

## *Routes of Exposure*



- Can be absorbed through the nail and the skin, into the bloodstream and passed on through mother's milk to a baby.
- Fumes can be inhaled during application.
- Is water soluble, and is leached out of the polish each time hands are washed, causing a “extensive but transient contact.”

# *Phthalates – Some Health Effects*

- *Humans*
  - Allergic reactions ranging from hives to anaphylactic shock.
- *Laboratory Animals*
  - Loss of pregnancy
  - Declining sperm count 
  - Skeletal and external birth defects
  - Damages the testes, prostate gland, penis and other parts of the male reproductive system





# *Phthalates – “Safe” Exposure Levels*

- **Ten years ago, EPA established a “reference dose” which is considered a “safe” daily dose. This dose for phthalates was based on studies on male rats, for which the only health effect studied was death.**
- **The Center for Disease Control released a new study conducted in 2000 on animals, which found birth defects due to exposure at the current “reference dose.” It found that a safer dose is 60% lower than the current “reference dose.”**



## *Formaldehyde*



**Use:** *in Nail Polish*

**Role:** used as the resin to add flexibility to the polish and to help it stick to the nail.

**Use:** *in Nail Hardener – 1% to 3%*

**Role:** to chemically react with the keratin protein in the nail bed to harden the nail.

# *Formaldehyde*

## *In “Steri-Dry” Disinfectant*

- Is used a disinfectant in fumigant container for disinfecting salon tools.
- The design of the container system guarantees that there will be a worker exposure whenever they open the container.
- Its use is required by the Massachusetts State Board of Cosmetology.

# *Formaldehyde Health Hazards*

## *Symptoms:*

- Eye, skin, & respiratory irritation
- Wheezing & coughing
- Fatigue
- Skin rash

## *Health Effects:*

- Sensitizer
- Irritant
- Allergen
- Deform nail
- Possible Carcinogen

## *Formaldehyde-Free*

### **Nail Hardener**

*Toughen Up* by Creative Nail Design is a nail strengthener & base coat.



Uses DMU instead of the 1% to 3% formaldehyde that nail hardeners use. Don't know if it contains Phthalates.

## *Formaldehyde Free*

### **Extending Top Coat**

*Top Coat* is used to extend the wear and gloss of nail polish.



Extending Top Coat  
in .25 or .50 oz.

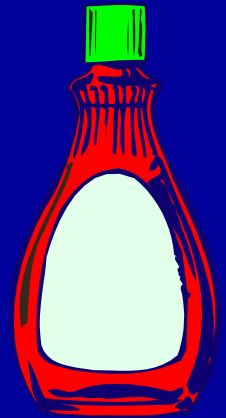
## **Some Products That Are *Toluene, Formaldehyde, and Phthalate Free***

- **L'Oreal Paris Jet-Set Quick Dry Nail Enamel**
- **Revlon Nail Enamel**
- **Garden Botanika Natural Color Nail Color**
- **Kiss products, Kiss Color**



## *Extensive Use of Solvents*

- 1. To dissolve and remove nail polish and other finishes.**
- 2. To remove acrylic nails.**
- 3. To dry glues used to adhere nail tips.**
- 4. To dry acrylic primer.**
- 5. To dry acrylic nail.**
- 6. To clean acrylic dust off of electric file.**
- 7. To clean Acrylic Applicator Brush with Resin Solvent.**
- 8. To dry nail basecoats, polish, and topcoats.**



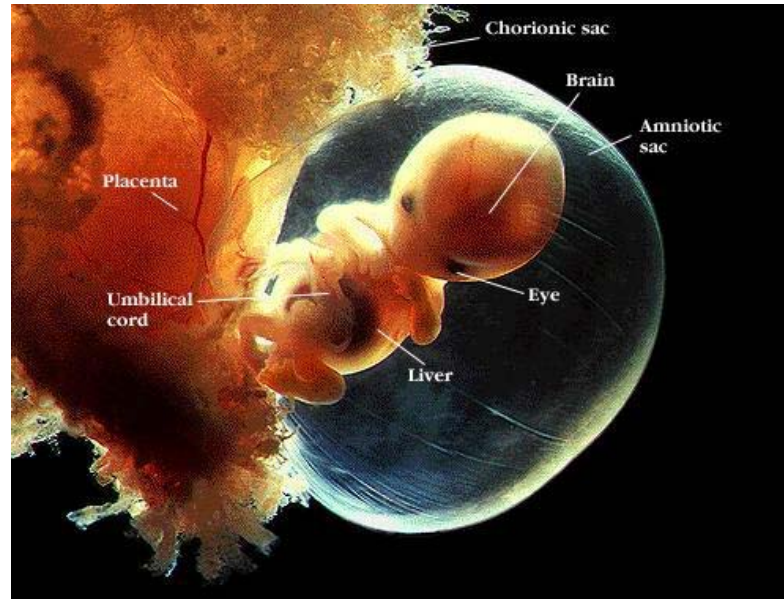
## *Types of Solvents Used in Nail Products*

- **Methyl ethyl ketone**
- **Acetone**
- **Toluene**
- **Xylene**
- **Ethyl ether**
- **Epichlorobdrin**





# Solvents – *Routes of Exposure*

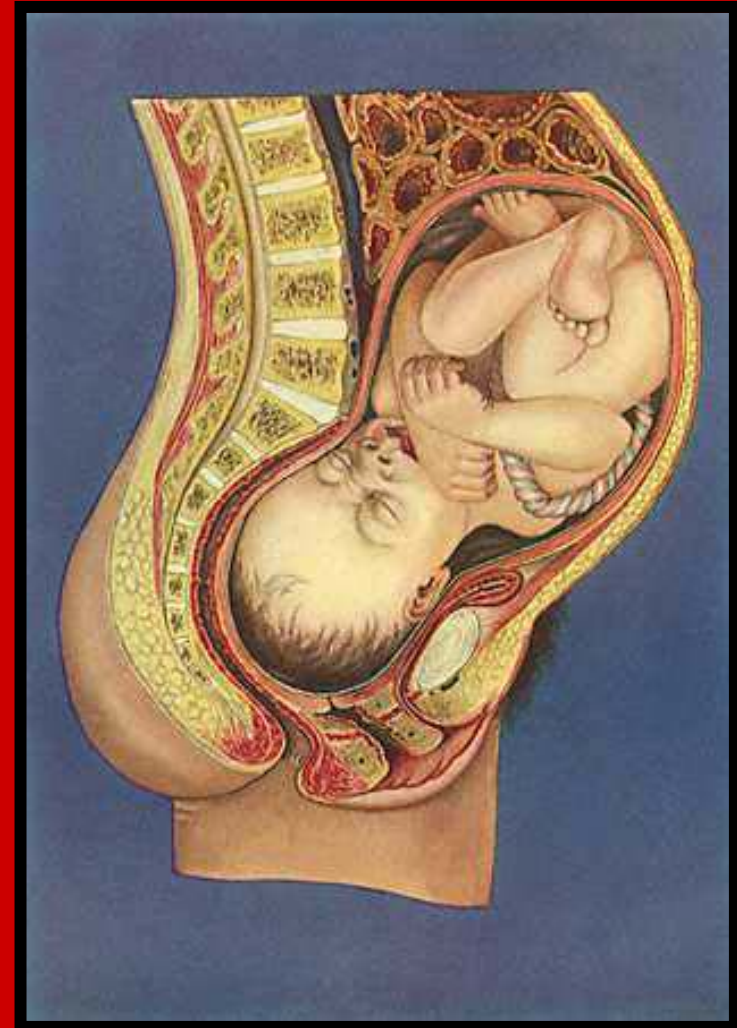


- **Skin Absorption**
- **Inhalation**
- **Once absorbed, most organic solvents can reach the fetus or enter breast milk.**

# Health Impacts of Solvents

## *Reproductive and Developmental Toxicity*

- *Reproductive:*
  - Infertility
  - Early miscarriage
  - Sperm toxicity
- *Developmental: Toluene - “Fetal Solvent Syndrome”*
  - Birth defects
  - Growth and developmental delays, IQ deficits, hyperactivity, attention deficits



# Glycol ethers

- **Not all glycol ether compounds have been adequately tested. Certain glycol ethers:**
  - **cause birth defects in test animals**
  - **damage the testes of male laboratory animals.**
- **Recent studies of exposed workers indicate that glycol ethers can reduce sperm counts in men. These effects can occur at low exposure levels that have no other health effects, so you can be exposed to harmful levels of the glycol ethers without any immediate warning symptoms.**

# Toluene

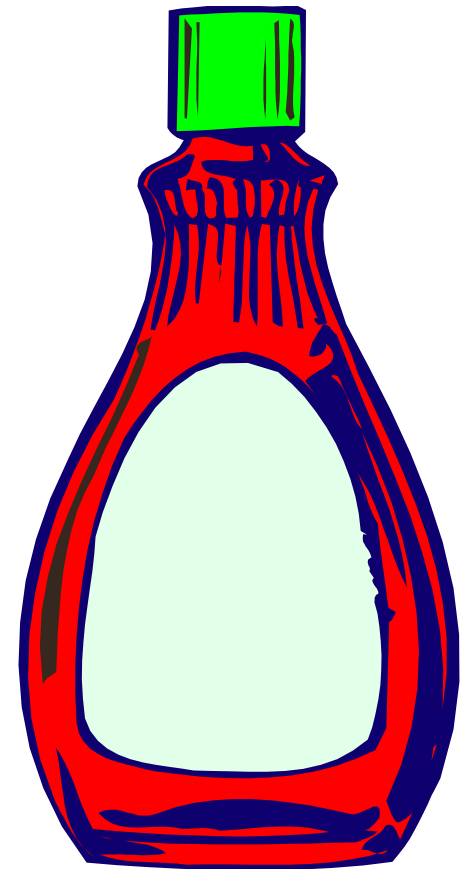


**Has been reported to cause birth defects and nervous system damage in the children of mothers who abused toluene by glue-sniffing during their pregnancy.**

**However, such effects are not likely to occur unless exposures are high enough to make the mother feel dizzy or sick.**

# Acetonitrile

- **Many artificial nail removers are almost pure acetonitrile, a very toxic chemical. Acetonitrile can cause birth defects in animals exposed to large amounts.**
- **It is absorbed very quickly through human skin.**



# Health Impacts of Solvents

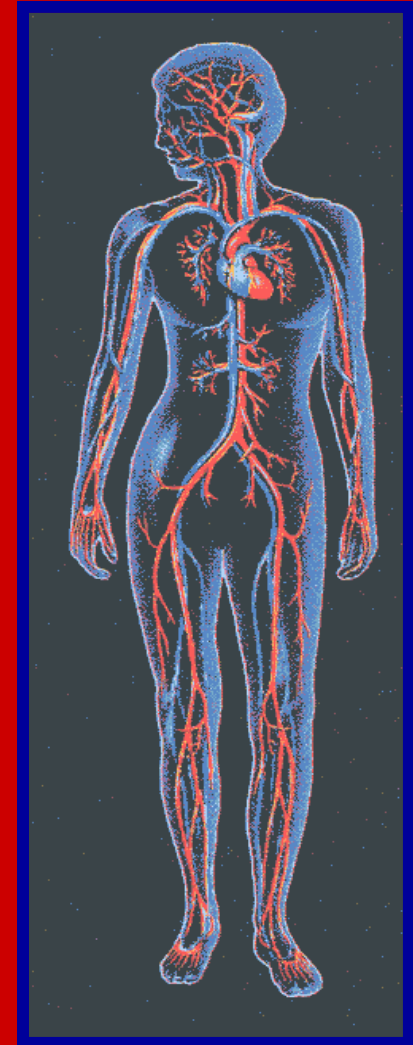
## *Nervous System*

- *Peripheral Nervous System (arms, legs)*

- *Motor*: weakness, uncoordinated, fatigue, tremor
- *Sensory*: numbness, tingling, visual or hearing problems

- *Central Nervous System (brain)*

- *Thought Processes*: memory loss, confusion
- *Emotional State*: nervousness, irritableness, depression, apathy, mood swings



# Health Impacts of Solvents

## *Irritant*

- **Eye, nose and throat irritant**
- **Skin irritant and dermatitis**



# Health Impacts of Solvents

## *Cancer*

- *Leukemia* – based on occupational studies of men and women
- *Cancer* – epichlorobdrin , a solvent in some nail polishes, is a “probable human carcinogen”





# *Clean & Disinfect Tools Between Each Customer*



**Disinfectants are used to prevent: staph and fungal infections, hepatitis and AIDS**

**The type of pathogenic bacteria that grows under artificial nails is not the same as the bacteria that grows under natural nails. It is more dangerous. Some hospitals ban the use of artificial nails.**

# Banning Artificial Nails in Food Service

*Marion County has banned the use of artificial nails and provides this training.*

## Non - acceptable practices

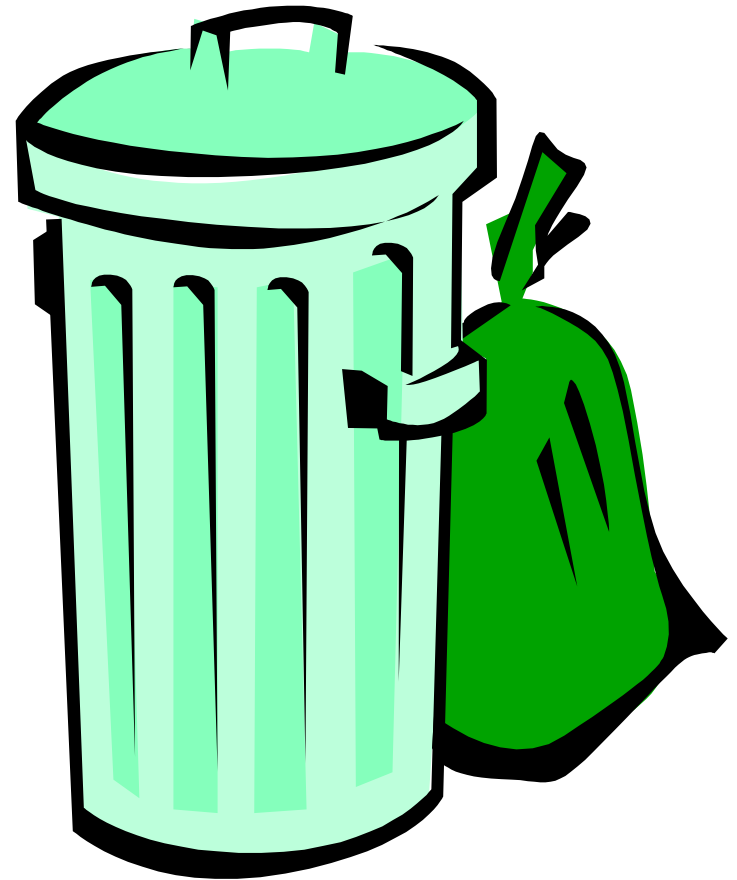
- ◆ Coming to work when ill
- ◆ Poor personal hygiene
- ◆ Un-clean work clothes
- ◆ False fingernails and nail polish
- ◆ Jewelry
- ◆ Uncovered cuts, scrapes, and burns



- Fingernails must be kept clean and trimmed.
- Ragged nails harbor bacteria and are difficult to keep clean.
- Long false nails can break off into food and present the same hazards as ragged nails.
- Chipping polish can also contaminate a food product.

**Nail Application Process:**  
*Reducing Exposures From Fumes from Waste*

- **Dispose of solution soaked gauze and other cleanup materials in a sealed container or bag.**
- **Keep a lid on the trash can and dispose of daily.**



# Nail Application Process: *Reducing Exposures*

- **Do not eat or drink in application area.**
- **Do not smoke in application area.**



# Nail Application Process: *Reducing Exposures*

Wash hands several times during the day especially:

- Between customers
- Before eating
- Before smoking



# **Nail Application Process:** *Reducing Exposures With PPE*

- **Long sleeves to reduce dust exposure**
- **Safety glasses**
- **Nitrile gloves**
- **Chemically resistant aprons**



# *Role of Ventilation in Exposure Control*

- **Remove chemicals from the air before you breathe them.**
- **Supply fresh air to dilute chemicals in the air.**





# **Types of Ventilation:**

## ***General Dilution Ventilation***

### ***Mechanical***

**Uses motors, fans and vents in the heating, ventilating, and cooling system (HVAC) to remove, dilute, condition and circulate the air.**

### ***Natural***

**Uses the force of the wind and movement in and out of the salon to move air in and out of windows, doors, leaks in building, cracks, etc.**

# **Types of Ventilation:**

## ***General Dilution Ventilation***

- **Designed to control temperature, humidity, carbon dioxide levels.**
- **Not a complete method of chemical removal, only dilution. Will be redistributed to all areas served by that system.**

# Ventilation Systems:

## *Air Purifiers*

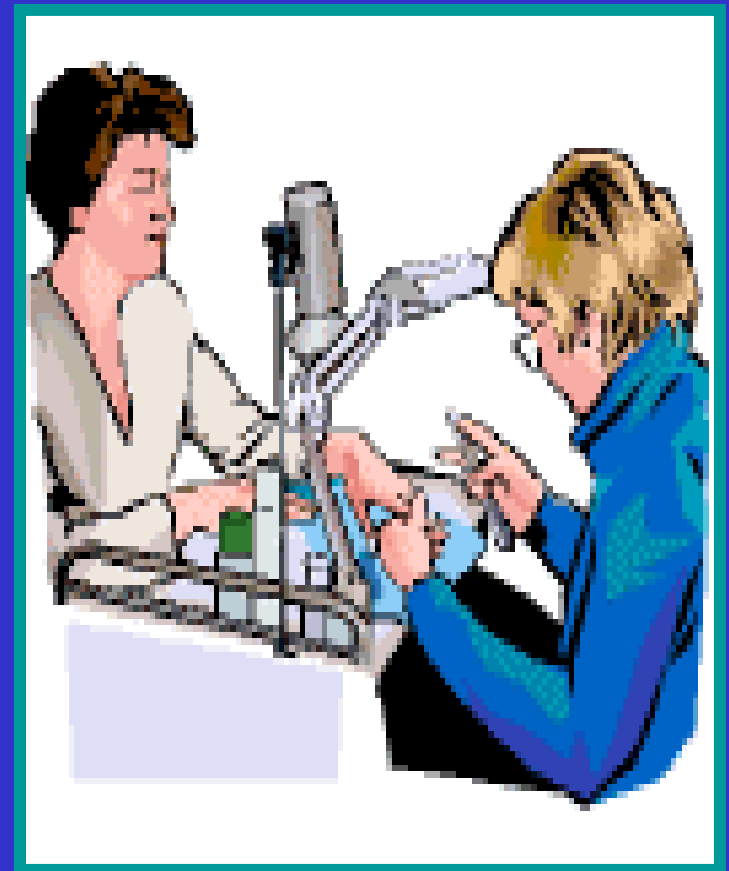
- **Consist of wall or ceiling mounted or free standing units.**
- **Use charcoal or low-efficiency filters.**
- **May clean air in salon but not reduce immediate exposures due to close work.**

# Types of Ventilation:

## *Local Ventilation Guidelines*

*Located at Point of Use  
the system should:*

- be close to client's hands
- draw air away from you, not towards you
- be away from a door or window that could disturb the air currents
- be vented to the outside



# *Vented Tables*

## *Available on the Market*

- Usually filter the air through a charcoal filtered vent, and not to the outside.
- These tables do not adequately filter the air due to the following:
  - The airflow was not strong enough to overcome the room currents
  - There can be leaks around the filter allowing fumes to escape before filtering
  - There is no fresh air exchange
  - There are a multitude of limitations on the effectiveness of the charcoal filter

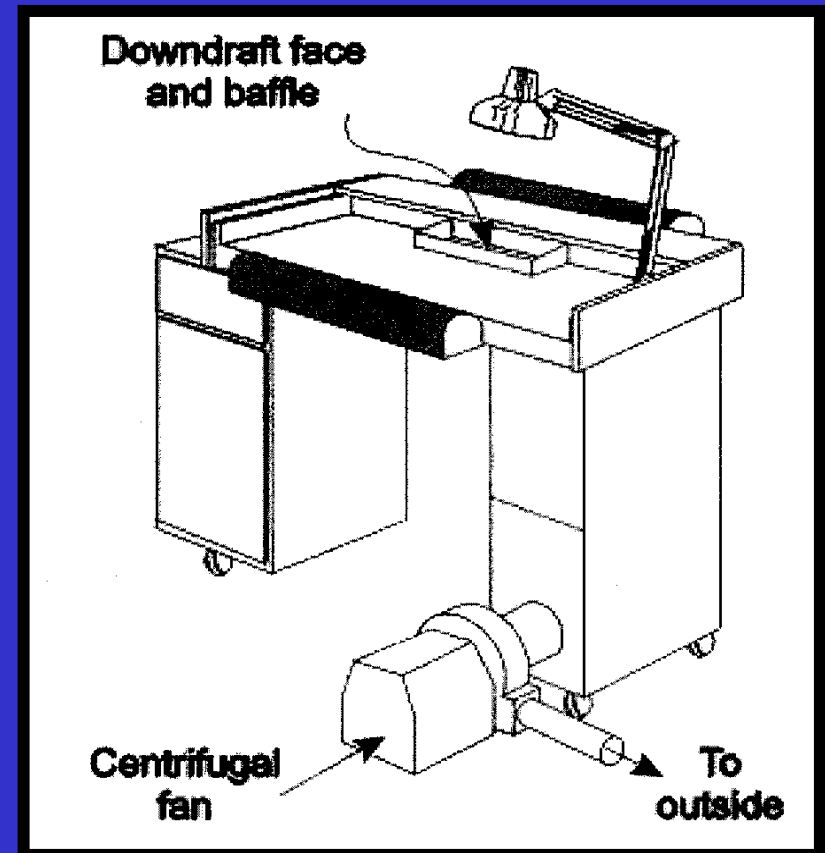
## ***Problems With Charcoal Filters In Manicure Tables & Air Purifiers***

- **May not be sealed around the filter and can leak**
- **May not have enough fan power to pull air through filter, & room currents can disrupt flow**
- **Don't know when filter is saturated and unusable, thus may not be changed enough**
- **Cannot wash or vacuum filter**
- **Humidity reduces effectiveness of filter**
- **Does not reduce dust exposure, only fume exposure**

# *Ventilated Nail Table*

The NIOSH redesigned table includes:

- Hood
- Ducts
- Fan



# IPC, Inc. Vented Nail Chambers



**Protects the client  
and technician.**

**Uses an exhaust system  
that  
vents to the outside.**





# **Dispensary**

**A separate room for the storage and mixing of chemicals**

- **Should be equipped with local exhaust ventilation.**
- **Should be under negative pressure and directly vented to the outdoors.**

# Product Storage of Flammable Nail Products

- **Nail Polish**
- **Nail Basecoat**
- **Nail Topcoat**
- **Nail Polish Remover**
- **Acrylic Basecoat**
- **Liquid Acrylic**
- **Resin Solvent**



# Identifying Health Reactions to Nail Products

- *Allergic Dermatitis* - Dermatologists and allergists can do patch testing to identify the chemicals to which your skin is allergic.
- *Asthma* – a pulmonary specialist can conduct an Inhalation Challenge to diagnose occupational asthma and identify the chemicals which caused it.

# Controlling Exposures

## *Substitution*

*Replace hazardous products with safer ones!*

- **Solvents - glycol ethers, acetonitrile, toluene**
- **Formaldehyde**
- **Phthalates**
- **MMA**
- **Methacrylic Acid**

# **Summary**

## **Controlling Exposures**

- **Product Substitution**
- **Engineering Controls**
  - **Work Practices**
- **Personal Protective Equipment**