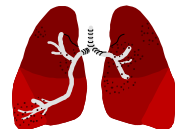




Occupational Airways



A newsletter of the Occupational Health & Special Projects Program, Division of Environmental Epidemiology and Occupational Health (EEOH), Connecticut Department of Public Health, 410 Capitol Avenue, MS# 11OSP, P.O. Box 340308, Hartford, CT 06134-0308 (860) 509-7744

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Worker Dust and Vapor Exposure in Nail Salons

Artificial fingernails, also known as sculptured or acrylic nails, have become increasingly popular since the 1970's. In the U.S., billions of dollars are spent on artificial nails, and approximately two thousand nail salons are opening each year. At the cost of enhancing customer appearances, nail technicians, cosmetologists and manicurists could potentially be paying the price with their health. Toxic vapors from the chemicals used to construct the artificial nails and dusts from motorized and manual filing can cause health problems including occupational asthma. Since polymer powders containing silica may also be used, the dusts generated when filing the finished nail present an additional health risk.^{1,2}

Nail Application



Acrylic nails are created using a methacrylate monomer liquid and polymer powder. The nail surface is first roughened by sanding or filing. The nail technician then dips a small brush into liquid methacrylate monomer and then into powdered polymer. The powder contains a peroxide accelerator which catalyzes the liquid monomer into a polymer. The mixture is applied to the nail using an extender mold. After the resin dries, the mold is removed, and the nail is ready for filing. The process takes 1 to 2 hrs. for initial

application, and 30 minutes to 1 hr for "fill ins", which are done when the natural nail grows and the space between the artificial nail and the cuticle needs filling in.^{1,3,4,5}

The first artificial fingernails were made by applying methyl methacrylate (MMA) dental acrylate to fingernails. In 1974, the Food and Drug Administration (FDA) banned the use of MMA from all artificial nail preparations because it caused nail deterioration and dislocation and allergic dermatitis in customers and nail technicians. MMA has been substituted with ethyl and other methacrylates. Despite the ban, studies have found that there are still some nail products that contain MMA.^{1,3,4,5}

Health Effects



Methyl methacrylate (MMA) is a colorless, flammable liquid with a strong, bitter odor. It is an eye and mucous membrane irritant and can cause allergic and irritant dermatitis. It is also a known cause of occupational asthma. Other health effects reported include slowed peripheral nerve conduction, hand numbness and pain, headaches, nausea, fatigue and sleep disturbances. Once polymerized, it is relatively inert and nontoxic. When cut or sanded, however, the dusts can cause eye, skin and mucous membrane irritation.^{1,3,4,6,7,8}

MMA has been found to be irritating at air concentrations below 50 ppm (parts per million) measured as an 8-hr time weighted average (TWA). This is much lower than the OSHA permissible exposure limit (PEL) which is 100 ppm measured as an 8-hr TWA. Studies have found that nail technicians' exposures during artificial nail application are below OSHA PELs. Even so, there are reports of nail technicians adversely affected by chemical exposures while applying artificial nails. These include reports of cases of occupational asthma.^{1,6}

Less is known about the toxicity of ethyl methacrylate, but it is believed to have similar

health effects as MMA. Currently there is no OSHA standard for ethyl methacrylate. Industrial hygiene recommendations are the same for both methyl and ethyl methacrylates.^{3,4}

MMA has a wide variety of uses besides artificial fingernails. It is used in the production of acrylic plastics, adhesives and surface coatings. In medicine, it is contained in bone cement, spray adhesives and bandage solvents, and in dental technology, it is used as a ceramic filler or cement. Medical and dental personnel working with any of these materials are at risk of developing symptoms and/or disease consistent with MMA exposure.^{6,7,9}

Investigations

Occupational Asthma: In Colorado in 1990, occupational asthma was diagnosed in six cosmetologists working with artificial fingernails. The Colorado Department of Health requested the assistance of the National Institute for Occupational Safety and Health (NIOSH) for evaluation and control of exposures. The primary ingredient of the liquid and powder components was ethyl methacrylate. However, NIOSH found trace amounts of MMA in 15 of 25 random bulk samples of both components. It was believed that trace amounts of methyl methacrylate were most likely impurities in the ethyl methacrylate and not an added ingredient. When air sampling was conducted, the levels of methyl methacrylate were nondetectable. Nail technicians' exposures to ethyl methacrylate were measured by having them wear personal air sampling devices while working at a modified vented manicure table and an unvented manicure table. The modified vented table reduced ethyl methacrylate exposure by *tenfold* compared to the unvented table. Therefore, it was suggested that salons use a modified vented or downdraft manicure table to alleviate vapor and dust exposure. (See Figure 2 on page 3.)³

Silica: Recently, an investigation was sparked in Illinois after an employee of the Department of Public Health (DPH), who was a customer at a nail salon, noticed that the bottle containing the powder component was labeled "silica". For nail applications, silica aids the ethyl methacrylate in flowing, therefore making the monomer less likely

to clump. This prompted the Illinois DPH to conduct studies involving 10 technicians in five salons and sample various polymer powders. Silica was present in quantities between 1 to 20% by weight in the polymer powders sampled. Since silica can cause silicosis, a fibrotic disease of the lungs, the health department was concerned about silica exposure from the dust caused by motorized and manual filing of the artificial nails. In all five salons, the silica exposure was below the NIOSH exposure limit, 0.05 mg/m³ (measured as an 8-hr TWA). For dust and vapor controls, the Illinois DPH recommended that nail salons use vented manicure tables with air exhausted to the outdoors.²

Most salons have little or no controls for hazardous substances used during artificial nail applications. Besides the components in the artificial nails, technicians are exposed to other chemicals such as those found in nail polish, fingernail glues and nail polish remover. Appropriate ventilation, such as that provided by a modified downdraft manicure table, would reduce the need for technicians to wear personal protective equipment. To minimize skin and dust contact, additional recommendations include hand washing, wearing long sleeved clothing, and not permitting food, drink and smoking at the manicure table.^{1,3,10}

Even though studies found exposure levels of vapors and dust were lower than guidelines and standards, nail technicians may be at risk for occupational asthma and other health effects associated with methacrylates. In order to decrease exposures, effective engineering controls and good work practices should be implemented. It is clear from the literature that ethyl methacrylate needs to be researched further and perhaps a standard needs to be set. Nail technicians need to be educated about the chemical hazards and about the controls available.³

(References on page 4)

REPORT CASES OF OCCUPATIONAL DISEASE NOW!

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Control of Acrylic Nail Emissions

by Anne Bracker, CIH, MPH
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Acrylic nail products can cause allergic and irritant reactions. Nail technicians who work with sculptured acrylic fingernail extensions may develop occupational asthma because of an inhalation exposure to the acrylate monomer or the dust generated when the nails are filed. A variety of industrial hygiene intervention recommendations have been developed in response to employer and employee requests for exposure control options. These recommendations are summarized below:

Substitution Options

It appears that all acrylic nail product lines contain acrylate functional monomers which have the potential to cause allergic sensitization. Therefore, the substitution of one product with a "hypoallergenic" or "odor free" product may result in limited symptom relief. However, the trial use of alternative product lines should be pursued in an effort to find a successful substitution.

Ventilation Options

A combination of local exhaust and dilution ventilation would reduce the air concentration of nail product emissions.

Local exhaust:

The extraction of emissions from the work area could be accomplished with a vented manicure table or vapor extraction system. If the air which is extracted is cleaned before it is re-introduced into the work area, the manufacturer should confirm that the filters and absorbing materials are designed to capture acrylic emissions. These filters should be replaced when they become saturated.

One study completed by the National Institute of Occupational Safety and Health (NIOSH) concluded that some vented manicure tables may be inadequate due to (1) leaks around the charcoal filter, (2) failure to change the filter, (3) uneven air flow across the exhaust opening, and (4) inadequate exhaust air to overcome room air

currents. NIOSH recommended the following modifications: (1) increase in the volume of

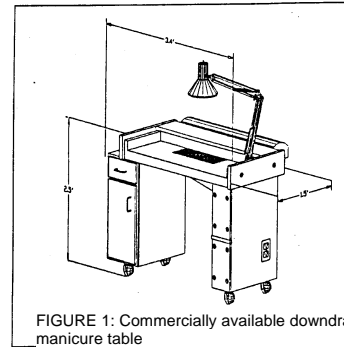


FIGURE 1: Commercially available downdraft manicure table

exhausted air to 235 cubic feet per minute (cfm); (2) enlarge the exhaust plenum to allow for consistent air flow rates; and (3) exhaust to the outdoors. Their observations are summarized in Figures 1 and 2.¹

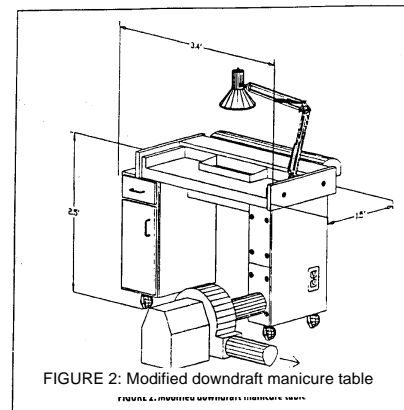


FIGURE 2: Modified downdraft manicure table

Dilution ventilation:

The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), recommends that hair and nail salons be provided with at least 25 cfm outside air per occupant.

Protective Equipment

Personal protective equipment should only be used as a last resort if engineering controls cannot be utilized. The use of a respirator to protect technicians from vapors and dusts is not feasible in the salon environment. However, gloves made of neoprene would provide skin protection.

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TO:

Summary of Number of Reported Cases of Selected Respiratory Diseases CT DPH Occupational Disease Surveillance Data					
	1994	1995	1996	1997*	ODSS Total**
Asthma	13	34	33	10	131
RADS***	1	1	5	2	15
Silicosis	4	1	0	1	8
Asbestosis	3	5	10	2	47
Asbestos-related pleural diseases	17	8	7	2	125
Total	38	49	55	17	326

* As of July 31, 1997. Data subject to change.

** Occupational Disease Surveillance System (ODSS) total since 11/91

*** Reactive Airways Dysfunction Syndrome

(Continued from page 2)

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