Appendix J

Gloves - Chemical Resistance & Selection

Gloves afford hand protection by minimizing skin contact with the contaminant but donning gloves often mislead and provide a false sense of security. No one glove can provide protection against all chemicals so it is important to select the appropriate glove and to know its limitations.

I. SELECTION

A. Hazard Assessment

In order to find the right glove, it is critical to perform a hazard assessment to identify the hazards involved. This information can be found on a chemical's label and/or material safety data sheet (MSDS).

B. Effectiveness

The effectiveness of a glove to protect against chemicals is based on *degradation*, *permeation*, and *breakthrough time*, so each of these properties must be evaluated when selecting the type of glove.

1. *Degradation*

Degradation is the change in one or more physical characteristics of a glove caused by contact with a chemical. Degradation appears as swelling or shrinking, stiffening or softening, slight discoloration, cracking, or having a rough or gummy surface.

Degradation tests vary with each manufacturer and it is very important to consult each manufacturer's glove chart

2. *Permeation Rate*

The permeation rate refers to the speed at which a chemical penetrates the glove material. This term is expressed in micrograms per square centimeter per unit or as "Excellent", "Good", "Fair", "Poor", and "Not Recommended".

3. *Breakthrough Time*

The breakthrough time is the elapsed time between initial contact on the outside of the glove with a chemical to the first detection of chemical on the inside surface.

Select gloves that have Permeation Rate ratings of "Excellent" or with the longest breakthrough times. Try to select a glove with a breakthrough time of at least 60 minutes.

C. Material Type

Gloves are made of many different types of material yet no one material type affords protection against all chemicals. For certain chemical mixtures, there are no materials that will protect for more than an hour after initial contact; **AND, DISPOSABLE LATEX GLOVES PROVIDE LIMITED CHEMICAL PROTECTION FOR SPECIFIC CHEMICALS**.

The following is a list of common glove types and their uses:

GLOVE TYPE	USE
Butyl Rubber	**Good** for many organics, ketones, esters; **Poor** for aliphatic, aromatic hydrocarbons, halogenated hydrocarbons, gasoline
Natural Rubber	**Good** for very dilute acids and bases; **Poor** for organics
Neoprene	**Good** for acids and bases, peroxides, fuels, hydrocarbons, alcohols, phenols **Poor** for halogenated and aromatic hydrocarbons
Polyvinyl chloride (PVC)	**Good** for acids and bases, some organics, amines, and peroxides; **Poor** for most organics
Polyvinyl alcohol (PVA)	**Good** for aromatic and chlorinated solvents; **Poor** for water-based solutions- *water destroys the gloves!*
Silver Shield™	**Good** for wide variety of toxic and hazardous chemicals; provides the highest level of chemical resistance. Flexible laminate glove; **Poor fit**- comes in small, medium, large
4H™	**Good** resistance to many chemicals; better dexterity than Silver Shield™
Nitrile	**Good** for wide variety of solvents, oils, greases, some acids and bases and biohazardous materials
Viton™	**Exceptional** resistance to chlorinated and aromatic solvents; **Good** resistance to cuts and abrasions

D. Latex Gloves

- Allergic reactions may result from using latex glove.
- Reactions may include appearance of an itchy rash (dermatitis). A more serious reaction may occur in sensitized individuals such as wheal, urticaria and asthma (wheezing, coughing) from minutes to hours following latex allergen exposure. Rarely, life-threatening anaphylaxis may follow.

- If users experience any of the above symptoms, remove the glove, wash your hands, and report to your laboratory supervisor and seek medical attention, if necessary.

- Select gloves that are powder-free and low in residual accelerators and extractable latex proteins or switch to non-latex gloves to prevent latex allergies.

E. **Performance**

Durability, thickness, and length of the glove material as well as dexterity requirements, sensitive skin or allergies and worker comfort are just some of the factors that must be considered before selecting gloves.

1. **ALL** *disposable gloves*, regardless of material type are designed for intermittent chemical exposure. If working with toxic agents, consider triple gloving with disposable nitrile gloves. Always remove first layer once contamination has occurred. Replace glove appropriately.

2. *Reusable gloves* should be washed prior to removal and air dried in the laboratory after coming into contact with a chemical. Do not come into contact with water when working with polyvinyl alcohol (PVA) gloves!

II. INSPECTION & MAINTENANCE

- **All gloves should be inspected before and after each use, and periodically while in use. Inspect for:**
- **Any holes or punctures,**
- **Signs of degradation,**
- **Chemical discoloration,**
- **Swelling, stiffness, cracking, or**
- **Signs of prior contamination or breakthrough.**

- If the integrity of the gloves is in question, they should be replaced immediately.

- Disposable gloves should be changed frequently; do not clean or reuse.

- Once a chemical has begun to diffuse into a glove, it will continue to diffuse into the elastomer even after the chemical on the surface is removed because of the concentration gradient that develops within the protective glove. Due to this problem, extreme caution is advised when using any chemical protective clothing that has been exposed to highly toxic chemicals. In fact, it is prudent practice to use disposable protective clothing where highly toxic chemicals are involved.

- **Always wash your hands after removing the gloves**. Some chemicals may be absorbed through the glove material, and may contact your skin. Your hands may also become contaminated from handling the gloves while removing them.

III. RESOURCES

A. Manufacturers

Manufacturers can provide degradation/permeation resistance charts that list the performance characteristics of their glove types to given chemicals. To request a chart, call the manufacturer whose gloves are utilized in your lab.

- Best Gloves, 1-800-241-0323
- Ansell Edmont, 1-800-800-0444
- North Safety, 1-800-430-4110
- MAPA Gloves, 1-800-772-6733

B. Internet

1. The following glove manufacturers have established Internet sites for glove information: (**NOTE**: These sites only reflect their own products)

Ansell Edmont (**www.ansell-edmont.com**) **Ansell Edmont Resistance Guide**	MAPA Professional (**www.mapaglove.com**)
Best Gloves (**www.chemrest.com**)	Microflex brand **Latex/Nitrile Glove Chart**
Kimberly Clark **Kimberly Clark Safeskin Gloves**	North Safety **www.northsafety.com**

2. To simultaneously search for the appropriate type of glove manufactured by any of the above listed companies, search by chemical name in the following website: **http://www.hazmat.msu.edu:591/glove_guide/**

3. NIOSH Guide to Hazards: **http://www.cdc.gov/niosh/npg/npg.html**

C. EH&S:

For further assistance, consult with EH&S at extension 46200.

Source:
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Personnel Protection and Safety, United States Environmental Protection and Safety, Office of Emergency and Remedial Response, Environmental Response Team.