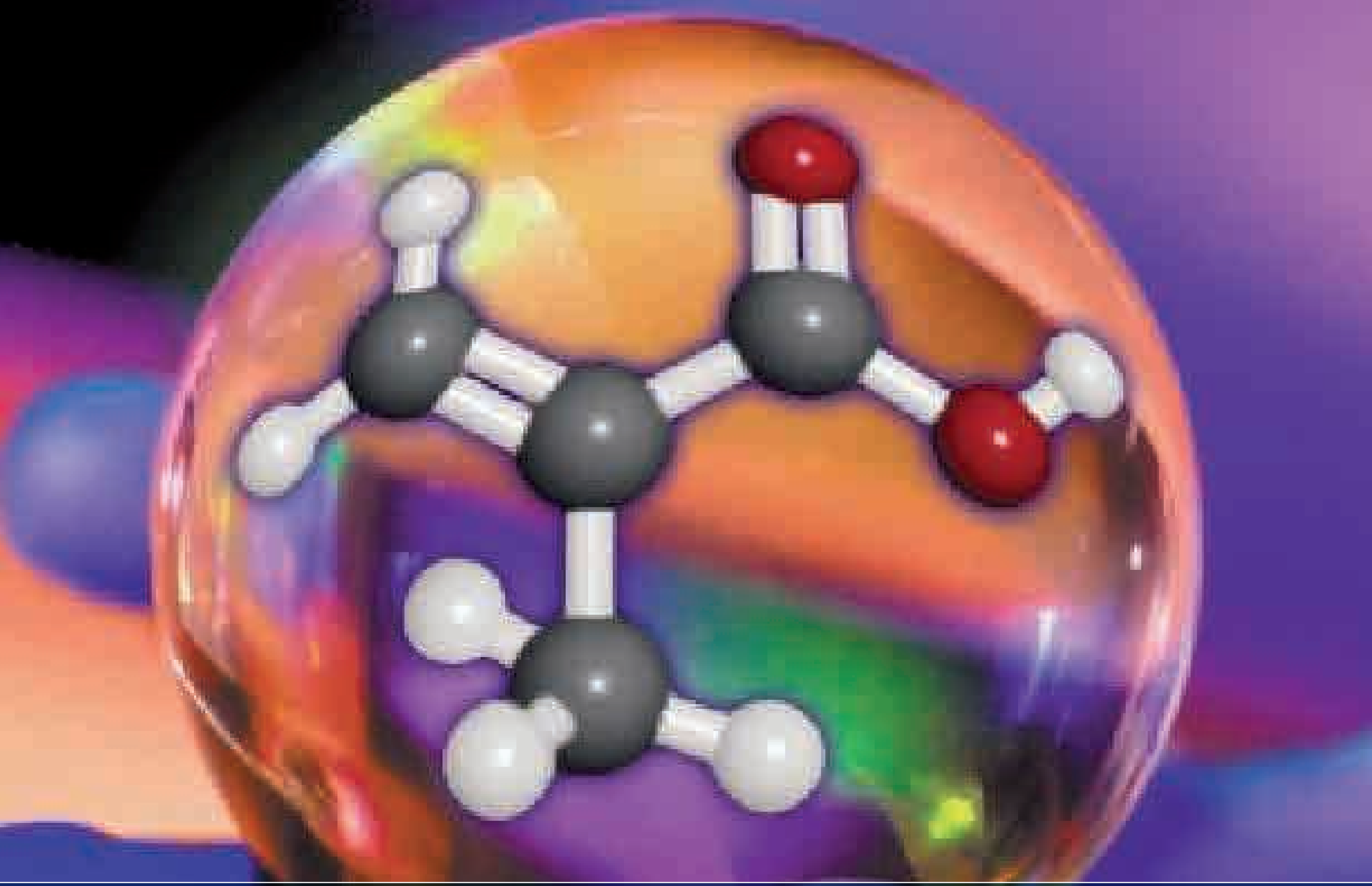


Methacrylate Monomers

Safe use of gloves

BEST PRACTICE GUIDELINES | 2013

cefic
Methacrylates Sector Group

Methacrylate Producers Association Inc.

Introduction

Best practice guidelines

This manual provides best practice information on the selection of gloves for the handling of methacrylic acid (CAS 79-41-4) and its esters including methyl methacrylate (CAS 80-62-6), ethyl methacrylate (CAS 97-63-2), n-butyl methacrylate (CAS 97-88-1), iso-butyl methacrylate (CAS 97-86-9), and 2-ethyl hexyl methacrylate (CAS 688-84-6).

The selection of a glove for a particular task requires a review of the hazards and determination of the most suitable glove for protecting against the highest risks. No one glove can provide complete protection to all hazards or would be suitable for every task. Addressing all the hazards may require the task to be refined in order to control the level of exposure to other risks (e.g. limiting the duration due to less compatibility of gloves to lower risk substances or provision of special tools to compensate for loss in dexterity).

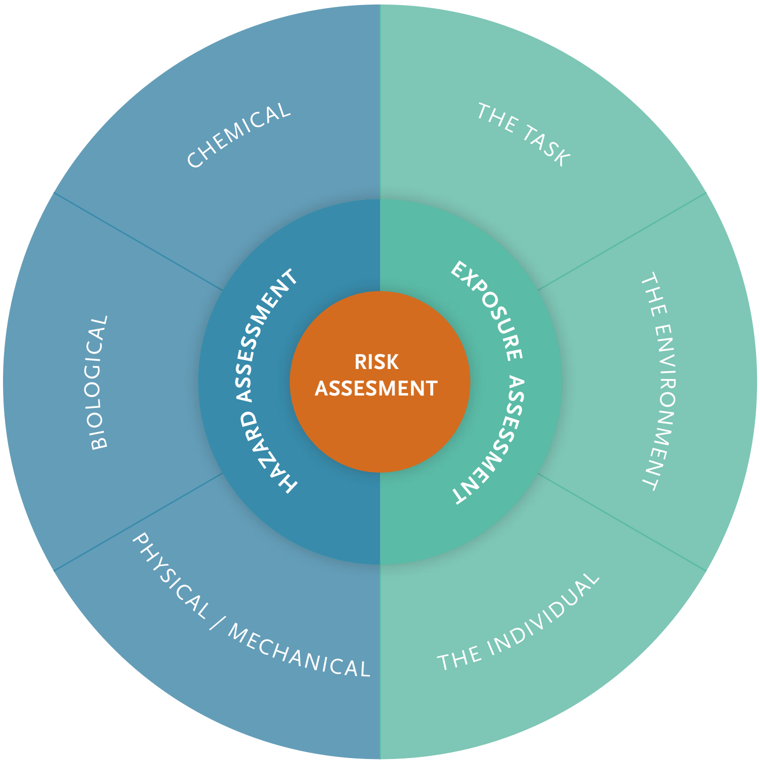
The most effective control to prevent skin problems is to design a process or task such that contact with harmful chemicals is avoided. Where this is impractical then the proper selection of the type of glove combined with the correct use can provide protection from the hazards associated with the handling of chemicals. These hazards are dependent upon the substance being handled but may range from allergies or dermatitis to skin cancers or health problems associated with absorption into the blood stream. Protective gloves themselves are available in a wide variety of styles and materials for protection against cuts, abrasions, thermal burns and chemicals. The choice of an inappropriate glove, however, may provide a false sense of protection and be potentially more harmful than using no glove at all. For example, if a leather or fabric glove is contacted by a chemical, that chemical may be conducted onto the skin's surface and be held in contact with the skin in the manner similar to that of a chemical patch test. This can often occur without the awareness of the wearer. In contrast, if no glove at all is worn, chemicals contacting the skin may have an opportunity to evaporate.

This guide aims to give general information to assist in selecting appropriate gloves with some background on performance against methacrylate monomers. However, it is guidance material only and is intended as information to support the user in performing a risk assessment to select an appropriate glove for their task.

Factors within a risk assessment

The selection of a suitable glove requires the completion of a risk assessment which combines an assessment of the hazards alongside the likelihood and frequency of exposure, an exposure assessment. Each of these is built from a review of a number of factors that should be considered as they may restrict the suitability of certain types of gloves.

The next pages give more details as to the types of issues that should be considered within each section of the assessment process.



Hazard assessment

The Hazard Assessment looks at the inherent properties and the potential for harm. This may be due to a number of factors arising from either the materials being handled or the physical conditions or process that are being undertaken. The key factors are:

Chemical

When selecting a glove for a task with potential exposure to chemicals it is important to:

- identify all chemicals involved
- understand the hazards associated with each of the chemicals
- review suitability of glove materials for each chemical using permeability charts available from glove suppliers
- Take into account that the different chemicals handled will have different recommended materials – the one that offers the longest breakthrough time for the first chemical to permeate may be the best choice
- consider that if one chemical is significantly more hazardous than the others then this may be the one that determines the choice of glove and the task may need adjusting to consider the breakthrough times for the other chemicals.

When in contact with chemicals the material may suffer from degradation, penetration or permeation. Degradation results from the reaction of the chemical with the glove material and may cause cracking, shrinking and/or the loss of elasticity. Penetration is the passage of chemical through small openings in the glove material, such as pinholes or punctures. Any such damage to the glove will reduce its chemical resistance and should be considered within the design of the task. Permeation is the passage of the chemical through the intact glove material, often without any apparent evidence of this effect. Resistance of gloves to the permeation of specific chemicals is quoted as breakthrough time in guidance available from glove manufacturers.

Biological

Some situations also present risk of exposure to bacteria and viruses. Tasks such as medical and dental, also often require specific protection whilst retaining a high level of dexterity and sensitivity.

Mechanical / Physical

Protection against mechanical hazards such as impact often requires fabric based gloves. However, these are often incompatible with physical extremes in temperature or may provide little or no chemical resistance and can even absorb chemicals, holding them against the skin. Some situations may require consideration of double gloving to provide the necessary protection or consideration as to which chemical; resistant gloves provide good mechanical resistance.

Exposure assessment

The Exposure Assessment considers the frequency, duration and likelihood for the individual to be subjected to the hazard. This includes factors that are specific to the task and the environment.

The individual

The effectiveness of a glove can be dependent upon the individual. It is important to consider different hand sizes – gloves that are too small can cause skin problems and loss of dexterity whilst too large can compromise grip and dexterity. Additionally, pre-existing skin conditions should be considered – individuals with cuts and abrasions may be required to wear gloves when others do not, or allergies such as latex allergy may restrict options in some cases.

The task

The features of the task may determine the type of glove, rather than the material. Things to consider include dexterity requirements – the thicker the glove the better the chemical resistance but the poorer the flexibility and ability to complete intricate tasks. Thicker gloves can also compromise grip but they may provide better protection for abrasion, puncture or tear.

The environment

The workplace environment may restrict the suitability of some glove materials and designs. Temperature extremes may compromise some materials whilst working outdoors in wet conditions could compromise grip.

Risk assessment

No one glove will provide complete protection against every hazard. The risk assessment should determine which is the primary hazard that requires control and ensure that the task is conducted in a manner such that the remaining hazards are suitably controlled. This requires a review not only of the hazards but the likelihood and level of any exposure. The glove selection may be to protect against the highest hazard material with provision of tools to compensate for potentially reduced dexterity, or double gloving with latex gloves to give improved dexterity but require the additional control of reduction of duration and / or immediate removal of gloves in the event of contamination. Some gloves are intended to be used once while others can be used repeatedly. Single use gloves should not be used multiple times as their protectiveness may be degraded. Multi-use gloves need to be carefully maintained and inspected before each use to ensure their protectiveness is not compromised.

Glove standards and guidelines

There are several European Standards associated with the protection offered by gloves the most applicable of which are listed below.

Although there is no equivalent ANSI standard for glove performance, in a similar manner, OSHA requires that selection be based upon the tasks to be performed and the performance and construction characteristics of the glove. For protection against chemicals, glove selection must be based on the chemicals encountered, the chemical resistance and the physical properties of the glove material.

EN NUMBER AND PICTOGRAM	DETAILS
89 686/EEC CE nnnn	The PPE Directive specifies classes of glove for 2 risk levels. Simple design gloves for minimal risk may only bear the CE mark. Gloves addressing higher levels of risk, e.g. chemicals, must be tested and certified by a Notified Body, identifiable by a unique number 'nnnn'.
EN 420:2003 	Instructions for use must include details of the manufacturer, available sizes, CE mark, care and storage, limitations in use and any substances within the glove that may cause allergies.
EN 374:2003 	Gloves giving protection from chemical and micro-organisms. Each letter in the code refers to one of 12 standard chemicals for which a breakthrough time of at least 30 minutes has been achieved. A Methanol (Primary alcohol) B Acetone (Ketone) C Acetonitrile (Nitrile compound) D Dichloromethane (Chlorinated paraffin) E Carbon disulphide (Sulphur containing carbon compound) F Toluene (Aromatic hydrocarbon) G Diethylamine (Amine) H Tetrahydrofuran (Heterocyclic and ether compound) I Ethyl acetate (Ester) J n-Heptane (Saturated hydrocarbon) K Sodium hydroxide 40% (Inorganic base) L Sulphuric acid 96% (Inorganic mineral acid)
EN 374:2003 	The 'low chemical resistant' or 'waterproof' pictogram is used for gloves that do not achieve the 30 minute breakthrough time for at least 3 of the substances but which do meet the penetration test.
EN 338:2003 	Protection from mechanical risks includes a 4 digit code. A Resistance to abrasion B Blade cut resistance C Tear resistance D Puncture resistance
EN 407:2003 	Thermal protection against heat and/or fire is shown by a pictogram with a series of 6 performance levels. A Resistance to flammability B Contact heat resistance C Convective heat resistance D Radiant heat resistance E Resistance to small splashes of molten metal F Resistance to large splashes of molten metal
EN 511:2006 	Protection against cold is shown by a pictogram with 3 performance levels A Resistance to convective cold B Contact cold resistance C Water impermeability

Safe use of gloves – tips for using

Gloves are specified to protect the worker according to the task. However, the protection given can be compromised if proper hygiene practices are not implemented fully. The key principles are:

1. Check that the glove is the correct type for the activity
2. Inspect gloves before use and check for evidence of damage, degradation, pinholes or punctures
3. Do not rely on the glove as the only protection – where possible eliminate chemical contact and use the glove as contingency for splash protection and not as immersion protection
4. Replace the gloves promptly if they start to degrade or show damage or if the duration of use is close to the chemical breakthrough time
5. Remove gloves carefully, ensuring that any chemical contamination of the glove does not contact the skin
6. Dispose of the gloves correctly, if necessary as contaminated waste

The following guidance is considered best practice as developed by the European Solvents Industry Group (ESIG). This information is also available from ESIG as a poster at: **www.esig.org**

01 Check the gloves: make sure you are using the right gloves for the job in the right size and that they are not damaged.

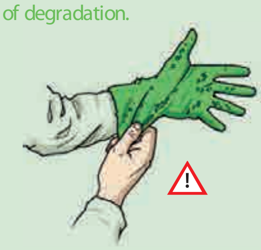
02 Wash and dry your hands before you put on your gloves.

Don't put gloves on wet hands.

03 Avoid contact with the chemicals as much as possible and make sure to avoid liquids from entering the cuff.

04 Don't exceed breakthrough time for the chemical you are working with.

05 Don't continue to use or re-use gloves showing signs of degradation.



06 Removing gloves: wash the gloves first and avoid contact with the skin.

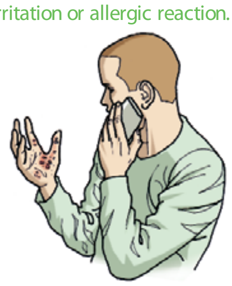
Remove gloves without touching the outer surface.

07 Dispose of the gloves in the appropriate receptacle.

08 Wash and dry your hands after you removed your gloves.

09 It may be useful to apply hand cream before and/or after use of the gloves.

10 Seek medical attention immediately if you have any irritation or allergic reaction.



Chemical resistance of common gloves to methacrylates

The table on the right summarises the times taken for methacrylate monomers to permeate through some of the more common glove materials. This information has been collected from testing carried out by manufacturers and published information. Anyone selecting a glove should consult with the glove manufacturer to confirm the performance of specific gloves or, if performance specifications are lacking, to discuss how to obtain additional information.

General remarks

1 mil = 1/1000 inch

- The resistance of the materials will be dependent on the thickness of the gloves, temperature and many other environmental factors
- The recommendations given are based on laboratory testing with pure chemicals and data available from certain manufacturers. This varies between manufacturers and for different applications.
- Glove manufacturers have databases with test results of their gloves against any chemicals. This information is available from your supplier - make sure you check your specific product and application.

Notes

- Where data shows not recommended for the thickest glove type specified by any company than all thinner gloves treated as not recommended
- Where data shows information for middle glove, if no information available for a thicker glove could assume same recommendation as thinner material as minimum but check with suppliers

CHEMICAL IDENTIFICATION			GLOVE TYPE																							
			SAFETY 4 4H[R] LAMINATE		BUTYL			VITON		NITRILE				NEOPRENE						PVC				NATURAL RUBBER LATEX			
GLOVE THICKNESS		mils	2.5	3	16	18	22	9	30	16	19	22	26	4	18	21	22	23	24	5	47	59	61	9	10	11	12
		mm	0.06	0.08	0.4	0.5	0.6	0.2	0.8	0.4	0.5	0.54	0.7	0.1	0.56	0.5	0.6	0.6	0.6	0.1	1.2	1.5	1.6	0.2	0.3	0.3	0.3
NAME	**Cas No**	**Acronym**	R		R			M		M				NR						M				NR			
Methyl Methacrylate	80-62-6	MMA	>480	>480	30-60				23				>30	9					29	11				<3	<3		
Ethyl Methacrylate	97-63-2	EMA		>480	398				2		23					<3						22					<3
iso Butyl Methacrylate	97-86-9	iBMA		>480			119			163									6				43	<3	<3		
n Butyl Methacrylate	97-88-1	nBMA		>480		96			72				335				23				13	35					
2 Ethyl Hexyl Methacrylate	688-84-6	2EHMA																									
Methacrylic Acid	79-41-4	MAA		>240	>480			>480					100					<3				82		<3		<3	

BREAKTHROUGH TIME IN MINUTES	<10	10	30	60	120	240	>480
	NOT RECOMMENDED	SPLASH PROTECTION		MEDIUM		GOOD PROTECTION	

Protection offered by commonly used gloves

The table below reviews the pro's and con's for some of the more commonly available glove types in protecting against the main hazard categories.

MATERIAL	+	–
Safety 4 4H Laminate	• Excellent chemical resistance	• Poor mechanical resistance • Poor dexterity and limited grip
Poly Vinyl Alcohol PVA	• Good for aromatics, aliphatics, chlorinated solvents, esters and most ketones • Good mechanical resistance	• Poor for water-based solutions • Poor touch sensitivity
Butyl Rubber	• Good for aldehydes, ketones, esters and concentrated mineral acids • Excellent dexterity and flexibility	• Poor for aliphatic, aromatic and halogenated hydrocarbons, gasoline and mineral solutions • Poor touch sensitivity • cost
Viton	• Good for chlorinated solvents, aliphatic, aromatic and halogenated hydrocarbons and concentrated mineral acids • Low surface tension repels most liquids • Good mechanical resistance	• Poor for ketones • Poor touch sensitivity • cost
Nitrile	• Good for solvents, greases, oils, hydrocarbons and some acids and bases • Excellent wet and dry grip • Excellent strength and puncture resistance	• Poor for ketones, oxidizing agents, aromatic or chlorinated solvents and organic compounds containing nitrogen
Neoprene	• Good for acids, bases, alcohols, fuels, peroxides, hydrocarbons and phenols • Excellent mobility and flexibility	• Poor for halogenated and aromatic hydrocarbons and organic solvents • Less resistance to tears and breaks
Poly Vinyl Chloride PVC	• Good for many acids, bases, oils, fats, peroxides, alcohols and amines • Excellent abrasion resistance	• Poor for solvents and ketones • Limited strength with less resistance to tears and punctures
Natural Rubber Latex	• Good for inorganic solvents and many acids • Highly flexible and good dexterity	• Poor for lubricants, oils or organic chemicals • May cause skin allergies • Hard to detect puncture holes

For more information please contact:

Cefic Methacrylates Sector Group
http://www.petrochemistry.eu/about-petrochemistry/methacrylates

Methacrylate Producers Association
http://www.mpausa.org/

Cefic - The European Chemical Industry Council

Chemistry making a world of difference

Cefic is the Brussels-based organisation representing national chemical associations and chemical companies in Europe. Cefic represents, directly or indirectly, around 29,000 large, medium and small companies in Europe, which employ about 2 million people and account for more than 30% of world chemicals production.

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