R L Slaughter
For All Your Laboratory Needs

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Allergic Reactions to Gloves
Causes and the Solution

Donald F. Groce, Best Manufacturing Company

Causes:

- Extraneous causes
- Exposure to chemicals
- Allergic reactions to glove materials
  - Natural rubber proteins
  - Rubber Accelerators

The Problem.

1. Extraneous Causes: many times contact dermatitis is attributed to gloves when in fact, the causative agent is from another source. The most notable is a change in soap or detergents. One of the most common causes of irritant contact dermatitis is a change in soap or incomplete rinsing of the hands after washing. Skin cleansers designed for and labelled as "heavy-duty cleansers" or "waterless hand cleansers" can have more irritating ingredients including solvents and abrasives such as silica or wood particles. Many times incomplete rinsing of cleansers from the skin can cause irritant contact dermatitis. Occlusion of the hand by wearing a glove on top of the residual irritants can aggravate the condition.

2. Exposure to Chemicals: Thin-gauge disposable gloves are not designed for heavy exposure to chemicals. There are some chemicals that can be safely handled while wearing thin-gauge disposable gloves. However, for heavy exposure to dangerous organic solvents or highly corrosive chemicals, chemical resistant gloves are recommended.

3. Allergic reactions to Glove Materials:

3.1 Natural rubber proteins: most severe allergic reactions to rubber products are caused by one of three things: natural rubber proteins, glove powder or rubber accelerators. The most severe kind of allergic reaction to rubber products occurs immediately and can involve the respiratory system. These reactions can be life threatening and are caused by sensitisation to natural rubber proteins. It has been estimated that up to 17% of personnel in the medical profession have had reactions to these proteins. These proteins can be absorbed however, onto the cornstarch powder used to make gloves easier to put on and take off. Aerosolised "protein laden" cornstarch has been identified as a causative agent in occupational asthma, hypersensitive airway and anaphylaxis in health care workers. Cornstarch powder alone is not an allergic substance. To help eliminate the risk of Type 1 life threatening latex allergy, switch to gloves which are made from 100% non-latex synthetic polymer (nitrile) and contain absolutely NO NATURAL RUBBER PROTEINS.

All N-DEX® powderfree gloves feature the proprietary non-allergenic polymer gel coating on the inside of the gloves to protect even more from allergic reactions to gloves and to assist in wet-hand donning of the glove.

3.2 Rubber Accelerators: a small segment of the general population is allergic to rubber accelerators used to process rubber gloves. The accelerators are used in Natural Rubber, Neoprene (Chloroprene) and in most Nitrile gloves. There are several different types of accelerators including: thiurams, carbamates and mercatobenzothiazole (MBT). Thiuram accelerators are responsible for about 60% of cases of contact dermatitis from accelerators. Carbamates are responsible for about 30% and thiazoles like MBT account for 1 to 5% of the cases.

The Solution

Best N-DEX® Free Breakthrough Technology
Best N-DEX® Free Non-Latex Accelerator-Free Gloves do not contain ANY rubber accelerators. Best® patented process has now also estimated the risk of Type IV contact dermatitis from rubber accelerators. Previously, N-DEX® gloves contained a low level of MBT. A small number of patients reported skin problems due to the MBT in our gloves. So, chemists at Best have invented a way to make N-DEX® Free with absolutely no carbamates, no thiuram and no MBT accelerators for the Safety Industry's First Latex-Free, Powder-Free, Rubber Accelerator-Free Glove.

Chemical resistance testing has shown no statistically significant difference in the protection properties between N-Dex Free gloves and the original N-Dex 7005 glove. The majority of this data was generated from testing of N-Dex 7005, but applies to Best N-Dex Free, as well. For heavy chemical exposure, we do not suggest disposable gloves, but rather chemical resistant gloves from our comprehensive range.

Chemical Tested	N-Dex Free 7705PF Gloves							
	Total Immersion Degradation (min)				ASTM F 739 Total Immersion Permeation Breakthrough			
	Rating				MDL	BDT	RATE	EN 374
	5	30	60	240	PPM	Min.	ug/cm²/min	Rating
1. Acetaldehyde	NR	NR	NR	NR	0.02	NR	NR	0
2. Acetic Acid 84%	E	P	P	NR	6.00	NR	NR	0
3. Acetone	NR	NR	NR	NR	0.02	NR	NR	0
4. Acetonitrile	P	P	P	P	0.02	4	153	0
5. Acrylonitrile	NR	NR	NR	NR	0.02	NR	NR	0
6. Ammonium Hydroxide 29%	E	E	E	E	0.08	ND	ND	6
7. Amyl Acetate	NR	NR	NR	NR	0.02	NR	NR	0
8. Amyl Alcohol	E	G	G	G	0.02	24	37	1
9. Benzaldehyde	NR	NR	NR	NR	0.02	NR	NR	0
10. Benzene	NR	NR	NR	NR	0.02	NR	NR	0
11. Bromoacetophenone,2 (10% in Acetone)	NT	NT	NT	NT	0.02	2	183	0
12. Butanol	E	E	G	G	0.02	13	36	1
13. Butyl Acetate	NR	NR	NR	NR	0.02	NR	NR	0
14. P-Tert-Butyl Toluene	NT	NT	NT	NT	0.02	11	100	1
15. Carbon Tetrachloride	F	NR	NR	NR	0.02	NR	NR	0
16. Cellosolve Acetate	P	NR	NR	NR	0.02	NR	NR	0
17. Chlorobenzene	NR	NR	NR	NR	0.02	NR	NR	0
18. Chloroform	NR	NR	NR	NR	0.02	NR	NR	0
19. Citric Acid	E	E	E	E		ND	ND	6
20. Cresols	P	NR	NR	NR	0.02	NR	NR	0
21. Cyclohexane	E	E	E	E	0.02	10	98	1
22. Cyclohexanol	E	E	E	G	0.02	80	20	3
23. Cyclohexanone	NR	NR	NR	NR	0.02	NR	NR	0
24. n-Dibutyl Phthalate	G	F	P	NR	0.02	NR	NR	0
25. o-Dichlorobenzene	NR	NR	NR	NR	0.02	NR	NR	0
26. 1,2-Dichloroethane	NR	NR	NR	NR	0.02	NR	NR	0
27. Diesel Fuel	E	E	G	G	0.02	ND	ND	6
28. Diethanolamine	E	E	E	E	0.02	ND	ND	6
29. Diethylamine	P	P	P	NR	0.02	NR	NR	0
30. Di-Isobutyl Ketone	E	E	E	E	0.02	NT	NT	NA
31. N,N-Dimethylacetamide	NR	NR	NR	NR	0.02	NR	NR	0
32. Dimethylformamide	NR	NR	NR	NR	0.02	NR	NR	0
33. Dimethylsulfoxide	E	G	F	P	0.01	23	84	1
34. 1,4-Dioxane	NR	NR	NR	NR	0.02	NR	NR	0
35. Ethanol	E	E	E	G	0.02	7	12	0
36 . Ethyl Acetate	NR	NR	NR	NR	0.02	NR	NR	0
37. Ethyl Benzene	NR	NR	NR	NR	0.02	NR	NR	0
38. Ethyl Ether	G	G	G	G	0.02	2	495	0
39. Ethylene Glycol	E	E	E	E	0.02	ND	ND	6
40. Formaldehyde	E	E	E	E	8.00	ND	ND	6

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41. Formic Acid	G	NR	NR	NR	0.04	NR	NR	0
42. Furfural	P	NR	NR	NR	0.02	NR	NR	0
43. Gasoline	E	G	P	NR	0.02	NR	NR	0
44. Glutaraldehyde 50%	E	G	G	G	0.02	ND	ND	6
45. Glyphosate"RoundUp"	E	G	G	G	0.02	ND	ND	6
46. Heptane	E	E	E	E	0.02	NR	NR	0
47. Hexane	E	E	E	E	0.02	11	8	1
48. Hydraulic Fluid	E	E	E	E	NA	NT	NT	NA
49. Hydrochloric Acid 37%	E	E	E	E	0.70	ND	ND	6
50. Iso Octane	E	E	E	G	0.02	120	1.5	4
51. Isobutanol	E	F	P	P	0.02	NR	NR	0
52. Kerosene	E	E	E	E	0.02	NT	NT	NA
53. Lactic Acid 85%	E	E	E	E	0.04	ND	ND	6
54. Methanol	E	G	G	F	0.02	NR	NR	0
55. Methyl Ethyl Ketone	NR	NR	NR	NR	0.02	NR	NR	0
56. Methyl Isobutyl Ketone	NR	NR	NR	NR	0.02	NR	NR	0
57. Methyl Methacrylate	NR	NR	NR	NR	0.02	NR	NR	0
58. Methylamine 40%	E	E	E	G	0.02	NT	NT	NA
59. Methylene Chloride	NR	NR	NR	NR	0.02	NR	NR	0
60. N-Methylpyrrolidone	NR	NR	NR	NR	0.02	NR	NR	0
61. Methyl-Tert Butyl Ether	G	P	P	P	0.02	NR	NR	0
62. Mineral Spirits	E	E	G	F	0.02	NT	NT	NA
63. Monoethanolamine	E	E	E	E	0.04	ND	ND	6
64. Morpholine	NR	NR	NR	NR	0.02	NR	NR	0
65. Nitric Acid 70%	G	P	NR	NR	4.00	NR	NR	0
66. Nitrobenzene	NR	NR	NR	NR	0.02	NR	NR	0
67. Nitromethane	F	P	P	P	0.02	NR	NR	0
68. Nitropropane	NR	NR	NR	NR	0.02	NR	NR	0
69. n-Octanol	E	E	E	G	0.02	ND	ND	6
70. Oleic Acid 98%	E	E	E	G		ND	ND	6
71. Pentane	E	E	E	E	0.02	4	88	0
72. Perchloroethylene	F	NR	NR	NR	0.02	6	353	0
73. Petroleum Ether	E	E	E	E	0.02	6	17	0
74. o-Phosphoric Acid 85%	E	E	E	E	0.00	ND	ND	6
75. Potassium Hydroxide 45%	E	E	E	E	0.40	ND	ND	6
76. 2-Propanol	E	E	E	E	0.02	15	29	1
77. n-Propanol	G	F	P	P	0.02	7	42	0
78. Propylene Oxide	NR	NR	NR	NR	0.02	NR	NR	0
79. Rotella Multigrade 15W40 Motor Oil	E	E	E	E	0.02	ND	ND	6
80. Shell Diala Oil AX Base Oil	E	E	E	E	0.02	ND	ND	6
81. Shell HVI 100 Neutral MQ Base Oil	E	E	E	E	0.02	ND	ND	6
82. Shell Turbo T 68 Hydraulic Oil	E	E	E	E	0.02	ND	ND	6
83. Shellwax 100	E	E	E	E	0.02	ND	ND	6
84. Sodium Hydroxide 50%	E	E	E	E	0.02	ND	ND	6
85. Stoddard Solvent	E	E	E	E	0.02	126	0.3	4
86. Sulfuric Acid 97%	G	P	NR	NR	0.05	NR	NR	0
87. Tannic Acid	E	E	E	E		ND	ND	6
88. Tetrahydrofuran	NR	NR	NR	NR	0.02	NR	NR	0
89. Toluene	NR	NR	NR	NR	0.02	NR	NR	0

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90. 1,2,4-Trichlorobenzene	NR	NR	NR	NR	0.02	NR	NR	0
91. 1,1,1-Trichloroethane	NR	NR	NR	NR	0.02	NR	NR	0
92. Trichloroethylene	NR	NR	NR	NR	0.02	NR	NR	0
93. Tricresyl Phosphate	E	E	G	P	0.02	ND	ND	6
94. Triethanolamine	E	E	E	E	0.02	ND	ND	6
95. Turpentine	E	E	E	G	0.02	ND	ND	6
96. Xylene	NR	NR	NR	NR	0.02	NR	NR	0

Degradation, Permeation Testing and CPC Rating of Best Gloves.

Degradation

Degradation is a physical change in the glove after chemical exposure. Typical effects may be swelling, wrinkling, deterioration or delamination. There are no accepted standards for measuring degradation. Best degradation testing is based on a protocol considered by the ASTM F-23 Protective Clothing Committee. One side of the glove material is exposed to the test chemical for four hours. The percent weight change was measured gravimetrically at four time intervals: 5, 30, 60 and 240 minutes.

The ratings were assigned as follows:

E = Excellent for a 0-10% weight change
G = Good for an 11-20% weight change
F = Fair for a 21-30% weight change
P = Poor for a 31-50% weight change
NR = Not Recommended for more than 50% weight change
N-DEX Degradation and Permeation Guide (Page #5)

Permeation

Permeation: ASTM F 739-91 test method for permeation of chemicals through chemical protective clothing under conditions of total immersion was followed. The units for reporting test results specified by ASTM F 739 include:

1. Minimum Detection Limit (MDL in ppm): the smallest amount of chemical that is detectable using the analytical system that is being employed to measure the permeation of the chemical being tested.
2. Breakthrough Detection Time (BDT): is the time in minutes after initial exposure of the glove to the test chemical to the time when the chemical is first detected in the inside of the glove.
3. Permeation Rate: is the steady state rate of a chemical in micrograms/minute permeating an area (cm2) of glove material.

The units of ug/cm2/min are clearly specified by ASTM F 739 for reporting permeation rates at a steady state.

4. Code used for reporting data: The code used for these test results is as follows:

ND = No detectable breakthrough of chemical after eight hours of total immersion.
NR = Not recommended because of severe degradation.
NA = Not applicable
NT = Not Tested
Blank spaces occur where test data is not yet completed.

EN 374 Rating were devised by the European Normalization Committee and are ratings based on the breakthrough time in minutes where:

Breakthrough Time in Minutes	Rating
Less than 10 minutes	0
10-30 minutes	1
30- 60 minutes	2
60-120 minutes	3
120-240 minutes	4
Greater than 240 minutes	5
Greater than 480 minutes	6

Available in 5 sizes and either smooth or textured finish. Please see the main catalogue, Section 1-37 for ordering information.

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