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SENSITIZATION CAPACITY OF EPOXY REACTIVE DILUENTS IN THE GUINEA PIG

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Abstract. The sensitization capacity of six epoxy reactive diluents was investigated with the "guinea pig maximization test". All the low molecular weight reactive diluents (MW 175 to 360) proved to be sensitizers. One diluent of higher molecular weight (MW 1 700) produced no reaction.

Key words: Guinea pig maximization test; Sensitization capacity; Epoxy reactive diluents

It is known that epoxy reactive diluents are sensitizers (1, 2, 3, 4, 5, 10, 11). Sensitization in humans has been reported after repeated patch testing; five of twenty-five persons became sensitized (6). Sensitization has been obtained in guinea pigs with low molecular epoxy reactive diluents using eight intracutaneous injections (14). Only a few diluents have been studied with the "guinea pig maximization test" (GPM-test) (12). The aim of the present work was to elucidate, by means of the GPM-test, the sensitization capacity of common reactive diluents not previously studied with this method.

CHEMISTRY

Reactive diluents containing one or more epoxide groups react with the hardener at approximately the same rate as with the resin. They are used primarily for reducing the viscosity of the resins.

MATERIAL AND METHODS

The methods were in accordance with the original description of the GPM-test (7, 8) and the same as in previous studies (12, 13).

Chemicals. All the reactive diluents used for sensitization were commercial products and were supplied by the Swedish Plastics Federation. The molecular weights of the diluents ranged from about 175 to 360, except for the aliphatic poly-glycidylether, whose molecular weight was 1 700. The chemical structures of the diluents are displayed in Fig. 1.

Sensitization concentrations. A 5% and 10% concentration in acetone or absolute alcohol was used for either intradermal injection or topical application. A 25% concentration in acetone was used for intradermal and topical sensitization for the aliphatic polyglycidylether of MW 1 700 (Table I).

Induction of sensitivity. The animals were sensitized in a two-stage procedure: intradermal injection and occluded topical application.

Reading of challenge reactions. The challenge site was evaluated 24-hours after removal of the patch. Three hours before the test was read the test site was shaved with an electric razor. Only obvious redness and swelling was regarded as an allergic response. The reactions were judged by two persons independently.

Controls. At the same time as the animals in the experimental groups were sensitized, the control animals in each series were exposed intradermally to CFA and vehicle.

When the sensitized animals in each series were challenged, control animals were also patch tested with the same reactive diluents, at the same concentrations.

RESULTS

The test results are summarized in Table I.

The 1,2-epoxydodecane elicited reactions in 40% of the animals. The monoglycidylester of synthetic fatty acids produced reactions in 87% of the animals. The diglycidylether of butandiol provoked reactions in 60% of the animals and the diglycidylether of neopentylglycol in 87% of the animals. The aliphatic polyglycidylether (MW 1700) produced no reactions at all in either series.

There were no reactions in the control animals.

Table I. *Sensitization and challenge to reactive diluents*

15 animals in each series

Reactive diluents	Vehicle	Sensitization conc. % (w/v). Intradermal and topical	Challenge conc. % (w/v)	Reacting animals (% of tested)
1.2-Epoxydodecane	Ethanol	5	0.5	40
Monoglycidylester of synthetic fatty acids	Acetone	10	1 & 5	87
Monoglycidylether of isomeric alcohols	Acetone	10	1	80
Diglycidylether of butandiol	Acetone	5	2 & 5	60
Diglycidylether of neopentylglycol	Acetone	5	2	87
Aliphatic polyglycidylether	Acetone	15	10 & 15	0
Aliphatic polyglycidylether	Acetone	25	15 & 25	0

DISCUSSION

Like the resins, reactive diluents contain epoxide groups and participate in the hardening process. Because of the epoxide group content of the reactive diluents and their low molecular weight, they are expected to be sensitizing. This has been established previously by means of the GPM-test (12).

In the present investigation the epoxydodecane and the low molecular weight mono- and diglycidyl ethers were found to cause sensitization. The glycidylester seems to be just as sensitizing as the glycidylethers.

The aliphatic polyglycidylether produced no challenge reactions. The explanation may be either that this compound of comparatively high molecular weight (MW 1 700) does not act as a hapten, or that the percutaneous absorption is insufficient to elicit a patch test reaction at challenge.

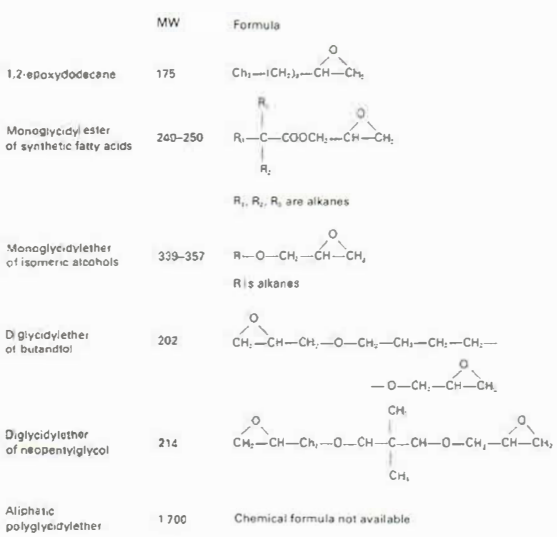

Fig. 1. Reactive diluents.

The results of the GPM-test reflect the sensitization capacity of a given chemical. Sensitization in humans also depends on several other factors, such as concentration, frequency and duration of exposure, and presence of irritants.

In industry, reactive diluents are rarely used separately, but are blended in commercial epoxy resins in concentrations of 10% to 30%. Usually neither the content nor the type of reactive diluent in a commercial epoxy resin product is known when the patients are examined. Thus, it may be difficult to perform patch testing with the relevant diluents in a given case. As a matter of fact, it is not known how often sensitization in humans does occur without concomitant sensitization by epoxy resins. However, certain diluents are reported to have caused sensitization (10).

Diluents that do not cause sensitization in the GPM-test are to be preferred. In the present work only one such reactive diluent was discovered, but it is important to find others, as different types of reactive diluents may be necessary in industrial use.

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