

PROPYLENE GLYCOL

Information Update

STUDIES REGARDING THE SAFETY OF PROPYLENE GLYCOL USE IN COSMETIC PRODUCTS

Propylene glycol is used as a solvent in a number of cosmetics, lotions, and ointments where it is applied to the skin as well as in a wide variety of other products, including varnishes, disinfectants, synthetic resins, antifreeze and other coolants, and aircraft deicers. Based on decades of use and information and comprehensive toxicity testing, propylene glycol is approved by the U.S. Food and Drug Administration (FDA) for use in foods and drugs. Questions sometimes arise about the potential for adverse effects from propylene glycol cosmetic use in light of skin sensitization studies that reported positive results.

The Cosmetic Ingredient Review (CIR) Expert Panel evaluated the use of propylene glycol in personal care products in 1993. The CIR Expert Panel is the authoritative body recognized by the FDA to approve the safety of chemicals used in cosmetics. The CIR Expert Panel evaluated more than 200 toxicological studies on all known potential health effects of propylene glycol. It concluded that propylene glycol is "safe for use in cosmetic products at concentrations up to 50%."¹ Since that review, additional studies have supported its conclusions.

In this Propylene Glycol Information Update, the CIR review is summarized for formulators interested in information on the use

of propylene glycol in cosmetics. A more concise version of this Information Update also is available.

Expert Review of Skin Studies

For any material, a certain portion of the population is more sensitive than the overall population. Accordingly, propylene glycol has been tested on the skin of both healthy volunteers (predictive tests) and persons with existing skin problems (provocative tests). Skin irritation and sensitization have been observed in normal subjects (predictive tests) and in patients (provocative tests) over a concentration range of 2 to 100%. Persons tested in provocative tests are often more sensitive to many different materials or have existing conditions that make it difficult to reach specific scientific conclusions from study results. Predictive tests are thus considered by the CIR and other experts to be more appropriate than provocative tests in establishing concentration exposure limits.

The CIR experts reviewed a number of provocative tests of propylene glycol. They found, for example, that in humans, allergic reactions were observed in 2 of 880 (0.2%) individuals with eczema tested with 2% aqueous propylene glycol; in 13 of 330 (4%) individuals patch tested with 10% propylene glycol; and in 21 of 851 (2.5%) atopic individuals tested with 5% propylene glycol. Thirty-three of the 851 atopic individuals also exhibited irritant/follicular reactions. Also, twenty-nine cutaneous reactions were observed in a population of 399 individuals with cosmetic-related contact dermatitis during patch testing with 10% aqueous propylene

¹ "Final Report of the Safety Assessment of Propylene Glycol and Polypropylene Glycols," *Cosmetic Ingredient Review, J. Am. Coll. Toxicol.* 13(6), 473-91 (1994).

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glycol. In some cases dermal findings that resulted from exposure to propylene glycol and were thought to be due to sensitization were attributed, on further examination, to irritation. The CIR Expert Panel suggested that these studies may indicate that patients with diseased skin may be at risk of developing irritation/sensitization reactions to propylene glycol even at low concentrations.

The CIR experts also reviewed tests of healthy volunteers and found that response rates were low except at higher concentrations under closed patch (exaggerated) test conditions. Slight skin irritation, for example, was observed in 3 of 16 subjects when propylene glycol (100%) was administered under an occlusive patch, but not when tested in open patch tests. No reaction was observed to 50% propylene glycol. In other studies, 24 normal subjects patch tested with occlusive patches at 1, 3, 10, and 30% concentration of propylene glycol exhibited skin irritation at 10 and 30% concentrations only. Neither irritation nor sensitization was observed in 204 subjects patch tested with 12% propylene glycol in a cream vehicle under occlusive patches. These studies, the CIR review found, suggest that in normal subjects propylene glycol may be an irritant when tested under occlusive patches that have the potential to exaggerate response. All the studies show that the irritation potential of this material is concentration dependent.

After describing these data, the CIR Expert Panel concluded: "Propylene glycol induced skin irritation reactions in normal subjects and in patients. In these studies test concentrations ranged from 2 to 100%. Reactions were observed at concentrations as low as 10% in predictive tests and as low as 2% in provocative tests." Given these results, the experts concluded, "A concentration limit for propylene glycol is considered necessary," and

chose 50% - a concentration they concluded would be "safe" for the identified uses.

Another recent review by two independent researchers agreed, concluding: "True allergic reactions to propylene glycol are uncommon and the clinical significance has probably been overestimated."²

More Recent Studies

Since the CIR review, additional studies have been completed. They support the conclusions of the CIR experts' evaluation.

In a repeated insult patch test of 104 persons, propylene glycol was studied under occlusion for an indication of allergy. The first induction patch was tested at 100% propylene glycol, which demonstrated some minor irritation. Subsequent induction patches and challenge patches were conducted at 50% aqueous solutions. No indication of allergy was noted upon challenge. One individual did respond with an irritation response both during induction and at challenge. This individual also responded to other study samples with a hyper-reactive irritation response.

In another recent study of propylene glycol, a repeated insult patch test was carried out using semi-occlusive patches on 104 subjects. This study also indicated no allergy upon challenge. There was a minimal irritant response at the first induction patch when tested at 100%. Irritation subsided significantly when the concentration was reduced to 50%. One individual did respond with a hyper-reactive irritation response during induction

² Funk, J.O., Maibach, H.I. *Propylene Glycol Dermatitis: Re-evaluation of an Old Problem*. Contact Dermatitis 31:2,36-41 (1994).

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and challenge. This individual also responded to other study samples with a hyper-reactive irritation response.

These additional studies support the conclusion, as found by FDA's experts, that propylene glycol can be used safely in cosmetics at concentrations up to 50%.

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This update has been prepared by the American Chemistry Council's Propylene Oxide/Propylene Glycol (PO/PG) Panel. The Panel's purpose is to address advocacy, research, education, communication, and evaluation needed to promote safe practices among producers and users of PO and the glycol derivatives of PO. For more information, contact the Panel Manager, Anne LeHuray, at 703-741-5630, or e-mail at anne_lehuray@americanchemistry.com.

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