

Consumer Hair Dye Kits Frequently Contain Isothiazolinones, Other Common Preservatives and Fragrance Allergens

To the Editor:

Based on best estimates, tens of millions of Americans are regular hair-dye users. Consumer hair dyes in Spain, Sweden, and the United States have been investigated for prevalence of allergenic hair dye-specific chemicals and have been shown to frequently contain paraphenylenediamine (PPD) and amino phenols.¹⁻³ However, hair-dye kits for consumer use typically contain multiple cosmetic products including dyes, shampoos, conditioners, toners, lighteners, and other miscellaneous items. These kits may constitute an important source of exposure not only for allergenic hair-dye substances but also for other common fragrance and preservative allergens. We here present an assessment of 159 hair-dye kits that included 539 available to American consumers and report the most common sensitizers in each product contained in every kit that are potential sources of exposure to hair dye, fragrance, and preservative allergens.

One hundred fifty-nine hair-dye kits containing 539 individual cosmetic products were purchased from major supermarket chains in Phoenix, AZ. Hair-dye kits were selected using the methods from 3 prior published consumer exposure studies.¹⁻³ Hair-dye kit selection was designed to maximize the number of represented brands across multiple stores. No products were rerecorded if found at a subsequent store. Products were purchased systematically: within each brand or subbrand, the darkest blonde shade, 1 "regular" light brown shade, 1 "regular" dark brown shade, 1 "regular" black shade, and 2 additional colors were purchased, if available. If any of these shades were not available, a similar shade was chosen; if no similar shade was available, it was not replaced by any other shade. In this way, different brands were incorporated, and similar shades in each brand were avoided to maximize unique products and create a representative sample comparable with prior studies. Purchased

hair-dye kits included colorants, conditioners, shampoos, toners, and so on. The lists of ingredients for each product in each kit were photographed. The product types, dye colors, and ingredients of each product were entered in a database in Microsoft Excel and cross-referenced with the North American Contact Dermatitis Group standard series allergens, including expansions of the allergen mixes (eg, fragrance mix I). As the term *fragrance* is nonspecific, it was not included in the cross-referencing. Rare allergens were not assessed.

This study analyzed 159 hair-dye kits that contained 539 individual cosmetic products. Every hair-dye kit contained at least 1 allergen (mean, 7; range, 1-23), and 63% of the products contained allergens (n = 340). There was an average of 2 allergens in each product. Common sensitizers included propylene glycol,

TABLE 1. Most Common Allergens From the North American Standard Series and Expanded Allergen Mixes in Hair-Dye Kit Products Available to US Consumers

Allergen Name	Percentage of Products Containing Allergen (n)
Propylene glycol	31 (n = 167)
p-Phenylenediamine	21 (n = 114)
Benzyl alcohol	14 (n = 77)
Methylparaben	13 (n = 63)
Stearamidopropyl dimethylamine	12 (n = 65)
Methylisothiazolinone	12 (n = 63)
Phenoxyethanol	11 (n = 58)
Methylchloroisothiazolinone/ Methylisothiazolinone	11 (n = 57)
Citronellol	10 (n = 54)
Tocopherol	10 (n = 53)
Cocamidopropyl betaine	8 (n = 44)
Methylpropional	7 (n = 40)
4-Amino-2-hydroxytoluene	6 (n = 35)
Amyl cinnamal	6 (n = 32)
Hexyl cinnamal	6 (n = 32)
Propylparaben	6 (n = 32)
Geraniol	5 (n = 28)
Limonene	4 (n = 24)
Ethylparaben	4 (n = 24)
Eugenol	4 (n = 20)
Colophony	3 (n = 16)
Coumarin	2 (n = 10)
Lanolin alcohol	2 (n = 8)
Decyl glucoside	1 (n = 6)
Hydroxyisohexyl 3-cyclohexene carboxaldehyde	1 (n = 5)
Cinnamyl alcohol	<1 (n = 1)

All authors have participated sufficiently to be included as authors. The preliminary results of this article were presented as a poster at the European Society of Contact Dermatitis meeting in 2014. Neither this article nor another article with similar content under our authorship is submitted for publication to any other journal.

D. Hamann and C. R. Hamann are first sons of the owner of SmartPractice, a company that sells dermatologic diagnostic products, including patch test supplies. P. K. has no funding or conflicts of interest to declare.

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parabens, PPD, isothiazolinones, and fragrances (Table 1; see Table 2, Supplemental Digital Content, <http://links.lww.com/DER/A7>).

In addition to PPD, many common allergens are found in hair-dye kits, such as propylene glycol, parabens, benzyl alcohol, and isothiazolinones. Furthermore, whereas approximately 10% of all individual products contained methylchloroisothiazolinone/methylisothiazolinone or methylisothiazolinone, isothiazolinones were found in at least 1 product in 40% of all kits tested. Although it is known that PPD is commonly found in black hair dyes, we here demonstrate that PPD is prevalent in brown and blonde hair dyes as well. Consumers cannot avoid PPD in common commercial hair-dye kits by avoiding black hair dye and selecting a brown or blonde dye kit. Surveyed hair-dye users in Denmark reported symptoms consistent with contact dermatitis at rates higher than expected based on PPD patch testing, suggesting that a more complete epidemiological picture of allergic contact dermatitis problems related to ingredients is needed.⁴ Hair-dye kit selection was designed to maximize the number of unique products and to be comparable with prior studies. The authors believe our sample is representative, but because we did not survey all available hair-dye kits, sampling bias is possible, particularly among exotic colors, which were underrepresented. In addition to hair-dye compounds such as PPD, clinicians must consider fragrances and preservatives as potential causes of allergic contact dermatitis in patients suspected of having hair dye-related dermatitis. Continued surveillance of common allergens in consumer products is essential to patch testers for accurate and effective patient education and avoidance.

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Improving the Diagnosis of Allergic Contact Dermatitis Using Patch Test With Gloves

To the Editor:

The diagnosis of allergic contact dermatitis due to gloves may be hampered by scarce availability of label information and by a spectrum of clinical investigation often limited to the main rubber additives. Contact allergy caused by gloves typically depends on chemicals involved in the production process, which are similar for both latex and synthetic rubber gloves such as neoprene and nitrile. Among these additives, there are accelerators used to speed up rubber vulcanization, antioxidants, and plasticizers.¹ When one suspects hand dermatitis secondary to use of gloves, the patch test with the European baseline series represents the first step of the identification of the causal agent. Unfortunately, the method allows the testing of the main rubber additives only, excluding other chemical substances contained in gloves, which can be also responsible for delayed-type allergy skin reactions. In these situations, the use of additional selected substances or series should be recommended. However, the choice of correct allergens to be tested is made difficult by the scarce availability of gloves' label information. Moreover, label information may not reflect the actual chemical composition of the final product because of chemical changes occurring in the vulcanization process.² A possible way to overcome this limitation and to better define the diagnosis of hand contact dermatitis is to test the glove as it is. There are no available data yet, but this approach is recommended by the EU-COST Action StanDerm TD 1206,³ a European-founded project on the Development and Implementation of European Standards on Prevention of Occupational Skin Diseases.

We analyzed data from workers referred to our clinic because of hand dermatitis during the period of 2011 to 2015 who were patch tested with extended European series, rubber series,¹ samples of gloves used in the workplace, and samples of alternative standard vinyl gloves (2 × 2 cm), applied on the skin of the patients for 48 hours. Skin reactions +, ++, and +++ at day 3 were considered allergic. All data were stored on an Excel data sheet (Microsoft, Redmond, Washington), and the statistical analysis was made using STATA 13.1 (StataCorp LLC, Texas). Continuous data were

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