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Fragranced consumer products and undisclosed ingredients

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ABSTRACT

Fragranced consumer products—such as air fresheners, laundry supplies, personal care products, and cleaners—are widely used in homes, businesses, institutions, and public places. While prevalent, these products can contain chemicals that are not disclosed to the public through product labels or material safety data sheets (MSDSs). What are some of these chemicals and what limits their disclosure? This article investigates these questions, and brings new pieces of evidence to the science, health, and policy puzzle. Results from a regulatory analysis, coupled with a chemical analysis of six best-selling products (three air fresheners and three laundry supplies), provide several findings. First, no law in the U.S. requires disclosure of all chemical ingredients in consumer products or in fragrances. Second, in these six products, nearly 100 volatile organic compounds (VOCs) were identified, but none of the VOCs were listed on any product label, and one was listed on one MSDS. Third, of these identified VOCs, ten are regulated as toxic or hazardous under federal laws, with three (acetaldehyde, chloromethane, and 1,4-dioxane) classified as Hazardous Air Pollutants (HAPs). Results point to a need for improved understanding of product constituents and mechanisms between exposures and effects.

1. Introduction

Scientific evidence grows about chemical exposures and potential health risks from everyday consumer products (e.g., CDC, 2001, 2003, 2005; Wallace, 1987, 1991, 1993, 2001). Essential to risk reduction is information, yet we have relatively little information on chemical constituents for many types of products. For instance, fragranced consumer products typically contain VOCs,[1] some of which may pose risks, but, as this article will show, may not be disclosed.

This article investigates the case of fragranced consumer products, and the challenges for understanding hazards. For one, chemicals are essentially invisible, making it difficult to discern to what, where, when, and how we are being exposed. Thus, we rely on product information (such as labels) and product regulations to reduce potential risks. For another, health effects from exposures are often difficult to detect. While some effects are immediate and noticeable, others are gradual, subtle, and sub-clinical. Of particular concern are chronic and often low-level exposures to mixtures of chemicals, which are the type of exposures that typify daily life. Finally—and the focus of this article—chemical constituents are often undisclosed. That is, chemicals in products may not be identified through information provided to the public or to regulatory agencies.

This article proceeds as follows. After this introduction, the second section reviews studies of human exposure and VOCs emitted from fragranced consumer products. The third section investigates the U.S. regulatory framework to see whether and how the laws require disclosure of ingredients in consumer products, and fragrances in those products. The fourth section presents results from a chemical analysis, using gas chromatography/mass spectrometry (GC/MS), that identifies VOCs in six fragranced consumer products, each widely used in the U.S. Chemicals identified in the GC/MS analysis are then compared to the chemicals on product labels and MSDSs, and to chemicals regulated under federal laws. The fifth section provides conclusions and recommendations for future work.

2. Human exposure and VOCs in fragranced consumer products

Human exposure studies, over the past two decades, have revealed widespread U.S. population exposure to VOCs (Wallace et al., 1991b; Wallace, 2001). Paradoxically, the largest contributors of VOCs to human exposure (nearly 90%) are not the sources traditionally recognized and regulated, but rather sources that are small, close to us, largely unregulated, yet often within our control (Wallace, 2001; Wallace et al., 1987), such as consumer products and other indoor sources. In particular, fragrance compounds, used in a wide variety of consumer products, can be primary sources of human exposure to VOCs (EPA, 1989; Sack et al., 1992; Wallace et al., 1991a; Cooper et al., 1992, 1995).

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[1] Although definitions and regulatory exclusions vary, VOCs can be considered as carbon-based compounds that exist in the gas phase at room temperature. VOCs typically have vapor pressures between 0.1 mm Hg and 380 mm Hg at 25 °C (Spicer et al., 2002:12-13).

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"Fragranced consumer products," as used in this article, refers to chemically formulated products with a fragrance, such as air fresheners, laundry detergents, dryer sheets, fabric softeners, dishwashing detergents, personal care products, cosmetics, after-shave, soaps and lotions, hand sanitizers, and cleaners. An individual "fragrance" in a product can contain up to several hundred chemicals (Bickers et al., 2003), and while the composition of an individual fragrance mixture is generally unknown to the public (Bridges, 2002), more than 2600 ingredients have been documented for use in fragrances (Ford et al., 2000).

Relatively little prior work has investigated the range of VOCs emitted from fragranced consumer products. In early, landmark studies, Wallace et al. (1991a) and Cooper et al. (1992) analyzed 31 fragranced products, such as perfumes, deodorants, soaps, fabric softeners, and air fresheners. The most common VOCs, with confirmed identification in more than one-third of the products, were ethanol, limonene, linalool, β-phenethyl alcohol, β-myrcene, benzyl acetate, benzyl alcohol, benzaldehyde, α-terpineol, β-citronellol, and α-pinene. Rastogi et al. (2001) analyzed 59 domestic and occupational products, such as soap, laundry products, dish wash, and cleaners, for 19 target fragrance compounds. Of these, the most common VOCs, in more than one-third of the products, were limonene, linalool, citronellol, eucalyptol, geraniol, and α-pinene.

In addition to primary VOC emissions from products, fragranced consumer product compounds can react with ambient compounds to generate secondary pollutants. For instance, terpenes (such as d-limonene, linalool, α-pinene, and β-pinene), emitted from the use of fragranced products (such as cleaning supplies and air fresheners), can react with indoor ozone to produce potentially substantial levels of secondary pollutants (Singer et al., 2006), which can include aldehyde compounds (such as formaldehyde), ultrafine particles, glycol ethers, secondary organic aerosols, and the hydroxyl radical (Nazaroff and Weschler, 2004; Liu et al., 2004; Sarwar et al., 2004; Wainman et al., 2000; Destaillats et al., 2006; Singer et al., 2006).

Exposure to fragranced products, as suggested by some studies, have potential associations with adverse health effects, including asthma and asthmatic exacerbations (Rumchev et al., 2004; Shim and Williams, 1986; Kumar et al., 1995), headaches (Kelman, 2004; Farrow et al., 2003), mucosal symptoms (Elberling et al., 2005; Millqvist et al., 1999), and, the emphasis of most prior work, epidermal exposure effects such as allergic contact dermatitis (e.g., de Groot and Frosch, 1997; Johansen, 2003).

On the other hand, studies conducted by the Research Institute for Fragrance Materials (RIFM) have evaluated the safety of fragrance ingredients (e.g., Bickers et al., 2003; Ford et al., 2000; Cadby et al., 2002; Smith, 2003, 2004; Smith et al., 2004), with considerable attention to acute toxicity and dermatological exposure effects,[2] and expanding research to other toxicological effects and exposure routes (Bickers et al., 2003). Additional studies report that no evidence indicates that fragranced product exposures elicit objective adverse effects in asthmatics (e.g., Opiekun et al., 2003), that inadequate or insufficient evidence exists to determine an association between fragrance exposure and asthma development (IOM, 2000), and that no evidence suggests that current UK indoor domestic exposures to VOCs, either individually or as a total, pose a health risk (IEH, 1996).

Prior work, as context for this particular study, examined two categories of fragranced consumer products (air fresheners and laundry supplies) and possible reactions, based on self-reported data. In two surveys of the U.S. population (n=1057, 1058; CL=95%; CI=3%), Caress and Steinemann (2004, 2005) found that 17.8% and 20.5% (first and second study) reported headaches, breathing difficulties, or other health problems when exposed to air fresheners or deodorizers; and 10.9% (second study only) reported irritation from the scent of laundry products, fabric softeners, or dryer sheets that are vented outside. The percentages were higher among susceptible populations. For instance, among asthmatics, 29.7% and 37.2% reported breathing difficulties, headaches, or other health problems when exposed to air fresheners; and 21.2% reported irritation from the scent of laundry products, fabric softeners, or dryer sheets that are vented outside.

Studies on exposures, emissions, and effects rely on and contribute to information on product constituents. The next section examines the U.S. laws that address the disclosure of ingredients in products.

3. Regulatory analyses

In the U.S., manufacturers of consumer products, and owners of chemical formulations (such as fragrances) in those products, are not required to disclose all ingredients to consumers. This section investigates the U.S. regulations that pertain to fragrances and consumer products, and the exemptions and exceptions in that coverage.

Fragrance ingredients are exempt from disclosure, in any product. Depending on the product, the word "fragrance" may or may not need to be listed, and this section looks at the two main cases. First, for fragranced products regulated under the Federal Food, Drug, and Cosmetic Act (FFDCA),[3] the product label needs to list the word "fragrance," but not the ingredients in the fragrance.[4] The label can also list a similar term, such as "perfume," "parfum," "natural fragrance," "pure fragrance," "organic fragrance," etc., even though these terms are not legally defined.[5] Also, an "unscented" or "fragrance-free" product may be a fragranced product, with the addition of a "masking fragrance." Second, for fragranced consumer products not regulated under the FFDCA, the product label does not need to list the word "fragrance" (or a similar word), or the ingredients in the fragrance. If the product does list the word "fragrance," the specific ingredients in the fragrance are still protected from disclosure.

Consumer product ingredients, more generally, are exempt from disclosure in several ways. Regulation of consumer products (other than food, drugs, cosmetics, tobacco, and pesticides) largely falls under the Consumer Product Safety Act (CPSA).[6] The CPSA relies on and gives preference to voluntary consumer product safety standards,[7] and may require labeling only if a warning is "reasonably necessary to prevent or reduce an unreasonable risk of injury associated with such product," [8] or if voluntary standards would not "eliminate or adequately reduce the risk," or are not likely to be followed.[9] Labeling requirements are limited to the date and place of manufacture, the identification of the manufacturer, and a certification that the product meets all applicable consumer product safety standards—if such a standard exists for that product.[10]

Notably, the CPSA does not require disclosure of all ingredients in products. Instead of listing ingredients, a manufacturer can provide other information on a product, such as a warning label. Similarly, the Federal Hazardous Substances Act (FHSA)[11] requires warning labels for hazardous substances,[12] but does not require that all ingredients be disclosed on the product's label.

[2] This emphasis is consistent with skin application considered the major route of exposure for intentional use of fragranced cosmetic products (e.g., Cadby et al., 2002).

[3] Pub. L. No. 75-717, 52 Stat. 1040, codified at 21 U.S.C. Section 321–397 (2000).

[4] 21 C.F.R. Section 701.3.

[5] Rastogi et al. (1996) found that 82% of perfumes based on "natural ingredients" contained synthetic fragrances.

[6] Pub. L. No. 92-573, 86 Stat. 1207 (1972), codified at 15 U.S.C. Section 2051–2084 (2002).

[7] 15 U.S.C. Section 2056(b) (1) (2002).

[8] 15 U.S.C. Section 2056(a) (2002); see also 58 Fed. Reg. 8013, 8015 (1993).

[9] 15 U.S.C. Section 2056(b) (2002); see also 58 Fed. Reg. 8013, 8015 (1993).

[10] 15 U.S.C. Section 2063(c).

[11] Federal Hazardous Substances Act, Pub. L. No. 86-613, 74 Stat. 372 (1960) (codified as amended at 15 U.S.C. Section 1261–1273 (2000)).

[12] A substance may be classified as a banned hazardous substance if the cautionary labeling required under the FHSA is found to be inadequate to protect public health and safety. id. Section 1261(q) (1).