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Asbestos Contamination in Talc-Based Cosmetics: An Invisible Cancer Risk

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ABSTRACT: The lack of regulation and adequate testing of talc-containing personal care products in the U.S. has resulted in the contamination of cosmetics with asbestos. As such, the true exposure of consumers to asbestos is poorly characterized and likely underestimated. In this study, transmission electron microscopy analysis revealed that 3 of 21 powder-based cosmetic products tested were contaminated with amphibole asbestos. One of these contaminated products is expressly marketed for use by children. The presence of asbestos found in products demonstrates the urgency to revise cosmetics policy. Further, talc-based cosmetics may be an overlooked and difficult to characterize source of exposure to asbestos, a known carcinogen.

KEYWORDS: Asbestos, talc, personal care products, cancer risk

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Talc is a mineral ingredient that has been used in personal care products for decades. The mineral can be used to improve the texture and feel of products, to absorb moisture, or as an inexpensive filler. Because of how and where talc is mined, mineral deposits used for manufacturing products sold in the US are consistently found to be contaminated with amphibole asbestos, such as tremolite and anthophyllite.[1] Asbestos is a carcinogen and it is known that there is no safe level of exposure to asbestos.[2]

A recent survey of the Environmental Working Group's Skin Deep® Database identified more than 2000 personal care products sold in the last 3 years (2018-2020) that contain talc.[3] The products include eye shadow, foundation, blush, face, and body powders. Some of these products are in the form of liquid and creams, but 57% are powder products that pose an increased risk of inhalation hazards.

In 1976, the Cosmetic, Toiletry, and Fragrance Association (CTFA) developed specifications for "cosmetic talc" purity, including non-detection of asbestos, to differentiate from industrial uses.[4] However, talc mined for both cosmetic use or industrial use comes from the same sources and carries the same risk of potential contamination.[5] Yet, the U.S. FDA does not require mandatory testing of talc supplies. The voluntary testing method included in the cosmetic talc specification, CTFA-J4-1 or the CTFA method for Asbestiform Amphibole Minerals in Cosmetic Talc, specifies X-ray diffraction (XRD) to screen asbestos, which lacks adequate sensitivity and specificity to screen for asbestos when compared to electron-microscopy based methods, for example.

To highlight the infectiveness of current voluntary screening methods and to investigate the occurrence of asbestos in talc-containing cosmetics products, we analyzed 21 talc-based cosmetics products (Table 1). The products were purchased in retail stores in San Francisco, California and Washington, DC, and from an online retailer. Samples were analyzed using Transmission Electron Microscopy (TEM) following procedures described in the U.S. Environmental Protection Agency "Test Method EPA/600/R-93/116."[6] Quantification of asbestos structures per gram weight talc was conducted using TEM and as described in the Asbestos Hazard Emergency Response Act (AHERA) and Millette.[7]

Tremolite asbestos was detected in 3 of 21 products tested—2 eye shadow palettes, and 1 toy make-up kit. Additionally, actinolite asbestos was also detected in one of the eye shadow palettes. All 3 products were purchased from a large-scale online retailer. In the toy make-up kit, 1 eye-shadow was positive out of 3 shades tested. In the 2 palettes, 20% and 40% of the eye-shadow colors tested contained asbestos (Table 2).

In this small sample set, 14% of products tested positive for asbestos. Similarly, in an FDA investigation in 2019, 9 talc-containing asbestos products, out of 52 tested, were found to be contaminated with asbestos as identified by polarized light microscopy (PLM) and transmission electron microscopy (TEM) analytical methods. While the FDA issued 3 warnings in 2019 to consumers regarding the positive products, the agency does not have the authority to issue mandatory product recalls[8] and instead worked with the companies to voluntarily remove products from the market. The limited testing and voluntarily action do little to address the numerous other products that continue to pose a significant risk. The prevalence of contamination underscores the urgency to develop standard screening methods and regulate talc used in cosmetic products.

The FDA does not currently require manufacturers to use any one standard method for screening, however, the agency

recently formed an interagency working group to address the issue. The working group has recommended the adoption of a consistent term "EMP," or elongated mineral particle with a minimum length to width ratio of 3:1, and using TEM "in addition to polarized light microscopy (PLM), to resolve the issues of sensitivity that cause reporting of false negatives for EMPs."[9] Standard methods for both PLM and TEM analysis are documented in EPA's Method for Determination of Asbestos in Bulk Building materials published in 1993.[6] Additionally, standard methods ISO10312 and ASTM D6281 for TEM analysis were both published in the late 1990s.[7] These methods, however, were designed to determine asbestos presence where it was intentionally added at levels >2% in the manufacturing process, rather than where other mineral resources such as talc were potentially contaminated naturally. Individual asbestos fibers, especially those that can naturally occur in and with talc, can remain elusive by these standardized bulk building material methods. Since there is currently no one method that can be followed as written for testing asbestos in consumer products, the development of a sensitive, cosmetic-specific method that routinely employs TEM is critical (Table 3).

Asbestos exposure is linked to numerous diseases including asbestosis, lung and ovarian cancer, and mesothelioma.[10] The recurrent presence of asbestos in cosmetics represents a harmful exposure that may cause potential harm to consumers. Applying powder makeup containing asbestos to the face is an inhalation risk. The FDA requires cosmetics to be safe yet does not specify how inhalation exposure should be assessed.[11] Further, given an invisible hazard and long latency to disease, it is difficult to track and characterize this type of exposure in the population. Studies have shown that over 60% or greater of mesothelioma cases in women are likely attributable to non-occupational asbestos exposures.[12,13] Baumann and Carbone[14] found that in examining data from 1999 to 2010, mesothelioma mortality rates decreased for men, in accordance with the decreased occupational exposure, but for women, the rate remained the stable, suggesting cases due to causes other than occupational exposure. Rates remained greater for men overall compared to women, but in populations under 50, the rates were similar. Despite declining use of asbestos in the U.S., mesothelioma deaths remain substantial, especially among younger

Table 1. Categories of cosmetics tested.

CATEGORY	NO. OF PRODUCTS TESTED
Toy make-up kits	7
Eye shadow palettes	7
Face powder	3
Body powder	2
Blush	1
Contouring palette	1
Total	21

Table 2. Three of 21 products tested were positive for tremolite asbestos. Actinolite asbestos was also detected in eye shadow palette #2.

CATEGORY	NO. OF SUBSAMPLES POSITIVE AND NO. OF SUBSAMPLES TESTED	QUANTITATION OF ASBESTOS (STRUCTURES/GRAM)	PERCENTAGE OF ASBESTOS IN PRODUCT[ǀ] (%)	ASBESTOS CONCENTRATION, PPM
Toy make-up kit	1 of 3*	4.33 and 4.67 million amphibole asbestos‡	0.0004-0.0005	4.3-4.6
Eye shadow palette #1	5 of 25†	2.25 to 3.57 million amphibole asbestos§	0.0002-0.0004	2.2-3.5
Eye shadow palette #2	18 of 45†	1.49 to 3.86 million amphibole asbestos§	0.0001-0.0004	1.5-3.8

*Three of 8 total powder-based eye-shadow colors were tested in a multi-product make-up kit.
†Twenty-five of 63 and 45 of 120 of total powder-based eye-shadow colors were tested from palettes #1 and #2, respectively.
‡Two sub-samples from the 1 asbestos-containing eye-shadow color were quantitated.
§A maximum and minimum was reported from quantitation of 3 separate asbestos-containing colors.
ǀParts per million and percentage calculations based on assuming average fiber dimensions of length of 5 µm, width of 0.25 µm, and the specific gravity of tremolite (3.15).

Table 3. Analytical methods to screen talc for asbestos.

METHOD	ADVANTAGES	DISADVANTAGES
X-ray Diffraction (XRD)	Rapid screening technique	Lacks adequate sensitivity and specificity to screen for asbestos and should be used along with more sensitive methods
Polarized Light Microscopy (PLM)	Standard method for identification of asbestos	May lack sensitivity for some materials that contain a low percentage of asbestos, should be used in tandem with TEM
Transmission Electron Microscopy (TEM)	Most sensitive method to identify asbestos	Time-consuming sample preparation, more expensive comparatively

populations, underlining the importance of preventing exposure[15] from all potential sources.

The aim of this study was to assess asbestos contamination in talc-based cosmetics and to call attention to the outdated methods for screening as well as bring awareness to the potential hazard in cosmetics. With nearly 15% of products contaminated in a small study, methods used by industries to screen talc supplies are not adequate.

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Author Contribution

All authors made substantial contributions to the manuscript. TS: project administration, conceptualization, collection of samples, writing-original draft, writing-review and editing. SF: conceptualization, laboratory resources, laboratory analysis, data validation, study images, writing-original draft, writing-review and editing. NSL: supervision, conceptualization, writing-original draft, writing-review and editing. All authors checked and accepted the final manuscript.

Supplemental material

Supplemental material for this article is available online.

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