

## Health risk Per- and Polyfluoroalkyl substances contamination in cosmetic products

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### EDITORIAL

#### ARTICLE INFO

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DOI: 10.20885/JKKI.Vol13.Iss3.art1

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Per- and polyfluoroalkyl Substances (PFAS) are groups of persistent organic chemicals comprising a carbon chain in which fluorine atoms switch hydrogen atoms.<sup>1</sup> The robust connection between hydrogen atoms makes PFAS considerably stable persistence materials. Some PFAS do not destroy at all, while others PFAS break down tremendously slowly into other PFAS.<sup>1</sup> In addition, they have a hydrophobic and a hydrophilic component that makes them pleased to settle as a stratum between water and organic solvent or solid surface. PFAS divided into short-chain and long-chain, according to the length of the fluorinated carbon chain. Long-chain PFAS, such as perfluooctanic acid (PFOA) and perfluorooctane sulfonate (PFOS), consist of eight carbon atoms. While short-chain PFAS, such as perfluorohexanoic acid (PFHxA) and perfluorohexane sulfonate (PFHxS), comprise six carbon atoms. Since discovered in the middle of 50, PFAS have raised concerns to scientists on the pose of environmental and human health risks.<sup>1</sup>

PFAS intentionally added as ingredients in some cosmetic products, including lotions, cleansers, nail polish, shaving cream, foundation, lipstick, eyeliner, eyeshadow and mascara.<sup>2</sup> It is imperative to note that PFAS makes skin smooth and shiny. However, some PFAS may also be present in cosmetics unintentionally due to raw material impurity or breakdown of PFAS ingredients that form other types of PFAS.<sup>2</sup> A study declared that approximately 25% of PFAS, exclusively perfluooctanoic acid (PFOA), was absorbed through the skin, and 45% of PFOA was retained in the epidermis.<sup>3</sup> This study also investigated that PFOA causes severe irritation to the skin and mucous membranes. Most people apply foundation, mascara, lotion and other cosmetics in two or three daily applications. Hence, it increases the deposition of PFAS in the skin and retains it in the epidermis more than in a single application.

Since International Agency Research on Cancer (IARC) classified PFOA as possibly carcinogenic to humans, some research has been conducted to evaluate PFAS exposure to cancer risk.<sup>4</sup> The C8 Science Panel Study in 2012 summarized a probable link between PFOA exposure and kidney and testicular cancer.<sup>5</sup> In addition, Bartell and Viera reinforced the previous study that PFOA was the most likely cause of kidney and testicular cancer.<sup>6</sup> Even though both studies were conducted in the animal model, PFAS contamination in cosmetic products should be alarming to the public to prevent the advanced effects of PFAS in humans.

A study in Denmark analyzed 18 cosmetic products. The highest concentration among cosmetic products was 3,340 ng/g perfluorohexanoic acid (PFHxA) in the foundation, while a total PFAS of 10,700 ng/g was found in the concealer. There were two foundations of PFOA that obtained the highest

concentration above limited values by the European Commission at 25 ng/g.<sup>7</sup> Concerning PFOA, it has an estrogenic effect in animal in vitro experiments.<sup>2,7</sup> Thus, it affects the mammary gland. In addition, PFOA was detected in the highest concentration in bone and bone marrow in humans.<sup>7</sup> The substances are also detected in high concentrations in human blood, lungs, and liver.<sup>2,7</sup> PFOA in the brains is not detected; however, PFBA and PFHxA were confirmed. Since the PFOA is the most effective binding to the protein, the most significant effect on the thyroid gland exists. Additionally, PFOA has the strongest binding to albumin in the blood to the other PFAS under consideration.<sup>7</sup>

These substances have raised attention for many decades. Many western countries banned the usage of PFAS in cosmetic and personal care products. The growth of cosmetic products in Indonesia increased sharply during the last ten years. However, screening PFAS in cosmetic products is challenging. We must encourage authorities to screen PFAS contamination to prevent health effects on the population.

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