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# Microplastics in Cosmetics and Personal Care Products: Impacts on Aquatic Life and Rodents with Potential Alternatives

(Mikroplastik dalam Produk Kosmetik dan Penjagaan Diri: Implikasi terhadap Kehidupan Akuatik dan Roden dengan Alternatif Berpotensi)

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ABSTRACT

Microplastics are environmental contaminants of emerging concern that are used in huge quantities in cosmetics and personal care products. As a result, microplastics are continuously released to the environment with serious implications to the ecosystem and human health. A literature search was carried out on Medline, Mendeley, Science Direct and Scopus, gathering relevant articles from 2014-2021. Common types of microplastics used in these products are polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET) and poly (methyl methacrylate) (PMMA). They are usually incorporated in toothpastes, shower gels, shampoos, creams, eye shadows, deodorants, blush powders, make-up foundations and skin creams as exfoliators, emulsifiers, binding agents, opacifying agents, anti-static agents and film-forming agents. Microplastics can cause stunted growth, infertility and low survival rate in aquatic life and they also have been linked to obesity, infertility, cancer and diabetes in humans. Major companies such as Unilever and L'Oréal have removed microplastics from their products or use the alternatives such as chitin, cellulose based microbeads and bio-based plastics. Information on long term effects of microplastics on humans is still scarce. The suitability of materials replacing microplastics and the effectiveness of campaigns and the implemented regulations are not fully evaluated. These research gaps are useful for other researchers to explore more on this subject.

Keywords: Contaminant; cosmetics; environment; microplastic; personal care products

ABSTRAK

Mikroplastik ialah pencemar alam sekitar dan lebih membimbangkan apabila ia digunakan dalam jumlah yang besar di dalam kosmetik dan produk penjagaan diri. Ini mengakibatkan pelepasan mikroplastik ke alam sekitar secara berterusan dan ia memberi implikasi yang serius terhadap ekosistem dan kesihatan manusia. Sorotan kajian dijalankan di Medline, Mendeley, Science Direct dan Scopus, dengan mengumpulkan artikel yang berkaitan dari tahun 2014-2021. Jenis mikroplastik yang biasa digunakan dalam produk ini ialah polietilena (PE), polipropilena (PP), polietilena tereftalat (PET) dan poli (metil metakrilat) (PMMA). Ia biasanya merupakan bahan tambah dalam ubat gigi, gel mandian, syampu, krim, pembayang mata, deodoran, serbuk pemerah pipi, asas solekan dan krim kulit sebagai pengelupas, pengemulsi, agen pengikat, agen pelegap, agen anti statik dan agen pembentuk filem. Mikroplastik boleh menyebabkan tumbesaran terbantut, ketidaksuburan dan kadar kelangsungan hidup yang rendah pada hidupan akuatik dan ia juga telah dikaitkan dengan obesiti, ketidaksuburan, kanser dan diabetes pada manusia. Banyak syarikat besar seperti Unilever dan L'Oréal yang telah mengeluarkan mikroplastik daripada produk mereka atau menggunakan alternatif seperti kitin, mikromanik berasaskan selulosa dan plastik berasaskan bio. Maklumat tentang kesan jangka panjang mikroplastik terhadap manusia masih terhad. Kesesuaian bahan menggantikan mikroplastik dan keberkesanan kempen dan peraturan yang dilaksanakan tidak dinilai sepenuhnya. Jurang penyelidikan yang dikenal pasti ini berguna untuk penyelidik lain meneroka lebih lanjut mengenai subjek ini.

Kata kunci: Alam sekitar; kosmetik; mikroplastik; pencemar; produk penjagaan diri

## INTRODUCTION

The National Oceanic and Atmospheric Administration (NOAA) and The Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) define microplastics as plastic particles with a diameter of less than 5 mm (GESAMP 2015; Frias & Nash 2019; National Ocean Service 2021). Microplastics have become more relevant in the last few decades due to the advanced technology which has led to the revelation of their presence in the air, soil, and water (Ramírez-Malule et al. 2020). Microplastics are made of synthetic polymers such as nylon, polyamide, polycarbonate, polyester, polyethylene (PE), low density polyethylene (LDPE), high density polyethylene (HDPE), polyethylene terephthalate (PET), poly (methyl methacrylate) (PMMA), polypropylene (PP), polystyrene (PS), polyvinyl alcohol, and polyvinyl chloride (PVC) mixed with other chemicals or additives (Bashir et al. 2021; Li et al. 2016; Ma et al. 2020). PE, PP, PET and PMMA are the most extensively used polymers in cosmetics and personal care products (Leslie 2014).

Microplastics can be classified into two categories namely primary microplastics and secondary microplastics. Primary microplastics are plastic particles manufactured with a size of less than 5 mm (Leslie 2014) and are added into a variety of products such as agriculture and construction materials, cosmetics, detergents, industrial abrasives, paints, personal care and pharmaceutical products. Primary microplastics are also referred to as microbeads when they are added into cosmetics and personal care products (Leslie 2014). Secondary microplastics are plastic particles produced unintentionally from fragmentations of larger plastic items due to mechanical actions, photodegradation, biological, and chemical degradations (Horton et al. 2017; Ramírez-Malule et al. 2020; Thompson et al. 2004; Usman et al. 2020). Examples of secondary microplastics are microfibers from textiles, tire dust from vehicles and fragments of agricultural plastics (Mcdevitt et al. 2017).

The main concern with regards to the use of microplastics in cosmetics and personal care products is the continuous release of microplastics into the environment through washing, showering or bathing. This has raised concerns regarding their impact on the aquatic ecosystem and human health knowing that sewage treatment plants are not always able to remove them effectively (Browne et al. 2009; Ternes et al. 2004). It was estimated in 2015 that the sum of annual release of microplastics from cosmetics and personal care products in the US, Europe and China was 3843 tonnes. These countries comprise 33% of the global population and based on this estimation, about $1.2 \times 10^4$ tonnes of microplastics were released into the environment globally in 2015, demonstrating the potential impact to the environment (Gouin et al. 2015; Worldometers 2019).

At present, methods in identifying microplastics involve several steps including extracting samples using density separation, chemical digestion, sieving, and filtration. They are then sorted visually based on size, shape and colour using the naked eyes or microscopes (binocular or digital) and scanning electron microscope for surface morphology characterisation (Fok et al. 2020). Identification of the polymer types is carried out through chemical characterisation using nuclear magnetic resonance (NMR), Fourier transform infrared (FTIR) and Raman spectrometers. In some modern laboratories, micro-FTIR, micro-Raman and thermal extraction/desorption-gas chromatography-mass spectrometers (TED-GC-MS) are used (Lambert & Wagner 2018; Van Cauwenberghe et al. 2013). Detailed sampling and separation methods and characterisation of microplastics are discussed by Usman et al. (2020).

Despite the potential hazard of microplastics and their associated risk to the environment various types of microplastics are still being used in cosmetics and personal care products. This paper focuses on primary microplastics and aims to: (a) identify cosmetics and personal care products containing microplastics; (b) provide an overview of the environmental and health risks associated with microplastics and regulations related to the use of microplastics; (c) suggest alternatives for microplastics, and (d) identify the current research gaps and provide recommendation for future research. In some sections, the authors mentioned about Malaysian practices in the context of global perspectives on this issue. This is in view of Malaysia as among the main plastic producers in the ASEAN countries (Amin et al. 2020), with 25% of the municipal solid waste (MSW) produced daily was plastic waste (Aja & Al-Kayiem 2014).

## COSMETICS AND PERSONAL CARE PRODUCTS CONTAINING MICROPLASTICS

Microplastics were first patented in the late 1960s to be used in cosmetics and personal care products but were not widely used until the 1990s (Perschbacher 2016). Natural exfoliants such as pumice, oatmeal, apricot and walnut husks were also replaced by microplastics since their introduction. They are incorporated in toothpastes, shower gels, shampoos, creams, eye shadows, deodorants, blush powders, make-up foundations and skin creams as exfoliators, emulsifiers, binding agents, opacifying agents, anti-static agents and film-forming agents (Leslie 2014; Ma et al. 2020; Scudo et al. 2017). They are added to toothpastes for aesthetic reasons and to aid in the cleaning (Praveena et al. 2018). Microplastics have been considered a potential threat to the environment because they are in a solid phase at normal environmental temperature, insoluble in water, non-degradable and small in size (Leslie 2014). A survey conducted by the Cosmetics Europe estimated that in 2015, 714-793 tonnes of microbeads were used in cosmetics and personal care products in the European Union (Cosmetics Europe 2017; Eunomia 2016). In the UK, it was reported that 680 tonnes of microbeads were used annually in cosmetics and personal care products (United Kingdom 2016). Product categories containing microplastics are detailed in Table 1.

TABLE 1. Personal care products containing microplastics (Cosmetics Europe 2017)

| Product categories | Amount of microplastics (tonnes) | Types of microplastics |
|---|---|---|
| Hand cleaners | 440.07 | Polyurethane |
| Body foot scrubs | 126.1 | Polyethylene |
| | 0.7 | Cellulose acetate |
| | 0.485 | Polylactic acid |
| Face scrubs | 72.95 | Polyethylene |
| | 1.33 | Polylactic acid |
| | 0.1 | Cellulose acetate |
| Face masks | 42.1 | Polyethylene |
| Body shower gels | 11.6 | Polyethylene |
| Face cleaning products | 9.34 | Polyethylene |
| | 1.13 | Nylon |
| Shampoo | 7.02 | Polyethylene |
| Foot care products | 1.01 | Polyethylene |
| Soap bars | 0.046 | Polyethylene |

In 2019, Malaysia imported USD1.3 billion cosmetics and personal care products and USD132 million is from the United States. Products imported include essential oils, shaving and skin care products, cleansers and soaps, cosmetics, hair care and perfume. Other major exporters of cosmetics and personal care products to Malaysia are China, European Union, Indonesia, Japan, Korea, Singapore and Thailand (Yeoh 2021). L'Oréal S.A., Procter & Gamble and Unilever, are among the major companies in Malaysia while SKII, Shiseido and Vaseline are among the top brands (GlobalData 2020). Since 2017, major cosmetics and personal care companies such as Clarins, Estée Lauder, Johnson & Johnson, L'Oréal, Marks & Spencer, Procter & Gamble, Reckitt Benkiser and Unilever agreed to voluntarily remove microbeads from their products (Connor & Swinburne 2014; Prance-Milles 2017; Smithers 2013). Similar move has been taken by Chinese government by issuing 2019 Industrial Catalogue which ban the production of cosmetics and personal care products containing microbeads by December 2020 (Mallesons 2020). In Malaysia, studies have shown that microplastics were found in fish (Ibrahim et al 2017; Karamai et al. 2017; Karbalaei et al. 2019), sediments (Noik & Tuah 2014; Sarijan et al. 2018) and surface water (Khalik et al 2018; Mohd Zaki et al. 2021; Suardy et al. 2020). However, it is not definitive that the source of those microplastics were from cosmetics and personal care products. Nevertheless, a study carried out by Praveena et al. (2018) confirmed the presence of microbeads in some cosmetics and personal care products sold in Malaysia. In this study, microbeads were extracted from toothpaste and face cleanser/scrub commonly used by Malaysians.

## ENVIRONMENTAL AND HEALTH RISKS OF MICROPLASTICS

Once in the oceans, low density microplastics float freely in the seawater and due to their hydrophobicity and large surface area, they act as a vector where they absorb organic pollutants and heavy metals from their surroundings (Azmi et al. 2016; Liu et al. 2019). Among the organic pollutants carried by microplastics are decabromodiphenyl ether (BDE-209) and bisphenol A (BPA) (Xia et al. 2020). Microorganisms such as bacteria and algae colonise the surface of microplastics forming biofilms which might be harmful to marine organisms (Tu et al. 2020). Density of microplastics increases due to the accumulation of these materials and eventually they settle on the seabed (Horton et al. 2017). Density of microplastics affects their distribution and availability to marine life (Auta et al. 2017). Degraded microplastics and contaminants adsorbed onto them can be toxic to marine life and human health (Rochman et al. 2013; Wright & Kelly 2017). BDE-209 was shown to cause structural damage in gills and digestive glands of scallop *Chlamys farreri* (Xia et al. 2020) while BPA is linked to many diseases such as obesity, infertility, cancer and diabetes (Perez-Bermejo et al. 2021; Rahman et al. 2016). Due to their small size, microplastics are more likely to be ingested by marine life such as copepods, arrow worms and salps from the lower trophic levels. They make their way up the food chain when these planktonic animals are consumed by larger fish which forms part of the human diet (Fendall & Sewell 2009). Effects of polymers (used to make microplastics) on marine organisms are discussed in detail by Usman et al. (2020). Among the effects are increased mortality (Rist et al. 2016; Tosetto et al. 2016), impaired food intake (Bergami et al. 2016; Cole et al. 2015; Welden & Cowie 2016), stunted growth (Au et al. 2015; Cong et al. 2019; Kalcíkova et al. 2017; Yu et al. 2018) and infertility (Cong et al. 2019; Jeong et al. 2016; Sussarellu et al. 2016) are detailed in Table 2 which shows the impacts of microplastics on rodents and aquatic life.

It was estimated that from 15% of Americans' caloric intake, 39,000 to 52,000 particles of microplastics were ingested by each person annually. An additional of 90,000 particles were consumed if water intake was through bottled sources only compared with 4000 particles if only tap water was consumed (Cox et al. 2019). A study on colectomy samples obtained from Malaysian adults showed that microplastics were detected in all the 11 samples with an average of 331 particles/specimen (Ibrahim et al. 2021). The behaviour of microplastics as vectors for heavy metals and microbial pathogens and their association with humans are discussed in detail by Fournier et al. (2021). Godoy et al. (2020) confirmed this behaviour in their simulation study which showed that chromium and lead adsorbed onto microplastics were able to cross the intestinal membrane. In general, microplastics can cause cytotoxicity, oxidative stress, obesity, infertility and increase the risks of chronic inflammation, cancer, neurodegenerative and immune diseases in humans (Prata et al. 2020). However, studies on toxicity associated with long term exposure to these polymers in humans are scarce. The literature gathered only confirmed the presence of microplastics in humans and nothing was discussed about the health impact of microplastics. Studies carried out in Japan, Europe, Iran, and Malaysia where samples were collected from stool, head hair, face skin, hand skin, saliva and colectomy specimens found that PE, PET, PP, polyamide, and polycarbonate were the main microplastics in the samples with size ranging from 50-500 µm (Abassi & Turner 2021; Ibrahim et al. 2021; Schwabl et al. 2019) and can be referred from Table 3.

## REGULATIONS ON MICROPLASTICS

In the United States of America, Microbead-Free Waters Act of 2015 bans the manufacturing, packaging and distribution of rinse-off cosmetics and over-the-counter (OTC) products such as toothpaste containing microbeads with the size of 5 mm or less, intended to be used as an exfoliator or to cleanse any part of the body and are made of polymers which are harmful to the environment (FDA 2015). Since 2014, many other countries such as Netherlands, Sweden, Canada, Australia, Scotland, South Korea, Taiwan, New Zealand, Ireland, South Africa, France, India, Italy, and the United Kingdom also banned the use of microbeads in cosmetics and personal care products (Plastic Soup Foundation 2021; United Kingdom 2018; Watkins et al. 2019). Cosmetic Europe, a European trade association for cosmetics and personal care industries also recommended members of the association to discontinue the use of microbeads (Cosmetics Europe 2021). Currently, there is no legislation which ban the use of microbeads in cosmetics and personal care products in Malaysia. However, Malaysia's Road Map for Zero Single Plastic Use with initiatives to minimise to use of plastics was introduced in 2018 (MESTECC 2018).

TABLE 2. Some of the impacts of microplastics on rodents and aquatic life

| Organisms | Impacts | References |
|---|---|---|
| Asian green mussel (*Perna viridis*) | Increased mortality | Rist et al. (2016) |
| Beachhoppers (*Platorchestia smithi*) | Increased mortality and reduced performance | Tosetto et al. (2016) |
| Brine shrimp (*Artemia franciscana*) larvae | Impaired food intake | Bergami et al. (2016) |
| Chinese mitten crab (*Eriocheir sinensis*) | Decreased growth and damaged liver | Yu et al. (2018) |
| Copepods (*Copepoda)* | Impaired food intake | Cole et al. (2015) |
| Duckweed (*Lemna minor*) | Decreased root growth | Kalcíkova et al. (2017) |
| European sea bass (*Dicentrarchus labrax*) | Compromised intestinal functions | Pedà et al. (2016) |
| Fathead minnow (*Pimephales promelas*) | Suppressed immune system | Greven et al. (2016) |
| Freshwater amphipod (*Hyalella azteca)* | Reduced growth | Au et al. (2015) |
| Goby fish (*Pomatoschistus microps*) | Reduced predatory performance | de Sa et al. (2015) |
| Langoustine (*Nephrops norvegicus*) | Impaired food intake and reduced body mass | Welden & Cowie (2016) |
| Medaka fish (*Oryzias melastigma*) | Decreased growth and reproduction and increased mortality | Cong et al. (2019) |
| Mice (*Mus musculus*) | Reduced locomotion | da Costa Araújo & Malafaia (2021) |
| | Disrupted energy and lipid metabolism and induced oxidative stress | Deng et al. (2017) |
| | Induced gut microbiota dysbiosis, intestinal barrier dysfunction and metabolic disorders | Jin et al. (2019) |
| Monogonont rotifer (*Brachionus koreanus*) | Reduced growth rate, lifespan, reproduction and body size | Jeong et al. (2016) |
| Mussels (*Mytilus galloprovincialis*) | Altered immunological responses and peroxisomal proliferation, induced the onset of genotoxicity and changes in gene expression profile | Avio et al. (2015) |
| Oyster (*Ostreidae*) | Decreased reproduction | Sussarellu et al. (2016) |
| Water flea (*Daphnia magna*) | Increased mortality | Jemec et al. (2016) |
| | Reduced mobility | Rehse et al. (2016) |
| Wistar rats (*Rattus norvegicus*) | Cardiac toxicity | Li et al. (2020) |
| Zebra mussel (*Dreissena polymorpha*) | Lack of protein modulation | Magni et al. (2019) |

TABLE 3. Some studies confirming the presence of microplastics in humans

| Countries | Number of participants & gender | Sample types | Characteristics & amount | Identification method | References |
|---|---|---|---|---|---|
| Asia (Japan) and Europe (Austria, Finland, Italy, Netherlands, Poland, Russia & United Kingdom) | 8 (5 females, 3 males) | Stool | Size: 50 - 500 µm<br>Shape: fragments and films<br>Amount: 20 pieces/10 g of stool<br>Type: PET and PP | FTIR | Schwabl et al. (2019) |
| Iran | 500 (250 females, 250 males | Head hair, face skin, hand skin and saliva | Size: 100 - 250 µm<br>Shape: Fibres<br>Amount: 3.5 pieces/ individu<br>Type: PE, PET and PP | Micro-Raman sepctroscopy | Abassi & Turner (2021) |
| Malaysia | 11 (5 females, 6 males) | Colectomy specimens | Size: 100 - 250 µm<br>Shape: Filaments and fibres<br>Amount: 28.1 $\pm$ 15.4 particles/g tissue<br>Type: polycarbonate, polyamide & PP | FTIR microscope | Ibrahim et al. (2021) |

## ALTERNATIVES TO MICROPLASTICS

Before microplastics were introduced to be incorporated into cosmetics and personal care products, manufacturers were using abrasive materials from natural sources such as cocoa beans, ground almonds, ground apricot pits, sea salt, ground pumice, organic waxes, ground walnuts, oatmeal, and granulated sugar (Perschbacher 2016). They were replaced with microplastics as some of these materials caused tearing of the skin leading to skin irritation, swelling and premature aging (Fendall & Sewell 2009; Oai 2019). Moreover, microplastics are more durable and cost-effective. Alternative materials should be studied further to minimise or eliminate their unwanted effects and reintroduced again into cosmetics and personal care products as they are biodegradable and safe to the environment (Perschbacher 2016; Sun et al. 2020). Among these alternatives are chitin, cellulose based microbeads, and bio-based plastics.

Chitin is a bio-degradable, biocompatible, low toxicity biopolymer which can be found in arthropods, fungi and crustacean shells and extracted from shrimp in an environmentally friendly manner utilising non-toxic solvents (King et al. 2017; Varma 2019). It can be found in abundance in nature and can be microbially and enzymatically degraded. Chitin can be directly extracted from waste shrimp shells using ionic liquid 1-ethyl-3-methylimidazolium acetate to extract and formed into porous microbeads by coagulation in polypropylene glycol. This method produces pure chitin beads of homogeneous shape with a narrow size distribution (King et al. 2017). The chitin microbeads are able to load up active compounds of varied structural types and releases it in aqueous medium within a couple of hours, demonstrating its effectiveness for commercial use (Varma 2019).

Bio-degradable cellulose-based microbeads are also another alternative for microplastics, which are abundantly found in plants and grasses (Varma 2019). Empty fruit bunches which are by-products from palm oil processing and dried jackfruit leaves are also high in cellulose content (Obrien et al. 2017). Cellulose-based microbeads can be manufactured using the cross-flow membrane emulsification technology, where their hardness can be controlled through the cross-linking process, which can further enhance their property as an exfoliant (Meyer 2010). Cellulose acetate extracted from these materials is similar in size to microplastics and has the ability to absorb oil and water (Tristantini & Yunan

2018) making it potentially useful as a commercially safer alternative microbead.

Bio-based plastics such as poly (lactic acid) (PLA) and polyhydroxyalkanoates (PHA) can also potentially replace microplastics (Naser et al. 2021). They are bio-degradable and produced from renewable sources such as corn starch, tapioca roots and sugar cane. Both PLA and PHA are produced by bacterial fermentation of carbohydrates. The *Lactobacillus* species (*L. delbrueckii, L. amylophilus, L. bulgaricus,* and *L. leichmanii*) (Jamshidian et al. 2010) is utilised to produce PLA while PHA is biosynthesised by *Cupriavidus necator* and *Pseudomonas* spp. (Surendran et al. 2020). Poor mechanical strength, poor thermal stability, slow degradation and high cost are among the drawbacks in the development of bio-based plastics (Andrade et al. 2003; Hazer & Steinbüchel 2007). PLA is improved by the introduction of poly (glycolic acid) (PGA). Both have the similar structure but PGA is not optically active and possibly due to quick degradation and higher heat distortion temperature, it has better mechanical and gas barrier properties (Gorth & Webster 2011; Takayama et al. 2014). PLA was shown to have poor persistent organic pollutants (POPs) adsorption behaviour compared with microplastics making it having a great potential to replace microplastics (Hyeong & Won 2020). The performance and robustness of PHA are enhanced by physical blending and chemical modification strategies where different types of bio-degradable polymers such as starch, cellulose, and lignin are blended with PHA and different functional groups are added to PHA synthetically (Li et al. 2016). Greenpeace (2016) has been working together with global cosmetics and personal care products in replacing microbeads with alternatives such as microcrystalline cellulose, hydrogenated castor oil, hydrated silica, jojoba beads, lactic acid polymers, pumice, walnut shells, apricot kernels, cornmeal, poppy seeds, almond shells, and sugar are detailed in Table 4.

TABLE 4. Some alternatives used by selected cosmetics and personal care companies to replace microplastics (Greenpeace 2016)

| Companies | Alternatives |
|---|---|
| Beiersdorf | Microcrystalline cellulose |
| | Cellulose |
| | Hydrogenated castor oil |
| | Hydrated silica |
| Colgate-Palmolive | Jojoba beads |
| L Brands | A non-plastic material |
| Henkel | Lactic acid polymers |
| | Pumice |
| | Walnut shells |
| | Silica |
| Clarins | Cellulose |
| Unilever Group | Apricot kernels |
| | Cornmeal |
| | Ground pumice |
| | Silica |
| | Walnut shells |
| Oriflame Cosmetics | Poppy seeds |
| | Almond shells |
| | Silica and sugar |
| Shiseido | Cellulose |
| Avon | Precipitated silica |
| | Hydrogenated vegetable oil |
| | Various ground seeds and shells |

Besides the alternatives to microplastics mentioned above, advancement to the water treatment facilities by incorporating filters which are effective in removing microplastics such as disc filters (DF), rapid sand filters (RSF), dissolved air flotation (DAF), and membrane bioreactors will contribute to reducing the amount of microplastics released to the aquatic environment (Talvitie et al. 2017). The use of microorganisms which can digest microplastics can also be explored (Urbanek et al. 2018). Plastic Soup Foundation (2021) also developed an application which can scan ingredients in cosmetics and personal care products to enable consumers making an informed decision when buying those products.

## WAY FORWARD

This paper provides an overview on the issue of microplastic pollution by focusing on microplastics derived from cosmetics and personal care products. Major cosmetics and personal care products companies such as Colgate-Palmolive, Clarins, Unilever Group and Shiseido have removed microbeads from their products or use the alternatives. However, small companies including locally manufactured cosmetics and personal care products might still use microplastics in their products. Awareness on the environmental and health risks of microplastics might prompt consumers to choose safer products. Most studies in the gathered literature discussed about microplastics impacts on the environment, aquatic life and rodents and the presence of microplastics in humans. None of these articles mentioned about the health impacts of microplastics on humans nor the tissue accumulations and changes caused by microplastics at cellular and molecular levels. The health impacts are postulated from studies carried out on other mammals. Most countries in the west have tighten their regulations on the use of microplastics in cosmetics and personal care products while in Malaysia, the effectiveness of initiatives in Malaysia's Road Map for Zero Single Plastic Use 2018-2030 is still not being objectively evaluated. Bio-degradable alternatives from natural sources are portrayed to be the potential substitutes of microplastics however, data on their suitability to replace microplastics in cosmetics and personal care products are still scarce. This knowledge gap needs to be explored further.

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