

MICROPLASTIC IN MARINE ENVIRONMENT AND ITS IMPACT

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ABSTRACT

This article was the result of a research of literature study sources and impact of microplastic in the marine environment. Plastic debris could make microplastic caused by ultraviolet and give some negative impact for marine environment. Plastic debris in marine environment has come from industrial and fishing activities (human activities). All of marine environment in the world has contaminated by microplastic, microplastic will give negative impact for marine biota, recent study inform that turtle and fish have high microplastic content in both them. plastics industries should take responsibility for the end-of-life of their products by introducing plastic recycling or upgrading programmers.

Keywords: Microplastic, marine environment, environment, plastic debris, plastics

INTRODUCTION

Environment has been degradation caused by industrial activities (Winarno et al., 2019; Wibowo & Syarifuddin, 2018; Rosanti, 2015; Wibowo & Sadikin, 2019; Rosanti, 2016; Wibowo et al., 2018). Environmental damage has attracted much attention from both of researchers and general public, plastic waste is therefore hazardous for the environment. Plastics are lightweight, synthetic or semi-synthetic organic polymers that are cheap, strong, corrosion-resistant and durable (Derraik, 2002; Wick et al., 2013), nobody knows how much time plastic waste to completely degrade in the marine environment. Many types of plastics in marine environment such as fishing nets, ropes and plastic bags, occur in the natural environment. It is estimated that 50% of plastic products, including utensils, plastic bags and packaging, are intended to be disposable (Hopewell et al., 2009; Rochman et al., 2013). Plastic production has continuous growth from

1950 until 2015 (**Fig. 1**) (PlasticsEurope Market Research Group, 2015).

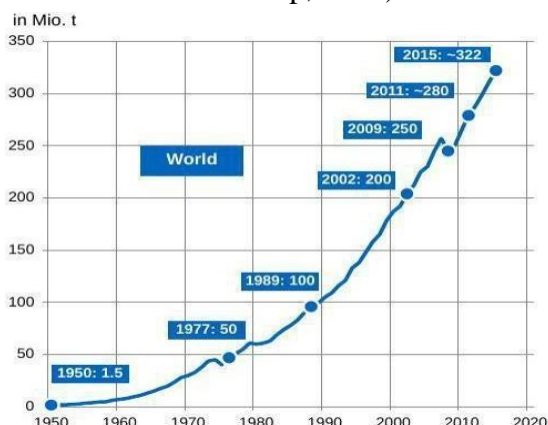


Figure 1. Plastic Production

Plastics has commonly used and abundant polymers are low-density polyethylene (LDPE), polyvinyl chloride (PVC), polystyrene (PS), high-density polyethylene (HDPE), polypropylene (PP) and polyethylene terephthalate (PET) are 90% total plastic production worldwide (Andrady, 2011).

Plastic will give negative impact for environment and human health. As some study about plastics, these polymers are also the most commonly found plastics in the environment, especially in marine environment (Tokiwa *et al.*, 2009). Microplastics is smaller plastic with size less than 5mm, have recently drawn

attention because microplastics not only make their way into the marine environment but are also more easily ingested by marine organisms, it's make microplastics may thus act as vectors for the chemical transfer of pollutants within the food chain (Thompson *et al.*, 2009).

Table 1. Occurrence of plastic debris found in water bodies.

Location	Regions	Water Bodies	Water Column	Debris load	Unit	Plastic Types	Plastic Sizes	Plastic (%)	Reference
USA	Laurentian Great Lakes	Lake	Surface Water	43000	item/k _m ²	Macroplastic and microplastic	0.355–0.99990 mm (81%), 1.000–4.749 mm (17%), N4.75 mm (2%)		(Wilson <i>et al.</i> , 2013)
Pacific Ocean North Pacific		Marine Surface Water		334271	item/km ²	Macroplastic and microplastic	0.355 to <4.76mm	98%	(Mallory, Roberston, & Moenting, 2006)
	Australia	Marine Surface water		4256.4	item/km ²	Macroplastic and microplastic	0.4 to 82.6mm	80%	(Revelles, Cardona, Aguilar, & Fernández, 2007)
	NE Pacific	Marine Surface water		8–9180	Item/m ³	Microplastics	64.8 μm to 5810 μm	75%	(Revelles <i>et al.</i> , 2007)
	Geoje Island	Marine Surface water		16000	Item/m ³	Microplasticsb	50μm to N1000 μm	-	(Song <i>et al.</i> , 2014)
Mediterranean Sea	North Pacific Central Gyre	Marine Surface Water		334.27	item/km ²	Macroplastic and microplastic	0.355 to N4.76 mm	98%	(Moore, 2008)
	Tokyo Bay	Marine Surface water		1.9–3.4	Items/Ha	No information	No information	48.3–58.9%	(Kuriyama et al, 2011)
	Eastern China	Marine Seafloor		No information	Items/Ha	No information	No information	<5%	(Lee <i>et al.</i> , 2006)
	South Sea of Korea	Marine Seafloor			Items/Ha	No information	No information	<10%	(Lee, Cho, & Jeong, 2006)

PLASTIC SOURCE

Plastic debris in marine environment has contributed by land, plastic debris in land has caused by

industrial areas, plastic bag usage, plastic bottle, solid waste disposal and human activities around beach and water bodies. Industrial activities, fishing activities will production plastic waste and give an



impact for marine ecosystem (Fig. 1). 80% plastic debris in marine environment come from land (Derraik, 2002; Rosarina and Laksanawati, 2018) and 20% come from commercial fishing. Fishing

activities an estimated 640,000 tons of plastic debris are added into the ocean every year, it's totally 10% of the total marine debris (Good *et al.*, 2010).

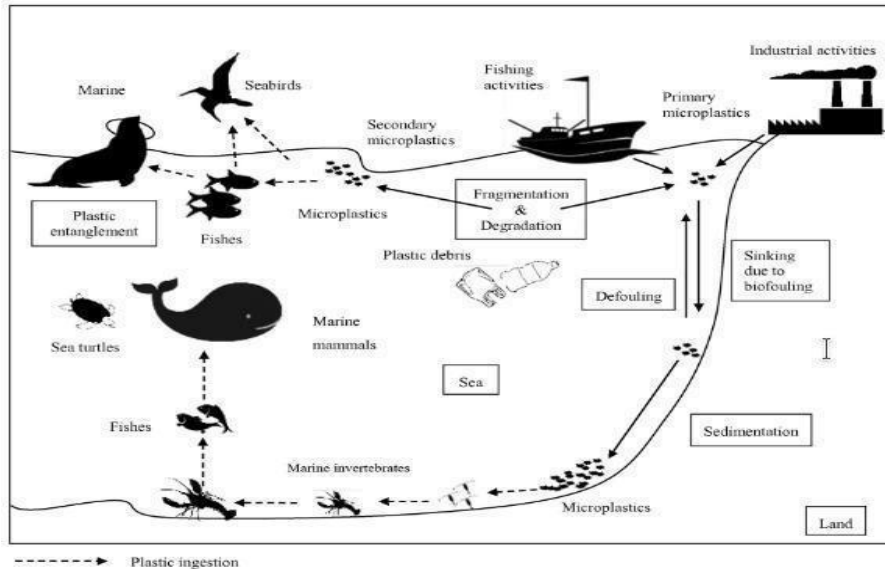


Figure 2. Pathways of plastic debris transportation in marine ecosystem

Effect on Organisms

Macro and microplastics are hazardous material to organisms (Good *et al.*, 2010). The effects of macroplastics and microplastics include blockage of the intestinal tract, inhibition of gastric enzyme secretion, reduced feeding stimuli, failure to reproduce, decreased

steroid hormone levels and delays in ovulation (Azzarello & Van Vleet, 2007). Microplastic has produced by degradation of plastic caused by ultraviolet (UV) radiation (Fig. 3) and because UV light is absorbed rapidly by water, plastics generally take much longer to degrade at sea than on land (Bergmann, 2009).



Figure 3. Properties changes of microplastics after degradation by UV

Microplastics has been a problem for world environment especially on marine environment, majority ocean in the world has been contaminated microplastics (Fig. 4). Microplastic will give physical impact for environment including internal and/or external abrasions and ulcers; and blockages of the digestive tract, which can result in satiation, starvation and physical

deterioration. In turn this can lead to reduced reproductive fitness, drowning, diminished predator avoidance, impairment of feeding ability, the potential transfer of damaging toxicants from seawater and ultimately death (Wright *et al.*, 2013;Gregory, 2009). Microplastics ingestion for many organism can see in Table 2.

Table 2. Plastics ingestion in marine organism

Organisms	Number of samples	Location	Ingested materials	Plastic Sizes	Reference
Turtle	265	Brazilian coast	No information	No information	(Santos <i>et al.</i> , 2015)
	20	Ubatuta	Soft plastic (54.3%), hard plastic (19%), nylon (21.4%), rubber (4.2%) and foam (1.1%)	(76%) 0–5 cm, (23%) 5–10 cm, (1%) >10 cm	(da Silva <i>et al.</i> , 2015)
	76	Paranagua	Plastic bags (44.7%), hard plastic (38.5%), nylon (7.73%), polystyrene (5.1%) and rubber (1.1%)	No information	(Guebert-Bartholo <i>et al.</i> , 2011)
Fish	566	North Sea	No information	0.4mm to 4.48mm	(Foekema <i>et al.</i> , 2013)
	504	English Channel	Semi synthetic cellulosic material rayon (58%), and polyamide (35%)	0.13 mm to 14.3 mm	(Lusher <i>et al.</i> , 2013)

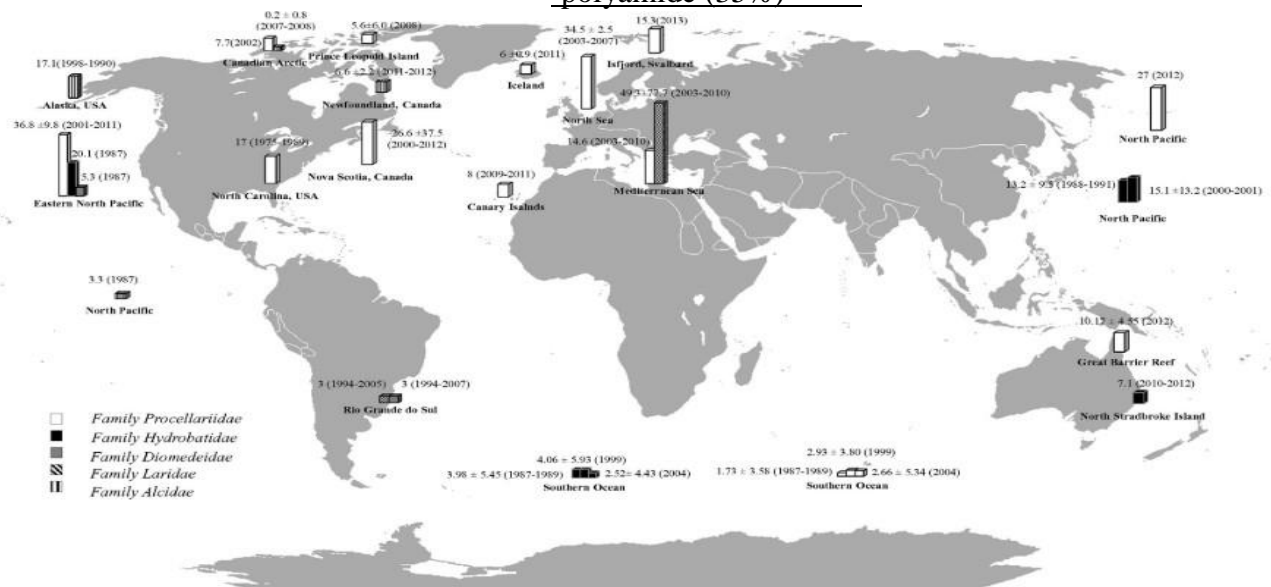


Figure 1. Plastic ingestion found in marine environmental in the world

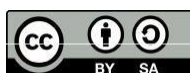
CONCLUSION AND FUTURE RESEARCH DIRECTION

Microplastics are problem for everyone in the world, this problem will give some negative impact for environment and human health. Microplastic has been growing every single years, 80% plastic debris has come from land and 20% from fishing activities. Microplastic is degradation material caused by UV and made any problems for marine ecosystem especially biota. Recommendation for future research direction is researcher should make bio-plastic that easy to reduce by nature. This problems need support by all of sector include regulation for limited plastic usage.

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