

SÍNTESIS DE PRODUCTO

IDENTIFICACIÓN DE LOS PARTICIPANTES

Nombre Completo	Identificación	Correo Electrónico	Tipo de Participación
Sebastián López Botero	1020439330	sebaslopezb@gmail.com	Autor
Carlos Augusto Alvarez A.	71338015	Carlos.alvarez66@hotmail.com	Asesor

GENERAL

FACULTAD	Facultad de Ingeniería
PROGRAMA ACADEMICO	Especialización en tratamiento, valoración y gestión de residuos sólidos
NOMBRE DEL TRABAJO DE GRADO	Vertimiento de residuos sólidos plásticos en la zona del ROPME, una problemática latente. Se envía a revista Cuaderno Activa, TdeA FECHA DE ENVÍO: 01/07/2020
PALABRAS CLAVE:	Basura marina, contaminación, residuos sólidos plásticos, ROPME
RESUMEN:	Una gran preocupación mundial es el impacto ambiental que causa la contaminación de residuos sólidos plásticos en las áreas marítimas. Esta cuestión ha sido ampliamente estudiada en los países aledaños a la Zona Marítima de la Organización Regional para la Protección del Medio Marino (ROPME) donde actualmente existe un amplio y rápido crecimiento demográfico y económico, lo cual ha ocasionado un considerable deterioro de los ecosistemas costeros. En este documento se describen generalidades de los residuos plásticos en el área del ROPME y características de estos desechos. Mediante la revisión bibliográfica, se analizan los impactos medioambientales al medio marino causado por los diferentes tipos de desechos según su tamaño y como se afecta la fauna y flora. Así mismo, se recomienda la implementación de planes de acción regionales y nacionales para abordar la amenaza creciente de contaminación y fomentar la prosperidad socioeconómica y ambiental de la zona marítima de estudio, con la participación de las partes interesadas y la utilización de la legislación reguladora.

REFERENCIAS

- [1] United Nations, «United Nations Convention of the Law of the Sea,» 1982.
- [2] G. Brighty, D. Jones y J. Ruxton, «High level scientific review for 'A Plastic Oceans 'film,» Plastic Oceans Foundation, 2017.
- [3] UNEP, Marine Plastic Debris and Microplastics: Global Lessons and Research to Inspire Action and Guide Policy Change United Nations Environment Programme, Nairobi, 2016.
- [4] B. Lyons, W. Cowie, Maes, T y W. Le Quesne, «Marine plastic litter in the ROPME Sea Area: Current knowledge and recommendations,» *Ecotoxicology and Environmental Safety*, vol. 187, 2020.
- [5] M. Gómez, «El Estudio de los Residuos: Definiciones, Tipologías, Gestión y Tratamiento,» *Serie Geográfica*, nº 5, pp. 21-42, 1995.
- [6] A. Ruiz, «Guía para la implementación del programa piloto de reaprovechamiento de residuos sólidos en Humanga, Pucallpa y Tinga María,» 2004.
- [7] L. Vesco, *Residuos Sólidos Urbanos: Su Gestión Ambiental en Argentina*, 2006.
- [8] P. Lettieri y S. Al-Salem, «Chapter 17 - Thermochemical Treatment of Plastic Solid Waste,» *Waste - A Handbook for Management*, pp. 233-242, 2011.
- [9] D. Brennecke, B. Duarte, F. Paiva, I. Caçador y J. Canning-Clode, «Microplastics as vector for heavy metal contamination from the marine environment,» *Estuarine, Coastal and Shelf Science*, vol. 178, pp. 189-195, 2016.
- [10] L. Parker, «Fast facts about plastic pollution,» *National Geographi News*, 2018. [En línea]. Available: <https://www.nationalgeographic.com/news/2018/05/plastics-facts-infographics-ocean-pollution/>.
- [11] T. Townsend, «Eight million tonnes of plastic are going into the ocean each year. Plastic Waste Washed up on a Beach in Haiti,» *The Conversation*, 2015. [En línea]. Available: <http://theconversation.com/eight-million-tonnes-of-plastic-are-going-into-the-ocean-each-year-37521>.
- [12] M. Al-Maaded, N. Madi, R. Kahraman, A. Hodzic y N. Ozerkan, «An overview of solid waste management and plastic recycling in Qatar,» *Journal of Polymers and the Environment*, vol. 20, nº 1, pp. 186-194, 2012.
- [13] Y. Tachwali, Y. Al-Assaaf y A. Al-Ali, «Automatic multistage classification system for plastic bottles recycling,» *Resources, Conservation and Recycling*, vol. 52, nº 2, pp. 266-285, 2007.
- [14] C. Meran, O. Ozturk y M. Yuksel, «Examination of the possibility of recycling and utilizing recycled polyethylene and polypropylene,» *Materials & Design*, vol. 29, nº 3, pp. 701-705, 2008.

- [15] M. Araújo, J. Silva y M. Costa, «Anthropogenic Litter on Beaches With Different Levels of Development and Use: A Snapshot of a Coast in Pernambuco (Brazil),» *Frontiers in Marine Science*, vol. 5, p. 233, 2018.
- [16] S. Zafar, «MSW Generation in the Middle East.,» 2018. [En línea]. Available: <https://www.ecomena.org/tag/msw-generation-in-middle-east/>. [Último acceso: 18 Junio 2020].
- [17] A. Alsulaili, B. Al-Sager, H. Albanwan, A. Almeer y L. Al-Essa, «An integrated solid waste management system in Kuwait. In: 5th International Conference on Environmental Science and Technology,» vol. 69, pp. 55-59, 2014.
- [18] GPCA, «Gulf Petrochemical and Chemicals Association. GCC Plastics Industry Indicators 2016.,» 2016. [En línea]. Available: <https://www.gpca.org.ae/2017/04/07/gcc-plastics-industry-indicators-2016/>. [Último acceso: 18 Junio 2020].
- [19] Goldstein, «GCC Plastic Market 2017-2030: Industry Share, Size, Emerging Trends, Demand Analysis, Growth Driver, Regional Outlook,» 2020. [En línea]. Available: <https://www.goldsteinresearch.com/report/gcc-plastic-market>.
- [20] BWR, «Bottled Water U.S. And International Development and Statistics.,» 2017. [En línea]. Available: <https://gpca.org.ae/wp-content/uploads/2018/03/GCC-Plastics-Industry-Indicators-2016.pdf>. [Último acceso: 18 Junio 2020].
- [21] Pandey, P., «Plastic Waste Management in UAE.,» 2016. [En línea]. Available: <https://www.ecomena.org/plasticuae/>. [Último acceso: 18 Junio 2020].
- [22] EEA, «Recycling of Municipal Waste,» 2018. [En línea]. Available: <https://www.eea.europa.eu/airs/2018/resource-efficiency-and-low-carbon-economy/recycling-of-municipal-waste>. [Último acceso: 18 Junio 2020].
- [23] A. Al Lahou y M. Alsabbaagh, «Assessment of municipal solid waste management in the state of Kuwait.,» *International Journal of Environmental Science and Development*, vol. 10, nº 2, pp. 51-56, 2019.
- [24] A. Löhr, H. Savelli, R. Beunen, M. Kalz, A. Ragas y F. Van Belleghem, «Solutions for global pollution of marine litter,» *Current Opinion in Environmental Sustainability*, vol. 28, pp. 90-99, 2017.
- [25] M. Haward, «The plastic pollution of the seas and oceans of the world as a kitchen and challenge in the governance of the oceans,» *Nature Communications*, 2018.
- [26] C. Xi y Y. Ning, «A Brief Overview of Renewable Plastics,» *Materials Today Sustainability*, vol. 7, 2019.
- [27] J. Shiber, «Plastic particle and tar pollution on beaches of Kuwait,» *Environmental Pollution*, vol. 57, nº 4, pp. 341-351, 1989.
- [28] H. Khordagui y A. Abu-Hilal, «Man-made litter on the shores of the United Arab Emirates on the Arabian Gulf and the Gulf of Oman,» *Water, Air, & Soil Pollution*, vol. 76, nº 3-4, pp. 343-352, 1994.

- [29] M. Claereboudt, «Shore litter along sandy beaches of the Gulf of Oman,» *Marine Pollution Bulletin*, vol. 49, nº 9-10, pp. 770-777, 2004.
- [30] M. Rajabizadeh y E. Kamrani, «The preliminary assessment of abundance and composition of marine beach debris in the northern Persian Gulf, Bandar Abbas City, Iran,» *Journal of the Marine Biological Association of the United Kingdom*, vol. 96, nº 1, pp. 131-135, 2016.
- [31] T. Root, «Las colillas de cigarrillos también significan contaminación plástica tóxica,» *National Geographic Society*, 27 Agosto 2019. [En línea]. Available: <https://www.nationalgeographic.com/medio-ambiente/2019/08/las-colillas-de-cigarrillos-tambien-significan-contaminacion-plastica-toxica#:~:text=Billones%20de%20filtros%20de%20cigarrillo%2C%20tambi%C3%A9n%20conocidos%20como%20colillas%2C%20quedan.&text=Lo.> [Último acceso: 19 Junio 2020].
- [32] S. Dobaradaran, T. Schmidt, I. Nabipour, A. Ostovar, A. Raeisi, R. Saeedi, M. Khorsand, N. Khajeahmadi y M. Keshtkar, «Cigarette butts abundance and association of mercury and lead along the Persian Gulf beach: an initial investigation,» *Environmental Science and Pollution Research*, vol. 25, nº 6, pp. 5465-5473, 2017.
- [33] S. Dobaradaran, I. Nabipour, R. Saeedi, A. Ostovar, M. Khorsand, N. Khajeahmadi, R. Hayati y M. Keshtkar, «Association of metals (Cd, Fe, As, Ni, Cu, Zn and Mn) with cigarette butts in northern part of the Persian Gulf,» *Tob Control*, vol. 26, nº 4, pp. 461-463, 2017.
- [34] C. Martin, H. Almahasheer y C. Duarte, «Mangrove forests as traps for marine litter,» *Environmental Pollution*, vol. 247, pp. 499-508, 2019.
- [35] G. Murray, «Environmental implications of plastic debris in marine settings-entanglement, ingestion, smothering, hangers-on, hitch-hiking and alien invasions,» *Philosophical Transactions of the Royal Society B: Biological Sciences*, vol. 364, nº 1526, pp. 2013-2025, 2009.
- [36] De-la-Torre y Gabriel, «Microplásticos en el medio marino: una problemática que abordar,» *Revista CIENCIA Y TECNOLOGÍA*, vol. 14, nº 4, pp. 27-37, 2019.
- [37] A. L. Andrady, «The plastic in microplastics: A review,» *Marine Pollution Bulletin*, vol. 119, nº 1, pp. 12-22, 2017.
- [38] J. Jiang, «Occurrence of microplastics and its pollution in the environment: A review,» *Sustainable Production and Consumption*, vol. 13, pp. 16-23, 2018.
- [39] A. de Souza, W. Kloas, C. Zarfl, S. Hempel y M. Rillig, «Microplastics as an emerging threat to terrestrial ecosystems,» *Global Change Biology*, vol. 24, nº 4, pp. 1405-1416, 2018.
- [40] Fundación Aquae, «Lista de contaminantes emergentes: los "contaminantes desconocidos",» [En línea]. Available: <https://www.fundacionaquae.org/contaminantes-emergentes/>. [Último acceso: 20 Junio 2020].
- [41] M. Cole, P. Lindeque, C. Halsband y T. Galloway, «Microplastics as contaminants in the marine environment: A review,» *Marine Pollution Bulletin*, vol. 62, pp. 2588-2597, 2011.

- [42] Y. Cho, W. Shim, M. Jang, H. Han y S. Hong, «Abundance and characteristics of microplastics in market bivalves from South Korea,» *Environmental Pollution*, vol. 245, pp. 1107-1116, 2019.
- [43] M. Browne, T. Galloway y T. Thompson, «Microplastic - An emerging contaminant of potential concern?,» *Integrated Environmental Assessment and Management*, vol. 3, pp. 559-566, 2007.
- [44] A. Andrady, «Microplastics in the marine environment,» *Marine Pollution Bulletin*, vol. 62, pp. 1596-1605, 2011.
- [45] K. Ashton, L. Holmes y A. Turner, «Association of metals with plastic production pellets in the marine environment,» *Marine Pollution Bulletin*, vol. 60, nº 11, pp. 2050-2055, 2010.
- [46] C. Rochman, «The Complex Mixture, Fate and Toxicity of Chemicals Associated with Plastic Debris in the Marine Environment,» *Marine Anthropogenic Litter*, pp. 117-140, 2015.
- [47] E. Teuten, J. Saquing, D. Knappe, M. Barlaz, S. Jonsson, A. Björn, S. Rowland, R. Thompson, T. Galloway, R. Yamashita, D. Ochi, Y. Watanuki, C. Moore, P. Viet, T. Tana y e. al., «Transport and release of chemicals from plastics to the environment and to wildlife,» *Philosophical Transactions of the Royal Society*, vol. 364, pp. 2027-2045, 2009.
- [48] PlasticsEurope, «Tipos de plásticos,» [En línea]. Available: <https://www.plasticseurope.org/es/about-plastics/what-are-plastics/large-family>. [Último acceso: 20 Junio 2020].
- [49] European Bioplastics, «What are bioplastics?,» [En línea]. Available: <https://www.european-bioplastics.org/bioplastics/>. [Último acceso: 20 Junio 2020].
- [50] X. Chen y N. Yang, «A Brief Overview of Renewable Plastics,» *Materials Today Sustainability*, Vols. %1 de %27-8, 2019.
- [51] E. Rojo y T. Montoto, «Basuras marinas, plásticos y microplásticos: orígenes, impactos y consecuencias de una amenaza global,» *Ecologistas en Acción*, 2017.
- [52] S. Baulch y C. Perry, «Evaluating the impacts of marine debris on cetaceans,» *Marine Pollution Bulletin*, vol. 80, pp. 210-221, 2014.
- [53] D. Laist, «Impacts of Marine Debris: Entanglement of Marine Life in Marine Debris Including a Comprehensive List of Species with Entanglement and Ingestion Records,» *Marine Debris: sources, impacts, and solutions*, pp. 99-139, 1997.
- [54] M. Stelfox, J. Hudgins y M. Sweet, «A review of ghost gear entanglement amongst marine mammals, reptiles and elasmobranchs,» *Marine Pollution Bulletin*, vol. 111, nº 1-2, pp. 6-17, 2016.
- [55] B. Farkas, B. Buzas, E. Gulyas y N. Maury, «A leatherback turtle found off Fujairah, United Arab Emirates,» *Marine Turtle Newsletter*, vol. 1, nº 154, pp. 15-16, 2017.
- [56] EAD, «Environment Agency - Abu Dhabi,» *Waste and Environment Annual Report*, 2016.

- [57] D. Shaw y R. Day, «Colour- and form-dependent loss of plastic micro-debris from the North Pacific Ocean,» *Marine Pollution Bulletin*, vol. 28, pp. 39-43, 1994.
- [58] S. Kashiwada, «Distribution of Nanoparticles in the See-through Medaka (*Oryzias latipes*),» *Environ Health Perspect*, vol. 114, nº 11, pp. 1697-1702, 2006.
- [59] A. SALvati, C. Aberg, T. dos Santos, J. Varela, P. Pinto, I. Lynch y K. Dawson, «Experimental and Theoretical Comparison of Intracellular Import of Polymeric Nanoparticles and Small Molecules: Toward Models of Uptake Kinetics,» *Nanomedicine*, vol. 7, nº 6, pp. 818-826, 2011.
- [60] T. Cedervall, L. Hansson, M. Lard, B. Frohm y S. Linse, «Food Chain Transport of Nanoparticles Affects Behaviour and Fat Metabolism in Fish,» *PLoS ONE*, vol. 7, nº 2, p. e32254, 2012.
- [61] G. Rossi, J. Barnoud y L. Monticelli, «Polystyrene Nanoparticles Perturb Lipid Membranes,» *The Journal of Physical Chemistry Letters*, vol. 5, nº 1, pp. 241-246, 2013.
- [62] J. Anderson, B. Park y V. Palace, «Microplastics in aquatic environments: Implications for Canadian ecosystems,» *Environmental Pollution*, vol. 218, pp. 269-280, 2016.
- [63] A. Naji, M. Nuri y D. Vethaak, «Microplastics contamination in molluscs from the northern part of the Persian Gulf,» *Environmental Pollution*, vol. 235, pp. 113-120, 2018.
- [64] P. Tourinho, J. Ivar y G. Fillmann, «Is marine debris ingestion still a problem for the coastal marine biota of southern Brazil?,» *Marine Pollution Bulletin*, vol. 60, nº 3, pp. 396-401, 2010.
- [65] M. Cole, P. Lindeque, E. Fileman, C. Halsband, R. Goodhead, K. Moger y T. Galloway, «Microplastic Ingestion by Zooplankton,» *Environmental Science & Technology*, vol. 47, nº 12, pp. 6646-6655, 2013.
- [66] A. Watts, M. Urbina, S. Corr, C. Lewis y T. Galloway, «Ingestion of Plastic Microfibers by the Crab *Carcinus Maenas* and Its Effect on Food Consumption and Energy Balance,» *Environmental Science & Technology*, vol. 49, nº 24, pp. 14597-14604, 2015.
- [67] A. Russel, C. Lewis, R. Goodhead, S. Beckett, J. Moger, C. Tyler y T. Galloway, «Uptake and Retention of Microplastics by the Shore Crab *Carcinus maenas*,» *Environmental Science and Technology*, vol. 48, nº 15, pp. 8823-8830, 2014.
- [68] A. Trouwborst, «Managing marine litter: exploring the evolving role of international and european Law in Confronting a persistent environmental problem.,» *Utrecht Journal of International and Europeam Law*, vol. 27, nº 73, pp. 4-18, 2011.
- [69] J. Jambeck, R. Geyer, C. Wilcox, T. Siegler, M. Perryman, A. Andrady, R. Narayan y K. Law, «Plastic waste inputs from land into the ocean,» *Science*, vol. 347, nº 6223, pp. 768-771, 2015.
- [70] GESAMP, «Sources, fate and effects of microplastics in the marine environment: a global assessment,» In: Kershaw, P.J. (Ed.), *IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection*. vol. 90, 2015.

- [71] World Economic Forum, «Ellen MacArthur Foundation and McKinsey & Company The New Plastics Economy —Rethinking the future of plastics,» 2016. [En línea]. Available: <http://www.ellenmacarthurfoundation.org/publications>. [Último acceso: 25 Junio 2020].
- [72] UNEP, «Single Use Plastics: A Roadmap for Sustainability,» 2018. [En línea]. Available: <https://www.unenvironment.org/resources/report/single-use-plastics-roadmapsustainability>. [Último acceso: 25 Junio 2020].
- [73] J. Clapp y L. Swanston, «Doing away with plastic shopping bags: international patterns of norm emergence and policy implementation,» *Environment Pollution*, vol. 18, pp. 315-332, 2009.
- [74] F. Convery, S. McDonnell y S. Ferreira, «The most popular tax in Europe? Lessons from the Irish plastic bags levy,» *Environmental and Resource Economics*, vol. 38, pp. 1-11, 2007.
- [75] R. Schnurr, V. Alboiu, M. Chaudhary, R. Corbett, M. Quanz, K. Sankar, H. Srain, V. Thavarajah, D. Xanthos y T. Walker, «Reducing marine pollution from single-use plastics (SUPs): A review,» *Marine Pollution Bulletin*, vol. 137, pp. 157-171, 2018.
- [76] D. Xanthos y T. Walker, «International policies to reduce plastic marine pollution from single-use plastics (plastic bags and microbeads): a review,» *Marine Pollution Bulletin*, vol. 118, pp. 17-26, 2017.
- [77] Gulf News, «Dubai Municipality Launches Campaign to Slash 500m Plastic Bags,» 2013. [En línea]. Available: <https://gulfnews.com/uae/environment/dubai-municipality-launches-campaign-to-slash-500m-plastic-bags-1.1174280>. [Último acceso: 25 Junio 2020].
- [78] EAD, «Environment Agency - Abu Dhabi. Internal Report. Waitrose Plastic Bags Pilot Study.,» 2018.
- [79] The National, «Waitrose Abu Dhabi Trial Sees 75% Reduction in Single-Use Plastic Bags,» 2018. [En línea]. Available: <https://www.thenational.ae/uae/waitrose-abu-dhabi-trial-sees-75-reduction-in-single-use-plastic-bags-1.746656>. [Último acceso: 25 Junio 2020].
- [80] Federal National Council, «Official Portal of the Government of the United Arab Emirates,» 2018. [En línea]. Available: <https://u.ae/en/information-and-services/environment-and-energy/waste-management>. [Último acceso: 26 Junio 2020].
- [81] PERSGA/UNEP, «Marine Litter in the PERSGA Region. PERSGA, Jeddah.,» 2008. [En línea]. Available: http://www.persga.org/Files/Common/Flipping_Books_Downloads/Marine_Litter_in_the_PERSGA_Regions.pdf. [Último acceso: 25 Junio 2020].
- [82] SPREP, «Pacific Marine Action Plan: Marine Litter 2018–2025,» 2018. [En línea]. Available: https://www.sprep.org/attachments/Circulars/prap_marine_litter.pdf. [Último acceso: 25 Junio 2020].
- [83] European Commission, «A European Strategy for Plastics in a Circular Economy,» Brussels, 2018.

