SustainaBlue

HEIs stands for Higher Education Institutions

Marine Debris in Circular Economy

3b. Circular Economy Solutions for Marine Litter

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Project: 101129136 — SustainaBlue — ERASMUS-EDU-2023-CBHE

Universiti Malaysia Terengganu

UMT

SustainaBlue
HEIs stands for Higher Education Institutions

PROJECT PARTNERS

Malaysia

Universiti Malaysia Terengganu UMT

USM Universiti Sains Malaysia APEX

Persatuan Kemajuan Akuakultur Malaysia — Malaysia Aquaculture Development Association

Indonesia

Universitas Indonesia — Veritas, Probitas, Iustitia

ITS Institut Teknologi Sepuluh Nopember

Greece

Πανεπιστήμιο Αιγαίου — University of the Aegean

symplexis

AEGEAN rebreath

Cyprus

University of Cyprus Oceanography Centre

Center for Social Innovation
www.csicy.com

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Project: 101129136 — SustainaBlue — ERASMUS-EDU-2023-CBHE

SustainaBlue

HEIs stands for Higher Education Institutions

Content

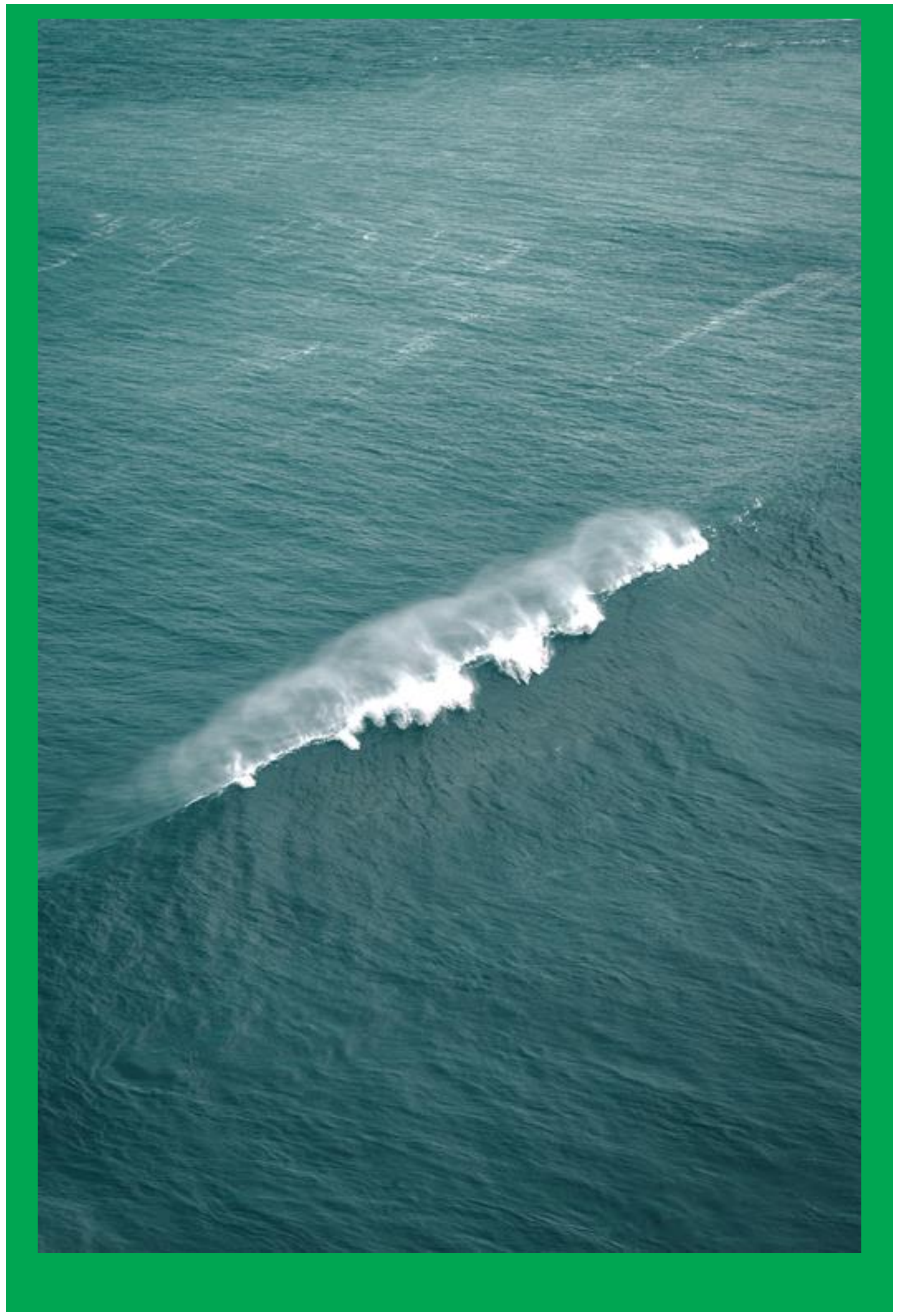
Co-funded by the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

Introduction

Objective:

- To explain the key principles of the circular economy, waste prevention, product design for recyclability, and closed-loop systems. .
- To explore the innovative approaches to plastic waste management, such as extended producer responsibility schemes, deposit-refund systems, and eco-friendly packaging alternatives. .



Learning Outcomes:

- Understanding the sources and impacts of marine debris on the blue economy industries.
- Exploring the principles and strategy of the circular economy as applied to the management of marine litter.
- Analysing the role of blue economy industries in plastic pollution generation and potential solutions, and waste reduction and recycling.

Co-funded by the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

Plastic Waste Management

Photo Adapted from *Mohamed Abdulraheem, 2023*

- The use of plastics comes with many harmful environmental impacts related to their production and poor methods of waste treatment.
- Around 9% of the generated waste was recycled, which was a very minute quantity compared to the total production (Evode et al., 2021)
- Approximately 80% of the generated waste was reported to accumulate in landfills or the natural environment.
- The poor disposal and plastic waste mistreatment effects are categorized under three main classes, including the effects of plastic waste on animals, public health, and environmental pollution

Co-funded by
the European Union

Strategies for Improving Waste Management

1. Extender Producer Responsibility (EPR) Schemes

OECD defines Extended Producer Responsibility (EPR) as an **environmental policy approach** in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle (Ellen MacArthur Foundation, 2022).

Based on this definition, the three main benefits of EPR are

1. The cost of end-of-life management is shifted from local institutions to producers ("polluter pays" principle).
2. The recycling and material recovery rates are boosted.
3. Producers are incentivised to adopt a more sustainable design for products (design for the environment).

- EPR is a well-known policy tool with almost 400 existing schemes globally, across various product types from packaging and used tyres, to vehicles and electronics (Watkins et al., 2019).
- For packaging specifically, around 65 policies to extend producer responsibility exist. This includes different kinds of schemes, of which around 45 can be considered mandatory, fee-based EPR schemes.

Adapted from (Eikocircle, 2023)

SustainaBlue
HEIs stands for Higher Education Institutions

Strategies for Improving Waste Management

2. Deposit-Refund system (DRS)

- **Deposit Refund Schemes (DRS)** have long been used for glass bottles and are now also used for plastic drink bottles.
- Under this system, customers pay a small deposit when buying a bottle and get the money back when they return it through a special return system (Recykal, 2025) .
- While DRS doesn't focus on chemicals, it helps collect specific types of plastic more effectively.
- This reduces litter, prevents pollution, and makes recycling easier. It also leads to cleaner, higher-quality recycled materials that aren't mixed with other waste or harmful substances. Some examples of DRS include:
- **South Australia** The state gives back AUD 0.10 for each returned beverage container, helping cut beach litter from bottles by two-thirds (ABC News, 2025).
- **Ecuador** In 2011, the country offered a USD 0.02 refund per PET bottle. This boosted recycling rates dramatically—from 30% to 80% within a year, recovering over a million bottles (Viteri, 2022).
- **United States (Selected States)** While there's no national law, many states have "bottle bills." California, for example, refunds USD 0.05 for smaller containers and USD 0.10 for larger ones. Since 1987, the program has helped recycle about 300 billion beverage containers (Watkins, 2019)

Co-funded by
the European Union

Strategies for Improving Waste Management

SustainaBlue
HEIs stands for Higher Education Institutions

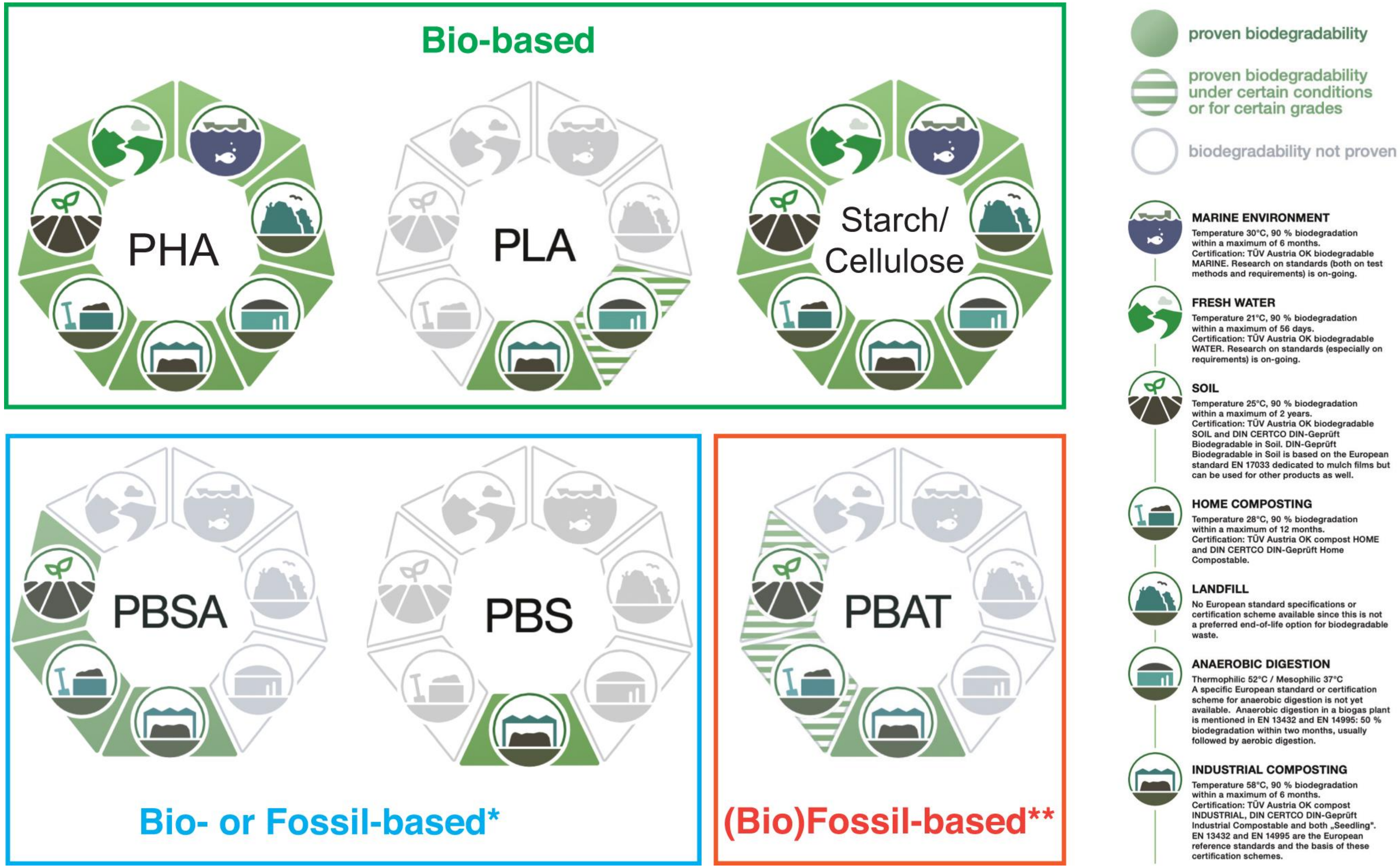
3. Eco-friendly packaging materials

Adapted from Parveen et al., 2024

- In a circular economy, **bioplastic** are a useful alternative to traditional plastics, especially for **single-use items**.
- Their main benefit is that, after use, they can be broken down by microorganisms into **carbon dioxide, methane, and natural biomass**. This means they don't leave behind long-term pollution (Yu &Flury, 2024).
- **Bioplastics** are mainly defined by either being made from **renewable biological sources** or by being **biodegradable**, even if they come from fossil fuels.
- They can be classified into different categories based on their raw materials. Using bio-based resources for bioplastics is considered more sustainable because they are **renewable** and help **reduce CO_2 emissions** by lowering reliance on fossil fuels (Parveen et al., 2024).

Co-funded by the European Union

Strategies for Improving Waste Management



Biodegradability of bio-based and fossil-based biodegradable polymers in various environments (Kaur et al., 2024).

SustainaBlue
HEIs stands for Higher Education Institutions
Co-funded by the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

Case Study Assessment

Case Study Poster Presentation on Circular Economy Strategies

Task:
In a group or individually, **select one** of the following plastic waste management strategies:

1. **Extended Producer Responsibility (EPR)**
2. **Deposit-Refund Systems (DRS)**
3. **Eco-Friendly Packaging Alternatives**

Your assignment:

- **Research a real-world case study** where the chosen strategy has been applied (e.g., in a country, company, or industry).
- **Create a poster** that presents your case study clearly and visually.

Your poster should include:

✓ Title and name of the strategy
✓ Background of the case study (location, organization, timeline)
✓ How the strategy works in the case
✓ Results or impacts (e.g., waste reduction, recycling rate, public response)
✓ Benefits and challenges
✓ Visuals: photos, infographics, charts, or logos
✓ References (brief)

Co-funded by
the European Union

Bibliography

- Evode, N., Qamar, S. A., Bilal, M., Barceló, D., & Iqbal, H. M. (2021b). Plastic waste and its management strategies for environmental sustainability. *Case Studies in Chemical and Environmental Engineering*, *4*, 100142. https://doi.org/10.1016/j.cscee.2021.100142
- *How to build a circular Economy | Ellen MacArthur Foundation*. (2021). https://www.ellenmacarthurfoundation.org/
- Yu, Y., & Flury, M. (2024). Unlocking the Potentials of Biodegradable Plastics with Proper Management and Evaluation at Environmentally Relevant Concentrations. *Npj Materials Sustainability*, *2*(1). https://doi.org/10.1038/s44296-024-00012-0
- Parveen, N., Naik, S. C. S., Vanapalli, K. R., & Sharma, H. B. (2024). Bioplastic packaging in circular economy: A systems-based policy approach for multi-sectoral challenges. *The Science of the Total Environment*, *945*, 173893. https://doi.org/10.1016/j.scitotenv.2024.173893
- Watkins, E., et al. (2019), "Policy approaches to incentivise sustainable plastic design", OECD Environment Working Papers, No. 149, OECD Publishing, Paris.
- ABC News. (2025, September 3). Wine and spirit bottles to be included in container deposit scheme in NSW and SA. https://www.abc.net.au/news/2025-09-03/wine-and-spirit-bottles-included-container-deposit-scheme/105729040
- Recykal. (2025, June 30). Why are countries all around the world implementing Deposit Refund Schemes? Recykal. https://recykal.com/blog/why-are-countries-all-around-the-world-implementing-deposit-refund-scheme/
- Watkins, E. et al. (2019), “Policy approaches to incentivise sustainable plastic design”, OECD Environment Working Papers, No. 149, OECD Publishing, Paris, https://doi.org/10.1787/233ac351-en.
- Viteri, J. S. (2022, March). Ecuador’s deposit return system for PET plastic bottles.
- Kaur, H., Garg, K., Sakshi, N., Mohan, C., & Singh, S. (2024). Role of green chemistry in producing biodegradable plastic and its role in sustainable development. In World sustainability series (pp. 23–49). https://doi.org/10.1007/978-3-031-77327-3_2

SustainaBlue
HEIs stands for Higher Education Institutions

Co-funded by the European Union

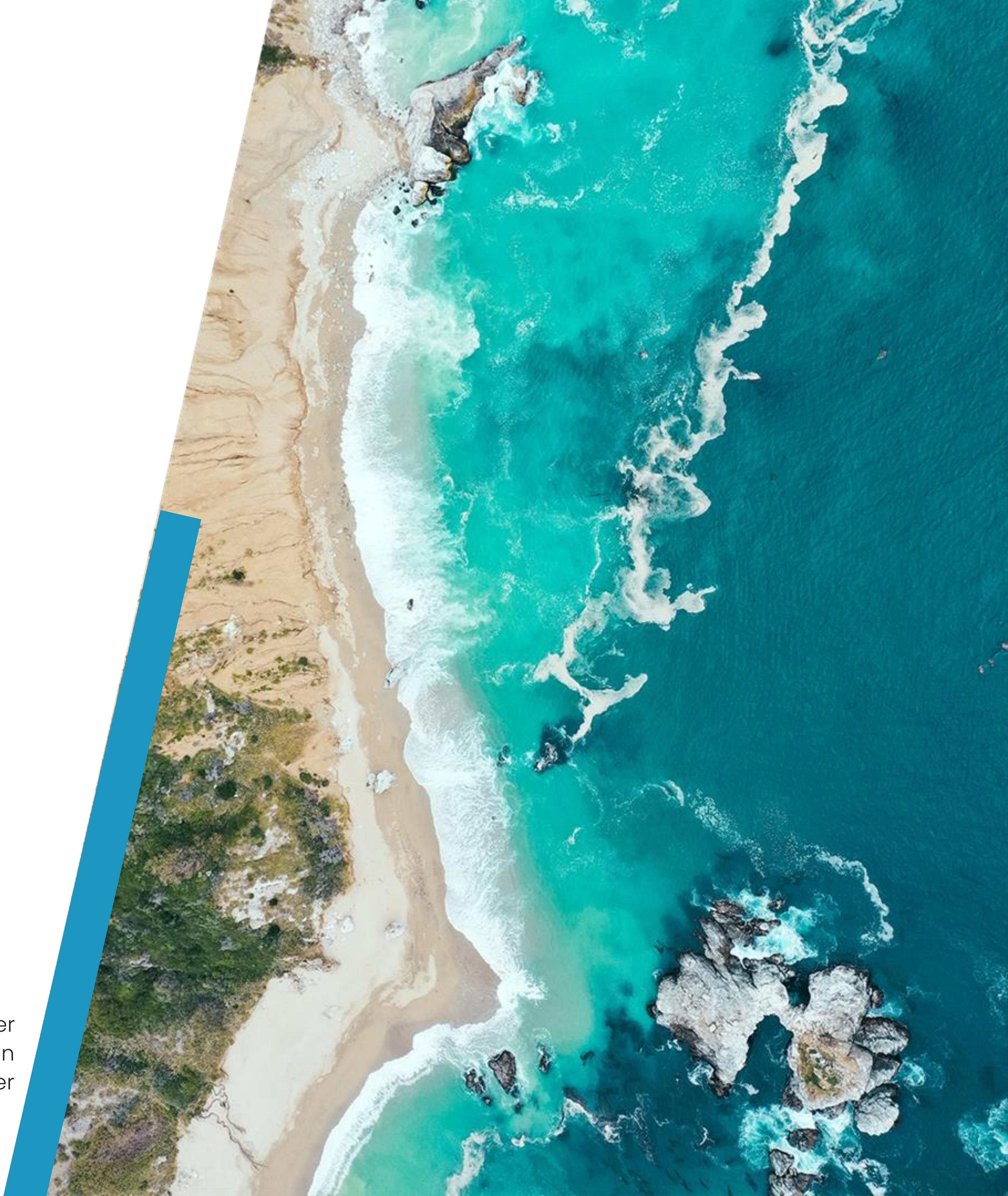
SustainaBlue

HEIs stands for Higher Education Institutions

THANK YOU

KESAVEN BHUBALAN

kesaven@umt.edu.my



Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Project: 101129136 — SustainaBlue — ERASMUS-EDU-2023-CBHE