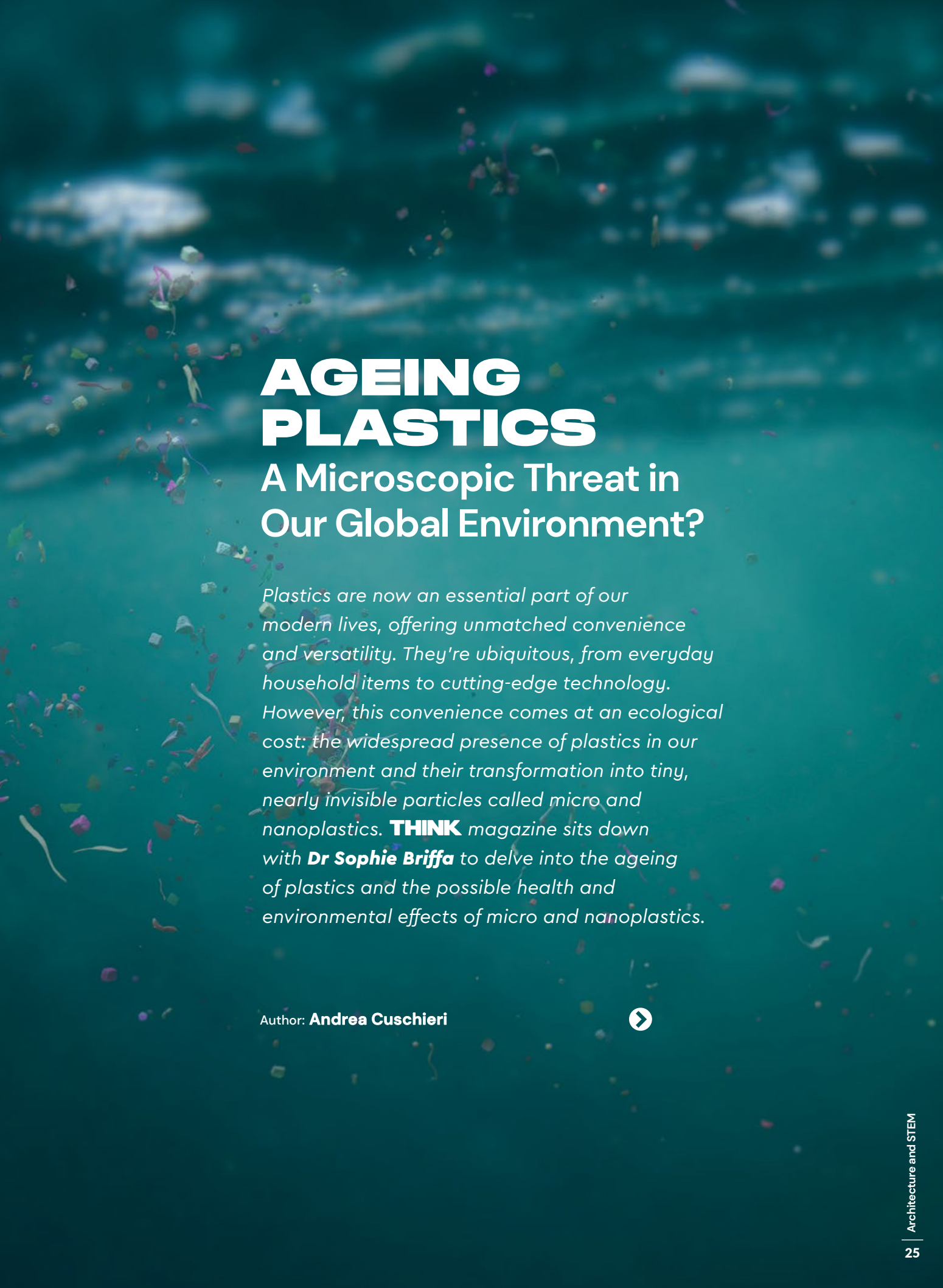
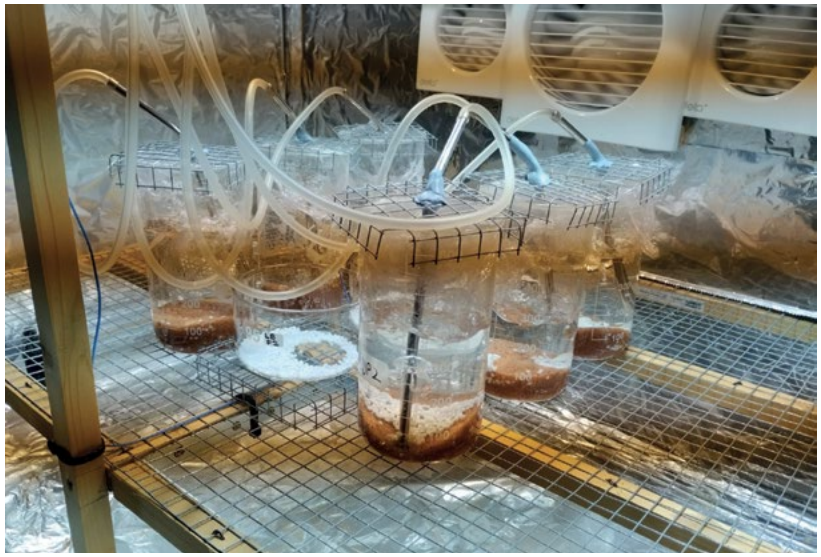


AGEING PLASTICS

A Microscopic Threat in Our Global Environment?

Plastics are now an essential part of our modern lives, offering unmatched convenience and versatility. They're ubiquitous, from everyday household items to cutting-edge technology. However, this convenience comes at an ecological cost: the widespread presence of plastics in our environment and their transformation into tiny, nearly invisible particles called micro and nanoplastics. **THINK** *magazine sits down with* ***Dr Sophie Briffa*** *to delve into the ageing of plastics and the possible health and environmental effects of micro and nanoplastics.*

Author: **Andrea Cuschieri**



Environmental ageing of micro/nano-plastics
Image courtesy of Dr Sophie Briffa

Microplastics are typically defined as plastic particles measuring less than 5mm in size, roughly the length of a grain of rice. In contrast, nanoplastics are even smaller, often measuring 100 times thinner than a human hair. However, the exact size distinctions between microplastics and nanoplastics can vary, contributing to ambiguity in terminology, especially concerning safety regulations in different regions.

One of the significant challenges scientists face when dealing with these minuscule plastics is the limited knowledge surrounding their potential harms. 'There is so much we don't know about the harmful effects of micro and nanoplastics, especially their toxicity effects on humans,' explains Dr Sophie Briffa, lecturer at the Faculty of Engineering, UM. The human body's ability to interact with and respond to particles of such diminutive dimensions remains a subject of ongoing research.

However, detecting and quantifying micro and nanoplastics poses a formidable challenge. Their small size and organic nature make them elusive in environmental samples. To complicate matters further, current technology has limitations. For instance, the detection of nanoplastics in bottled water is constrained by the equipment's ability to identify particles smaller than a certain threshold, similar to searching for a needle in a barn full of haystacks.

HOW UM RESEARCHERS ARE STUDYING AGEING TINY PLASTICS

Getting a grasp on how these tiny plastics break down, or age, is vital. It helps us understand what to look for when trying to detect these minuscule plastics. One such approach involves replicating plastics' degradation under environmental conditions, for example, in seawater.

Dr Briffa and her team conducted experiments to simulate the ageing of a specific plastic, polyethylene terephthalate (PET), within a controlled environment. Thanks to the controlled environment, they could closely observe how these plastics gradually transformed into nanoplastics over time.

Here, the researchers selected PET pellets, a commonly used plastic in various consumer products. These PET pellets were exposed to extended periods of UV radiation, mimicking the effects of sunlight, inside a specially designed weathering chamber filled with water columns to simulate seawater conditions. The initial observations have yielded fascinating insights into the plastic's ageing process. Within a relatively short period of 100 days, the researchers observed changes to the microplastics and were able to detect nanoplastics within the water column.

Research into the ageing of plastics conducted by Dr Briffa and her team is part of a broader effort to shed light on the environmental ageing of plastics. One of the key takeaways from their ongoing study is that plastic ageing indeed leads to transformations, even within a relatively short time frame. Although the research focused on PET, it opens up a plethora of questions about how other types of plastics may behave under similar conditions. Given the vast diversity in the chemical composition among plastics, the extent and nature of their transformations remain uncertain.

Studying tiny plastics presents a range of challenges. The tools scientists use to detect and measure them

Dr Sophie Briffa
Photo courtesy of Francesca Attard (iCreatemotion studio)

have limitations. Traditional microscopes struggle to see particles of this minuscule size, and although special stains like Nile Red (a dye used to enhance the visibility of molecules as it fluoresces) can help make them visible, these methods are not without their limitations.

Another challenge is the complex organic background of the environment. In nature, plastics coexist with various other organic materials, making it challenging to isolate and identify nanoplastics accurately. The intricacies of working within this organic matrix necessitate innovative solutions and refined techniques for accurate detection and quantification.

THE JOURNEY TO GREENER PLASTICS: HOW UNDERSTANDING AGEING MAKES A DIFFERENCE

Ongoing research into plastic ageing is just the beginning. To fully understand how different plastics age and transform in various conditions, future studies must broaden their scope. This includes investigating other commonly used plastics like polystyrene, polypropylene, and biodegradable polymers, each of which may exhibit unique ageing characteristics, affecting their environmental impact.

Research should also consider a wider range of environmental factors such as UV exposure, temperature changes, and different aquatic environments to get a more detailed understanding of plastic behaviour and promote eco-friendly practices.

Understanding how plastics change over time is crucial for reducing their environmental impact. As our understanding of plastic ageing grows, we can influence how plastic products are made. Knowledge about durability and long-term effects can drive innovation, leading to more eco-friendly materials and production methods. Addressing plastic's environmental impact requires collaboration between governments, industries, and individuals. Companies must reduce plastic waste, adopt sustainable practices, and explore alternatives. Consumers, armed with information, can make informed choices, and awareness campaigns can promote responsible plastic use. By supporting eco-friendly products, consumers are demanding corporate responsibility and a greener future.

As our knowledge of plastic ageing grows, it can influence policy making, impacting initiatives like the Sustainable Development Goals and the European Green Deal, which aim to reduce plastic use and protect the environment. This knowledge empowers individuals to advocate for responsible practices, influencing regulations and corporate behavior to work towards a more sustainable future.

TACKLING THE ENVIRONMENTAL PROBLEM OF MICRO/NANO-PLASTICS (MNPs)

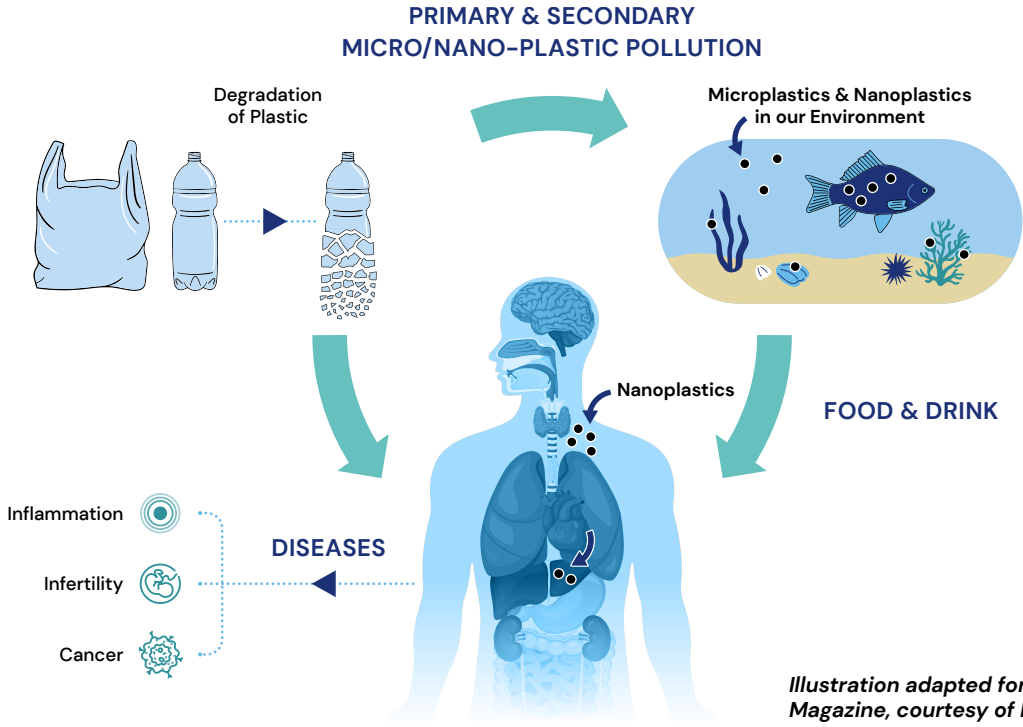
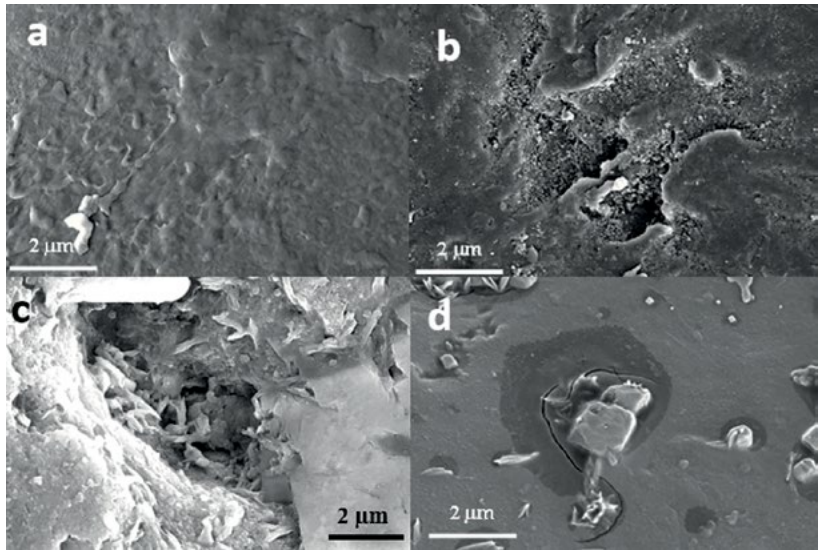


Illustration adapted for **THINK** *Magazine, courtesy of Dr Sophie Briffa*



Relevant experience:
- **Set-up development**
- **Organic Characterisation (Raman and microscopy)**
- **Understanding NM behaviour in the environment**

Results:
- **Weathering chamber successfully designed**
- **Physical and chemical changes noted**
- **Microplastics were detected in the liquid column**
- **Complexity of dynamic ageing environmental processes**

Image courtesy of Jack Galea