UNIVERSITA' DEGLI STUDI DI MESSINA

Dipartimento di Scienze Chimiche, Biologiche, Farmaceutiche ed Ambientali

Corso di Dottorato in Biologia Applicata e Medicina Sperimentale

XXXVII Ciclo

SSD: BIO/07

Impiego, riutilizzo e riciclo di plastiche biodegradabili in impianti di mitilicoltura

Tesi di Dottorato di:
Giuseppe Cangemi

Tutor UNIME:
Prof. Fabio Marino

Tutor SZN:
Dott.ssa Teresa Romeo

Co-Tutor SZN:
Dott.ssa Carmen Rizzo

Coordinatore:
Prof.ssa Emanuela Esposito

Anno Accademico 2023/2024

The waste related to the fishing sector represents 14% of marine litter (ML) and causes a significant impact on marine biodiversity. The "socks" used for the cultivation of mussels represent 77% of the plastic waste deriving from the production chain and are in third place among the waste deposited on the seabed, especially in proximity of mussel farming plants. These wastes can remain in the marine environment and undergo physical, chemical and biological degradation processes, giving rise to microplastics (MPs), which can be ingested by numerous marine organisms, in particular by filter-feeding bivalves.

For this reason, this study focuses on the management of this type of waste through the use of socks made of biodegradable and compostable bioplastics, specifically Mater-Bi®, as an alternative to traditional polypropylene (PP) socks used in mussel farming plants, in order to mitigate the impact related to the dispersion of this type of waste in the environment. Furthermore, it is important to simultaneously monitor the accumulation of MPs in mussels, sediments and waters surrounding the farms and the microbial communities associated with the two materials to evaluate the degradation modes and the impact of these activities in a delicate lake environment such as Lago Faro (ME). A total of 240 individuals of *Mytilus galloprovincialis* were collected at four times from both types of socks and tissues were chemically digested using potassium hydroxide to extract plastic. Visual sorting was used for water and sediment samples. The abundance and characterization of plastic was determined under a stereomicroscope, allowing the identification of size, shape, and color. Overall, 183 MPs were isolated from the 240 mussel samples, respectively in 54.17% of the samples taken from MBi socks and in 49% of the samples taken from traditional socks. From the surface water samples, 404 plastic particles were isolated with an average concentration of 0.76±0.73 particles/m^3; a total of 106 plastic particles with an average concentration of 26.5 ± 24.2 MPs/1000g were isolated from the sediment samples. Fragments and filaments were the most common shapes detected. NGS analyses highlighted a marked differentiation between the bacterial communities associated with the two substrates.

The multidisciplinary approach used in this study has provided a detailed view of MPs contamination in the research area. The collected data also provide fundamental information on the behavior of new biodegradable and compostable materials, opening new opportunities for the development of sustainable solutions in the field of mussel farming.