MICRO 2024 PLASTIC POLLUTION FROM MACRO TO NANO

A RELIABLE ANALYTICAL METHOD TO QUANTIFY AND CHARACTERISE MICROPLASTICS IN MUSSELS AND CLAMS USING GOLD-COATED FILTERS AND QUANTUM-CASCADE LASER INFRARED TRANSFLECTANCE IMAGING (QC-LDIR)

A. López-Rosales, Jose M. Andrade, M. Estela del Castilllo Busto, Elba Iglesias Juan Carnota-Nuñez, Paula García-Tejedor, Soledad Muniategui-Lorenzo

Grupo Quimica Analítica Aplicada, Instituto Universitario de Medio Ambiente, Facultade de ciencias,

Universidade da Coruña. Campus da Zapateira, E-15071 A Coruña, Spain.

QAnAp Química Analítica Aplicada Research Group

INSTITUTO UNIVESITARIO DE MEDIO AMBIENTE UNIVERSIDADE DA CORUÑA

UNIVERSIDADE DA CORUÑA

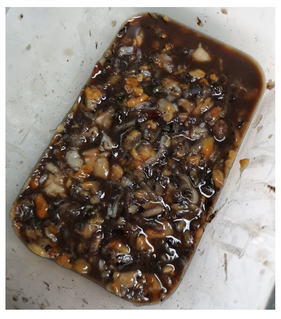
1. INTRODUCTION AND OBJECTIVES

Galicia, a major seafood producer in Spain, ranks second in mussel production worldwide. Mussels, efficient filter feeders, are key to studying environmental microplastics (MPs) due to their sentinel role. This study aims to compare three methods for isolating MPs from bivalves. The enzymatic-oxidative one was the most effective, although the two-step alkaline-oxidative method revealed also as a viable, low-cost option. The study introduces also a high-throughput characterisation technique using quantum-cascade laser imaging and gold-coated filters.

2. SAMPLE PREPARATION

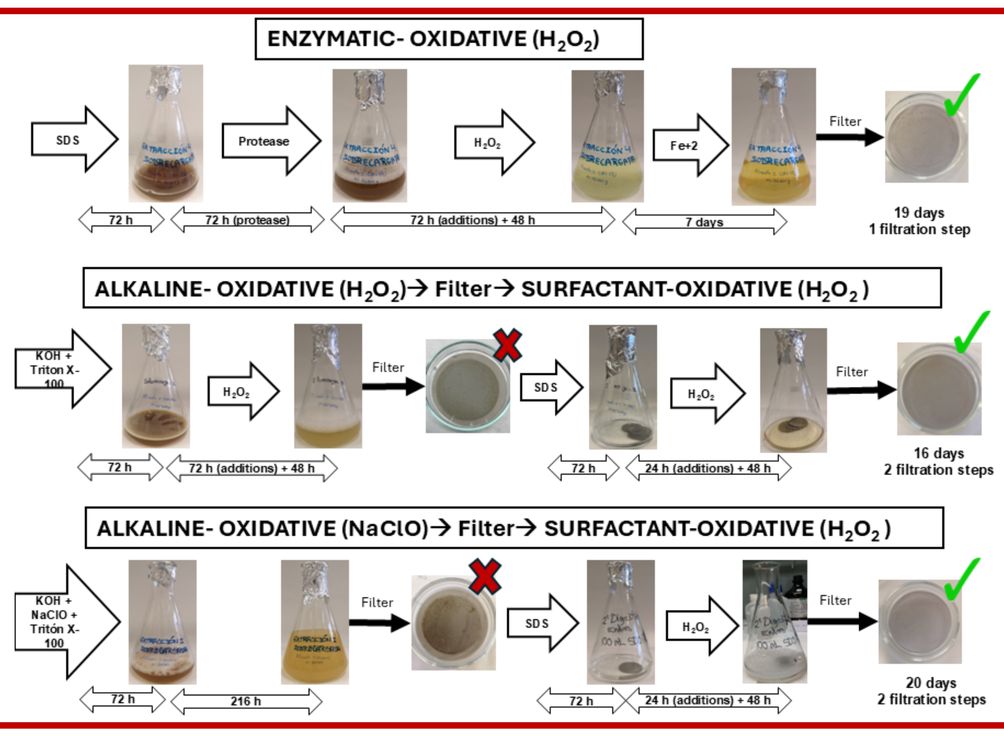
Defrost

Removal and slicing edible parts

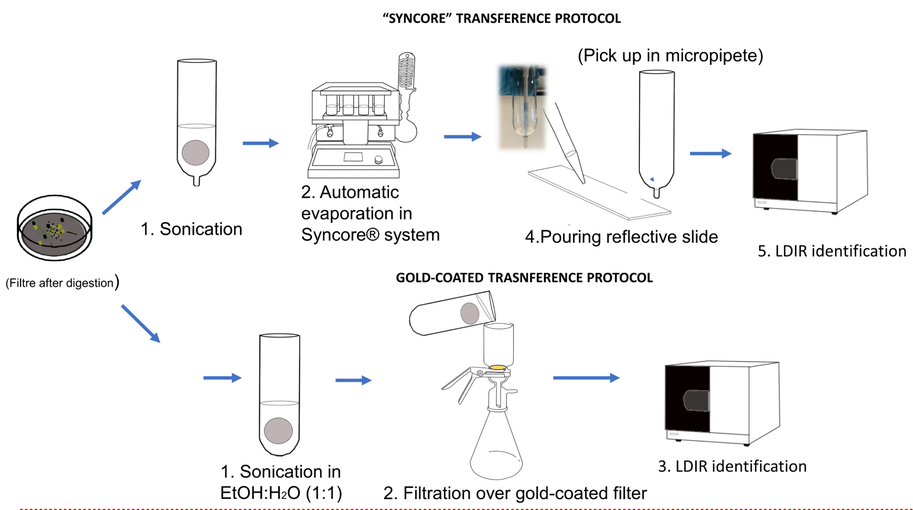


Homogenisation

3. COMPARISON OF DIGESTIONS

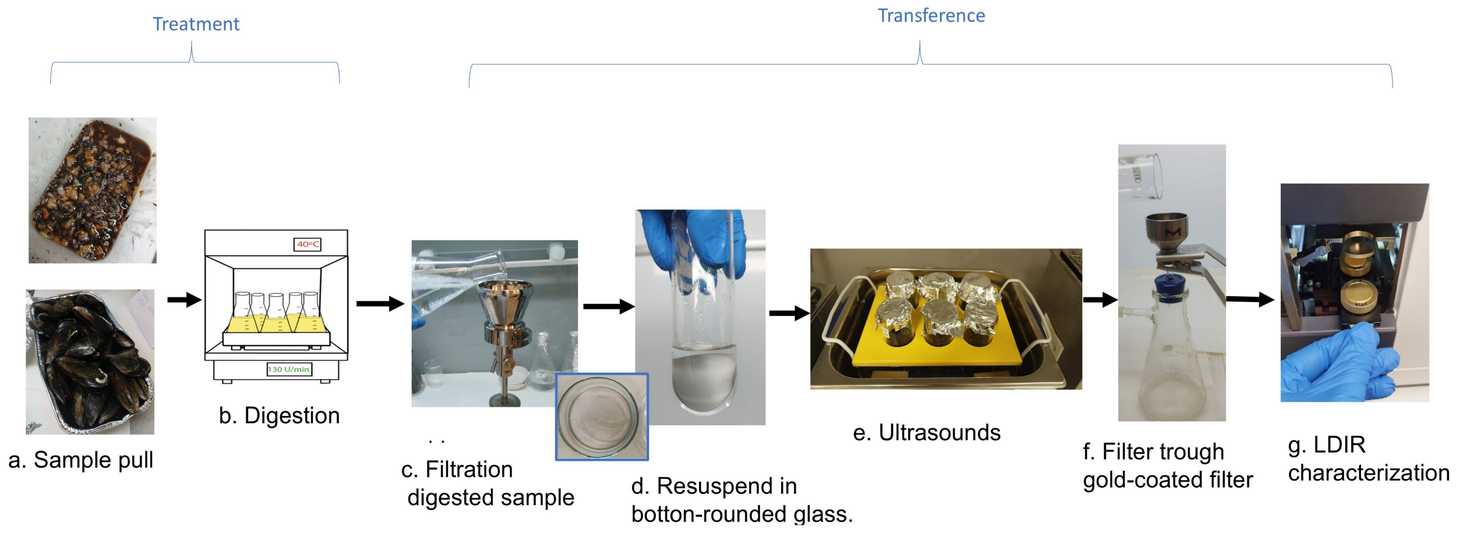


4. COMPARISON OF TRANSFERENCE FORMS



- Particle recoveries: 85-90 % (reflective slide) & 90-97 % (GC filter)
- Fibre recoveries: 65-72 % (reflective slide) & 81-99 % (GC filter)
- Time: 3 days (reflective slide) & 5 h (GC filter)

5. FINAL OVERALL PROTOCOL



Enzymatic digestion, pre-filter sample through a 10 µm stainless steel filter, sonicate and filter through gold coated filters

6. LDIR CHARACTERISATION

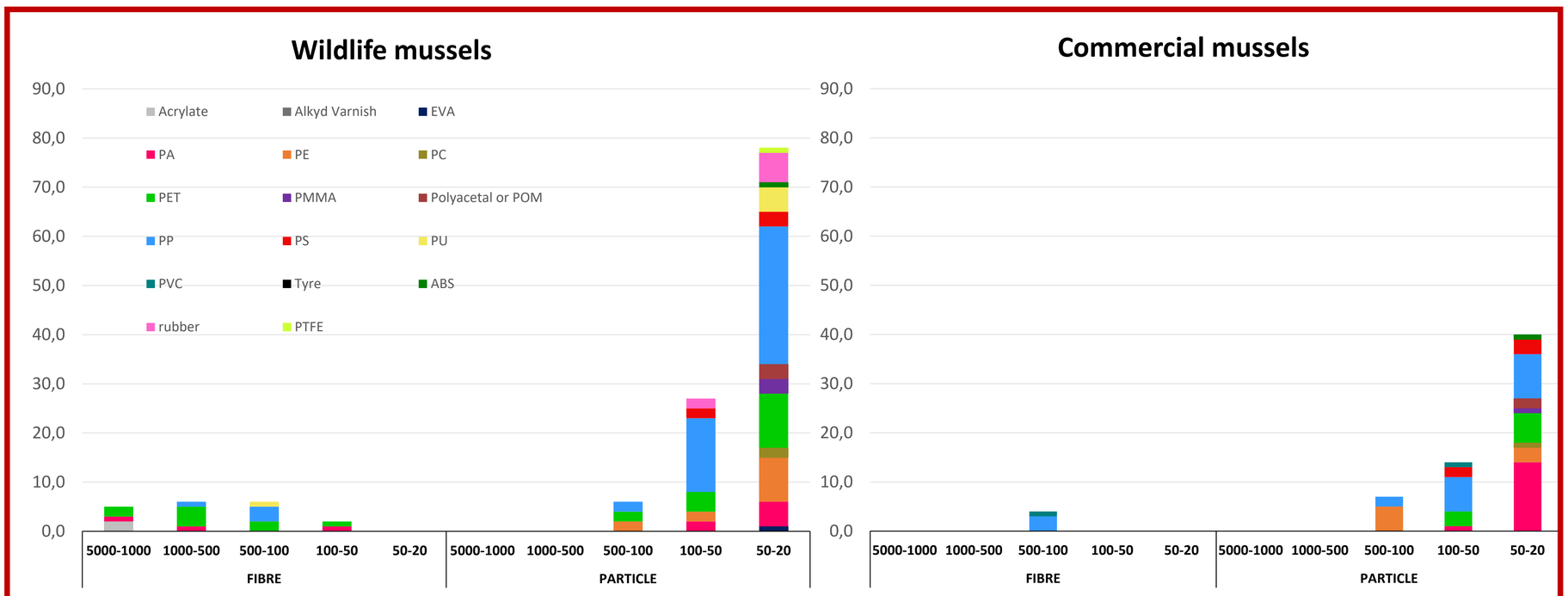
Hit Quality Index (HQI)

Low confidence
0.85 ≤ HQI < 0.9

Medium confidence
0.9 ≤ HQI ≤ 0.95

- HQI should be > 0.90 for most polymers (except for tyre and Rubber, > 0.95).
- 0.85 < HQI < 0.9 matches must be reviewed

7. APPLICATION TO SAMPLES



Most abundant polymers were PP, PET and PE. In general, the number of MPs is lower in commercial mussels for all polymers and sizes (except for PA in the 50-20 µm range).

8. CONCLUSIONS

- The comparison of three digestion procedures reveals that the enzymatic protocol performs best because in most of cases it needs only one filtration step (which improves the recoveries).
- The transference protocol using gold-coated filters is the most suitable one because it saves time and improves recoveries.

9. ACKNOWLEDGEMENTS

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