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Identification of an optimized protocol for extraction and characterization of microplastics in seafood products

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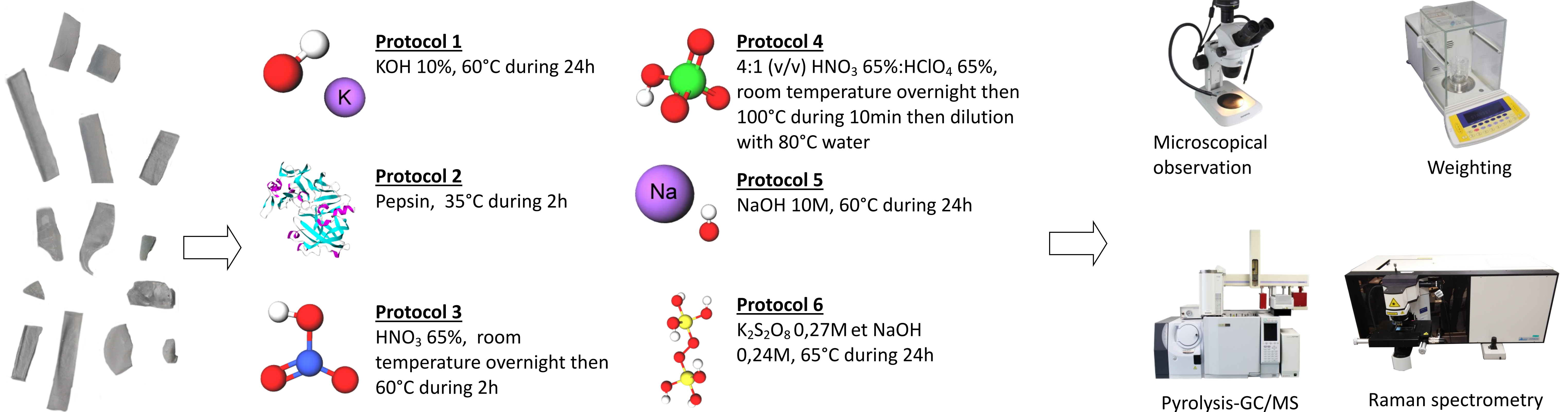
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Introduction

Microplastics particles (<5 mm) are found in the Oceans worldwide and ingestion by marine species have been recently described. Microplastics can also represent a threat for human consumers through the consumption of seafood products. To date, a few studies have investigated the levels of contamination collected *in situ*. It is crucial for microplastics extraction to use solvent(s) or chemical(s) allowing efficient tissue dissolution without degrading plastic polymers. The purpose of this work was to benchmark six existing protocols on fifteen plastics polymers and assess their impact on polymers integrity coupled with an efficient digestion of biological matrices.

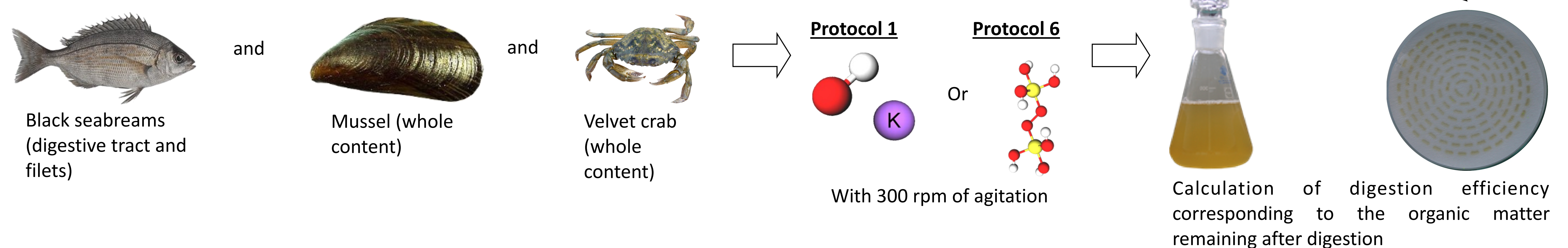
Material and methods

Experiment 1 : Testing 6 different protocols on plastics integrity



Fifteen tested families : high and low density polyethylene (HDPE & LDPE), polypropylene, (PP) expanded polystyrene (ePS), crosslinked polystyrene (PSXL), polystyrene (PS), poly(methyl-methacrylate) (PMMA), poly(lauryl-lactam) (PA-12), polycaprolactam (PA-6), polyethylene terephthalate (PET), polyurethane (PUR), polytetrafluoroethylene (PTFE), unplasticized polyvinyl chloride (uPVC), polycarbonate (PC) and cellulose acetate (CA)

Experiment 2 : Application of selected protocols on seafood products



Results and discussion

Experiment 1

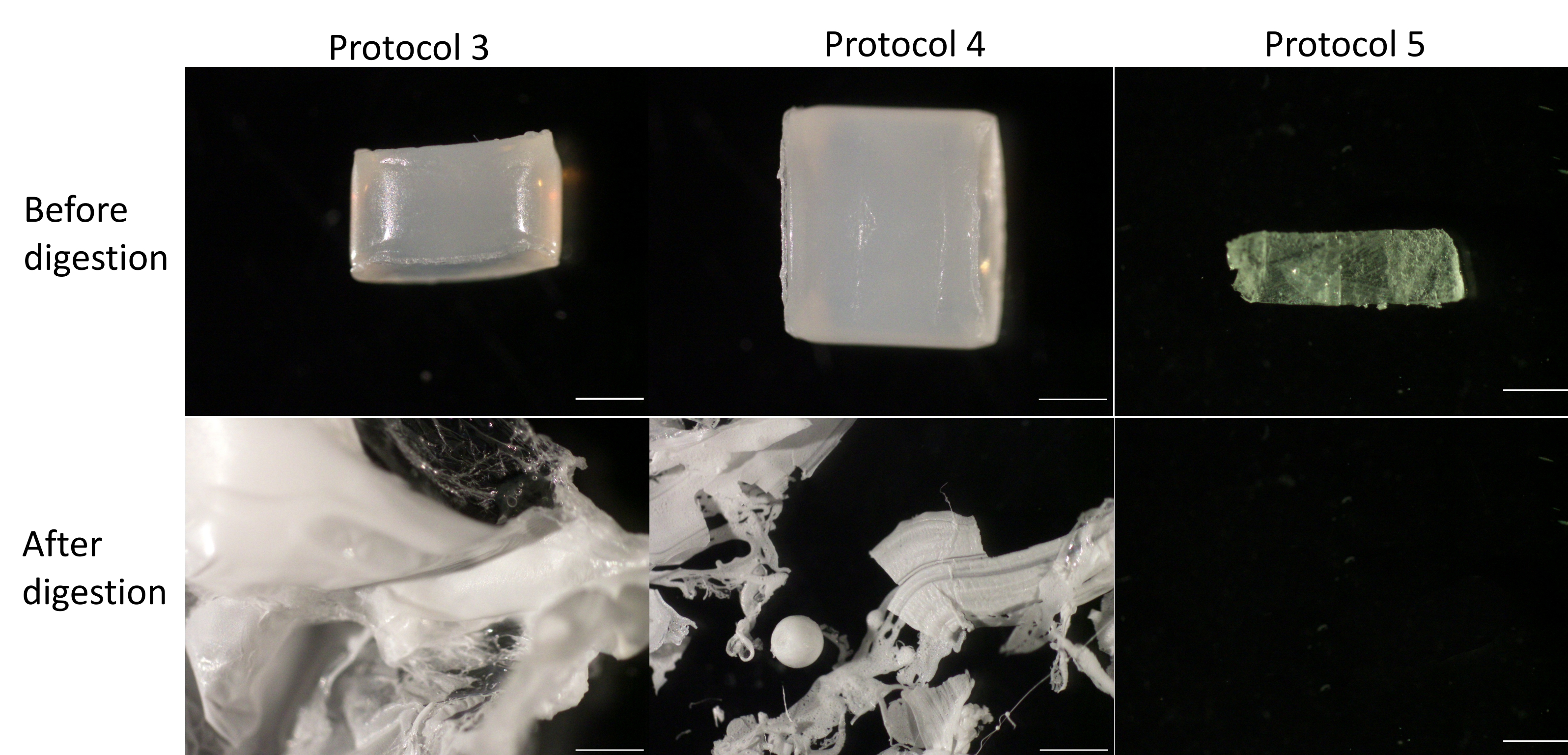


Figure 1 : Pictures of plastics degraded using protocol 3, protocol 4 and protocol 5. White bars represents 1mm

During experiment 1, with protocol 3 and 4, PA-12 plastic are partially degraded and with protocol 5 PC is totally degraded (Figure 1). Moreover, protocol 2 using pepsin is too expensive to be kept to be applied in field survey. Finally none of these protocols (2, 3, 4 and 5) were kept as promising protocols for the following experiment 2. Protocols 1 and 6 were used for experience 2 as they have no impact on plastic integrity and identification using Pyrolysis-GC/MS and Raman spectrometry.

Conclusion

Protocol 1 using KOH 10% at 60°C during 24h at 300rpm is proposed to be a suitable protocol for extraction and characterization of microplastics in seafood products. This protocol should be recommended by international bodies. The selected protocol is now apply in a field study to determine the prevalence of microplastics in the major seafood products consumed in France.

Experiment 2

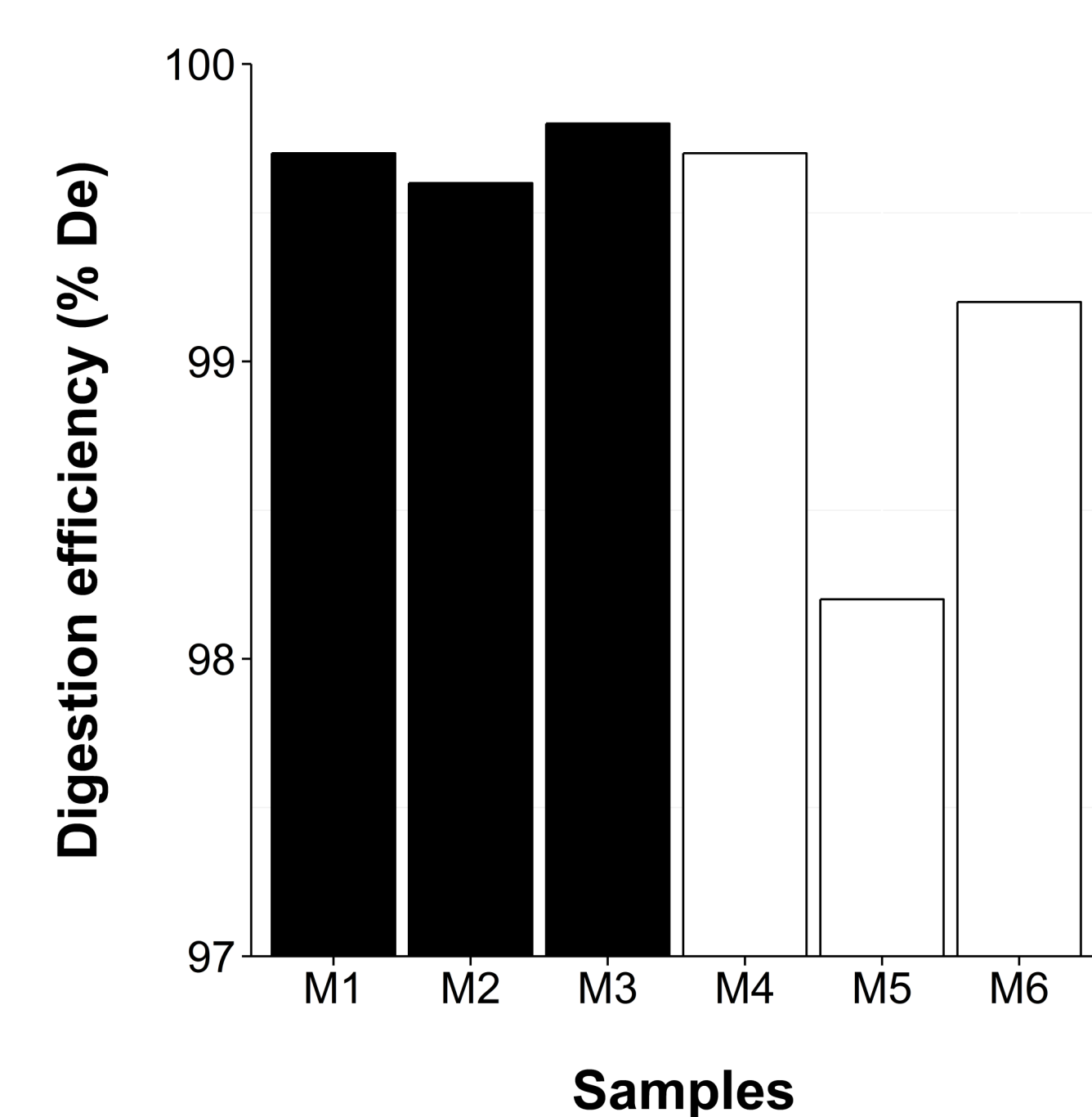


Figure 2 : Comparison of digestion efficiency for three musells treated with protocol 1 (M1 to M3) and with protocol 6 (M4 to M6)

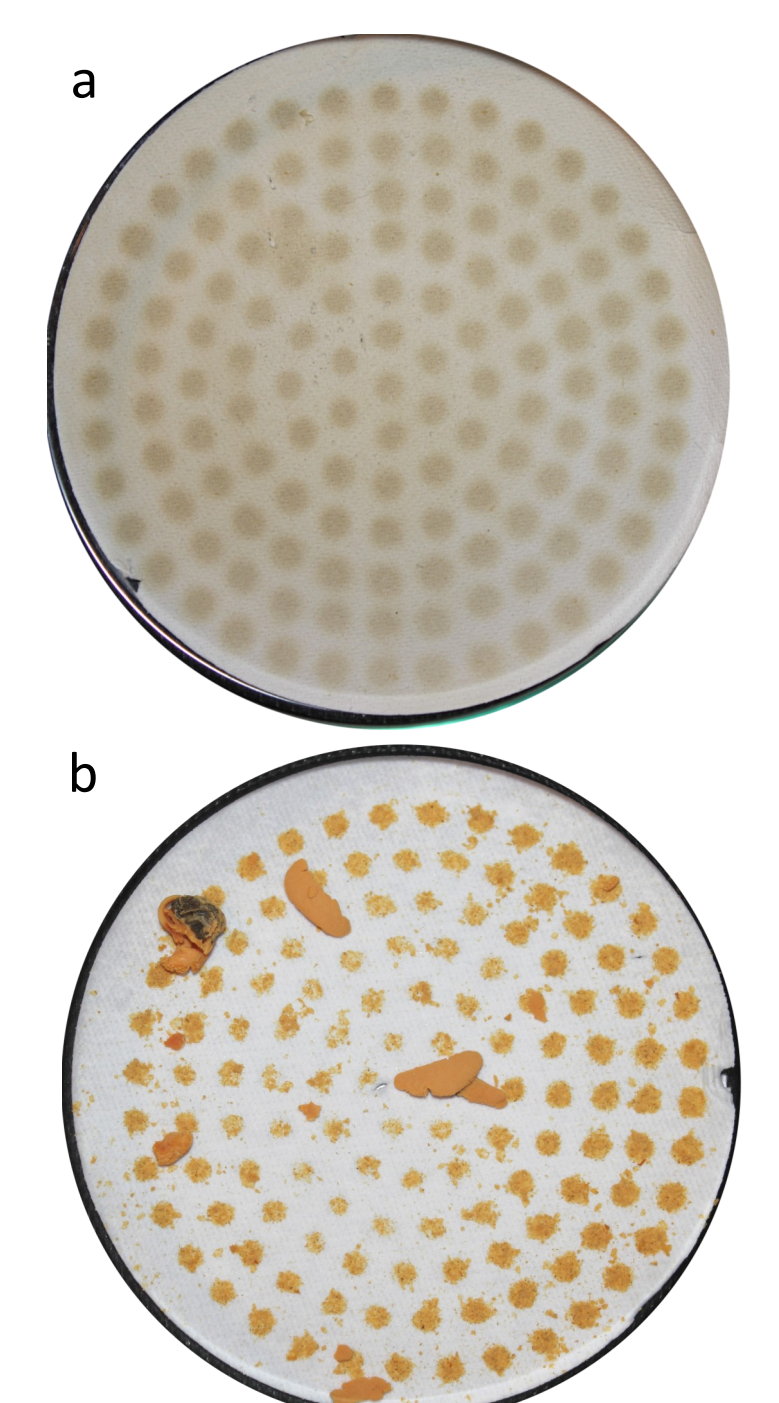


Figure 3 : Musells filters after digestion with protocol 1 (a) and protocol 6 (b)

During experiment 2, protocol 6 did not efficiently digest whole musells (Figure 2) as pieces of musells were still visible (Figure 3b). Protocol 1 allowed a good filtration and revealed negligible debris (Figure 3a) on the filter after digestion of musells. Digestion of velvet crabs and black seabreams using protocol 1 led to easy filtration and observable filters.

Acknowledgments

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