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OCCURRENCE OF MICROPLASTICS IN THE BURROWING CRABS *C. armatum and C. amnicola* FROM MANGROVE TIDAL MUDFLATS IN LAGOS, NIGERIA

***Olarinmoye, Oluwatosin M., Badmos, L. A., Mekuleyi, G. A. and Awe, F. A.**

Department of Fisheries, Lagos State University, PMB 0001 Ojo, Lagos Nigeria.

*Corresponding authors' email: pisxs22@gmail.com Phone: +2348074009529

ABSTRACT

Numerous studies have documented Microplastics (MP) in aquatic and associated terrestrial environments including wetlands, worldwide Crabs, Because of their habitual bioturbatory activities crabs are more exposed to microplastics (MP) sequestered in wetlands where they feed and inhabit. The MP particles gain entrance through inadvertent ingestion while foraging for food, and tidal inundation of holes and burrows. This study investigates the occurrence and types of microplastics in the burrowing crabs *Cardisoma armatum* and *Callinectes amnicola* from mangrove tidal mudflats in Ojo, Lagos, Nigeria. Microplastic ingestion and retention in two crab types, *C. armatum and C. amnicola* was assessed. Crab GIT and gills were extracted and digested using a potassium-peroxide based tissue digestion protocol followed by visual segregation of suspect particles and confirmation using Fourier micro- transform infrared spectroscopy (μ-FTIR). 10 subjects from each species were sampled, with 112 suspect MP mainly Fibrous (96%), with a preponderance of black (64%), and, blue fibres (20%). Other occult MP consisted of various fragments and films of various colours ranging from red to yellow. Mean lengths and widths of potential MPs (were 669 and 802.8 µm respectively.38 particles were successfully analysed by FTIR, with 16 definitively typed as plastic, the majority of which were Rayon (67%), followed by PET (13%),with PP,PA,PET, and Nylon constituting the remainder of typed plastic. Total organ plastic occurrence percentages were (49% and51% each for gills and stomachs respectively. This study's findings contribute to the growing body of evidence on microplastic ingestion and retention in marine organisms.

Keywords: Microplastics, Lagos, Nigeria, *Cardisoma armatum*, *Callinectes. amnicola*

INTRODUCTION

Microplastics (MP) are fast attaining contaminants of concern status as a result of their worldwide presence in all environmental compartments, especially the aquatic. In this last environmental niche their ubiquity translates into significant bioavailability to Denizen species in the world's water bodies and concern for their possible effects on ingesting incidental subjects. Numerous studies have documented Microplastics (MP) in aquatic and associated terrestrial environments including wetlands, worldwide.

The risk of incidental MP Ingestion by aquatic and semi aquatic organisms, and probable deleterious effects consequent on the latter have fueled increasing concerns about the health of exposed populations of fauna, and, population/ecological integrity. Especially, with increasing evidence of the vectorial significance of MP in the persistence and transfer of chemical pollutants which makes these more bioavailable to less discriminatory feeders like crabs Whose natural bioturbatory habits bring them into close contact with detrital material and associated contaminants. Which presumably makes them more vulnerable to the ingestion-effect continuum (Villagran et al., 2020), contrary opinions concerning the roles of MP and their role in promoting the ingestion of hydrophobic organic fouling agents exist (Engler, 2012; Koelmans et al., 2016; Teuten et al., 2007).

Although, no pathognomonic pathologic sequelae. Have been documented widely which are attributable to microplastic ingestion per se, this, maybe due to their inherent chemical inertness and indigestibility primarily. In recent times, there has been concern about the effects of fouling chemicals and persistent organic pollutants which could adhere to microplastics a making such chemicals more bioavailable to aquatic animals (Amelia et al., 2021; Andrade et al., 2021; Rochman et al., 2013), over considerable distances. These latter vectorial, and transport roles could have serious ecological implications for individual life forms and ecological food webs (Heinrich & Braunbeck, 2019; Tumwesigye et al., 2023; Walkinshaw et al., 2020) via trophic transfer mechanisms (Mateos-Cárdenas et al., 2022). In consequence, Microplastics are fast attaining an important adjunct role in aquatic chemical pollution and transmission.

This study was undertaken to establish the presence , types and comparative contributions of MP load between active foraging as (evidenced by examination of GI contents) and tidal inundation of beach and burrow (gills), of crabs from an intertidal estuarine habitat inhabited by the burrowing crab species .*C, armatum and C. amnicola* in Lagos Nigeria.

MATERIALS AND METHODS

Study Area

Ojo is a primarily residential town in a local government area of the same name in Lagos state Nigeria with an estimated population of 941,523 (LBS, 2017).Inhabitants are mainly fisher folk and, traders though a thriving local sand dredging industry exists.

Specimen acquisition and processing

Specimens of *C. armatum and C. amnicola* were purchased from the Ojo quayside market, and transported on ice in coolers to the Fisheries laboratory of the Lagos state university. Cooling during transport, Apart from keeping specimens fresh also was an effective means of immobilisation inducing torpor in the specimens before arrival in the laboratory which eased the following handling and organ isolation steps. On arrival, Specimens were measured (Table (1and2). subsequently pithed, and dissected for removal of the gastrointestinal tracts and gills. Soft tissues were stored at -20$^{0C.}$until analysed.

Microplastic extraction
Excised soft tissues were thawed and allowed to reach room temperature in covered glass petri dishes for a few hours. They were then digested using 10% KOH solutions. Resulting solutions were filtered through Whatman Number 5 filter papers (product Catalog number: 1005-055). Filters were placed in clean labelled glass Petri dishes and allowed to dry.

Quality control
Efforts were made to reduce and eliminate airborne Contamination. During laboratory screening for MPs including the swabbing of all work surfaces with 70% ethanol solution before the start of procedures. Aliquots all individuals involved wore cotton lab coats and latex gloves. laboratory doors and windows were shut to reduce wind-borne contamination. Uncovered Petri dishes with filter paper discs were left on the work areas to serve as blanks for determining the incidence of airborne MP contamination. Plastic fragments and MPs from the blanks were analysed along with the specimen filters.

Visual inspections
Filters were visually examined under a Leica MZ10F with a GXCAM-U3PRO-20 camera attachment microscope and suspected plastics were imaged in Capture-T software (Version ×64).Suspected microlitter items suspected to be of plastic origin were identified for further identity confirmation and polymer type identification.

FTIR polymer identification and validation
A LUMOS II FTIR Imaging Microscope (Bruker, UK) was used for definitive Identification of suspect MP. Using a micro-ATR (objective coupled with a liquid nitrogen-cooled MCT (Mercury-Cadmium-Telluride) IR infrared detector. For micro-ATR FTIR, Spectra were collected in reflectance mode in the range 4000-500 cmG1 at a resolution of 4 cmG1. For particles that couldn't be analysed using micro-ATR FTIR, transmission mode was used. For transmission mode, particles of interest =were transferred to 25 mm Anodisc filters (0.2 m porosity, Whatman, VWR, UK). Spectra were collected in transmission mode in the range 4000-1250 cmG1 at a resolution of 4 cmG1. For all cases, polymer
Identification was verified based on the percentage match against trusted microplastic spectral libraries From Bruker Optics ATR-Polymer Library, Diamond-ATR, IR-Spectra of Polymers. etc.

RESULTS AND DISCUSSION
112 potential MPs were visually identified figure1 and 3). Mainly fibrous. Mean lengths and widths of potential MPs (were 669 and 802.8 µm respectively. Black fibres were most preponderant followed by Blue. 38 particles (40%), successfully analysed And typed by ATR-FTIR. 16 (42%) of these were definitively typed as MP with remaining items being of natural/ cellulosic origin (Rayon was the most abundant MP type at26%), followed by PET, polyacrylate, and nylon.(Figure 2).

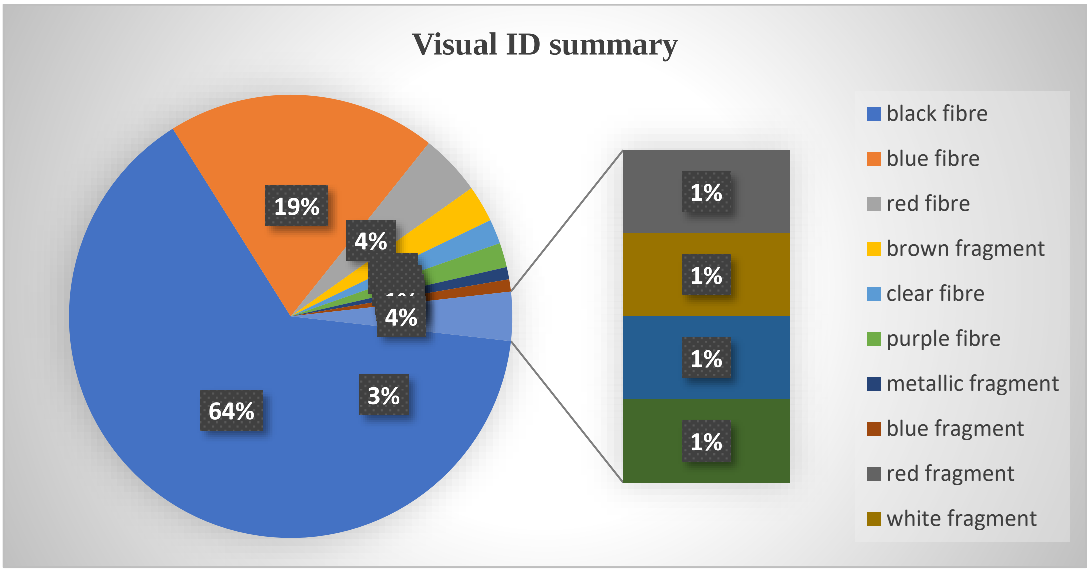

Figure 1: Visual ID summaries

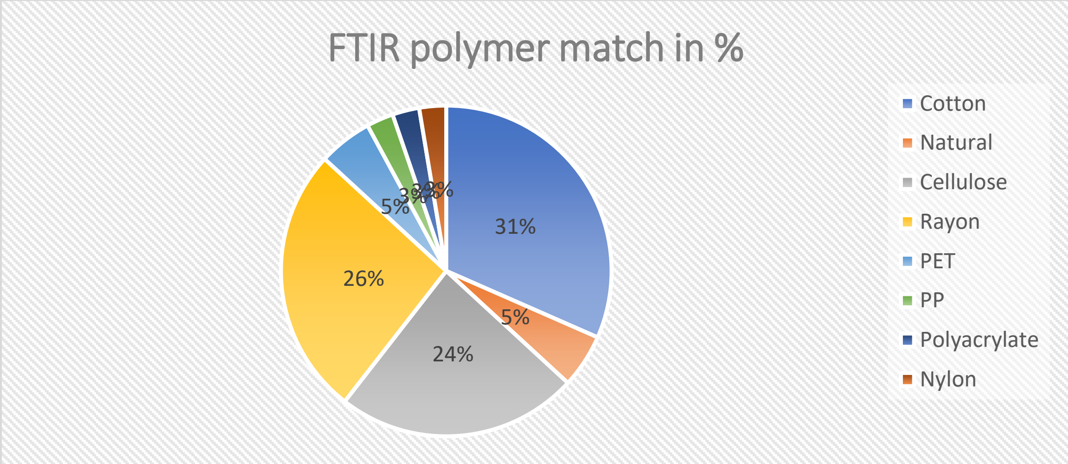

Figure 2: FTIR polymer ID results

Discussion

The presence of microplastics (MP) in the burrowing crabs *Cardisoma* armatum and *Callinectes amnicola* from mangrove tidal mudflats in Ojo, Lagos, Nigeria, mphasises the pervasive nature of microplastic pollution in aquatic and associated environments (Browne et al., 2011). This study's findings contribute to the growing body of evidence on microplastic ingestion and retention in marine organisms

The predominance of fibrous microplastics (96%), particularly black (64%) and blue fibers (20%), is consistent with previous studies documenting the abundance of synthetic fibers in marine environments close to urban locations (Dris et al., 2018; Kaliszewicz et al., 2020)). The identification of Rayon as the primary microplastic type, followed by PET, polyacrylate, and nylon, suggests a significant contribution from textile(Zambrano et al., 2019) and other textile associated synthetic fabric waste. Probably arising from waterside laundering of clothes.The similar percentages of microplastic occurrence in gills (49%) and stomachs (51%) of both species is indicative of the near equal contributions of tidal inundation and active foraging to microplastic ingestion and gill sequestration. This finding supports the notion that crabs, as bioturbators, are particularly vulnerable to microplastic exposure due to their habitat and feeding behaviours. Microplastic ingestion by crabs raises concerns about food safety, as these crustaceans are a common food source for humans (Smith et al., 2018). The potential transfer of chemical pollutants via microplastics could lead to bioaccumulation and biomagnification in the food chain, posing health risks to consumers(Rochman et al., 2013).

CONCLUSION

This study's findings contribute to the growing body of evidence on microplastic ingestion and retention in marine organisms.

Implications for Ecosystem Health: The ingestion of microplastics may have subtle, long-term effects on crab health and population dynamics(Urbina et al., 2023), potentially impacting ecosystem balance (Wright et al., 2013). Microplastics can also serve as vectors for invasive species, pathogens, and pollutants, further threatening ecosystem integrity (Barnes et al., 2009). , and could affect feeding behaviours through less foraging intensity through inducing illusory satiation (Matheus et al., 2020).

RECOMMENDATIONS

More intensive efforts are required by government and regulatory bodies to mitigate microplastic pollution in Nigerian coastal ecosystems: This necessarily would involve the Implementation of more effective waste management strategies, focusing on textile and plastic waste reduction, coupled with regular monitoring of microplastic pollution in Nigerian aquatic environments. Future research should prioritise investigations into microplastic transfer through trophic levels in controlled studies simulating realistic food webs and chains. In addition, there should be enhanced collaborative efforts between investigators and laboratories for the development of standardised protocols for microplastic analysis and identification for use in Nigeria.

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