

## Environmental Forensic Analysis of the Shoreline Microplastics Debris on the Limbe Coastline, Cameroon

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**Abstract :** The prevalence and unpleasant nature of plastics pollution constantly observed on beach shore on stormy events has prompt researchers worldwide to thesis on sustainable economic and environmental designs on plastics, especially in Cameroon, a major touristic destination in the Central Africa Region. The inconsistent protocols develop by researchers has added to this burden, thus the morphological nature of microplastic remediation is a call for concerns. The prime aim of the study is to morphologically identify, quantify and forensically understands the distribution of each plastics polymer composition. Duplicates of 2×2 m (4m<sup>2</sup>) quadrants were sampled in each beach/month over 8 months period across five purposive beaches along the Limbe - Idenau coastline, Cameroon. Collected plastic samples were thoroughly washed and separation done using a 2 mm sieve. Only particles of size, < 2 mm, were considered and forward follow the microplastics laboratory analytical processes. Established step by step methodological procedures of particle filtration, organic matter digestion, density separation, particle extraction and polymer identification including microscope and were applied for the beach microplastics samples. Microplastics were observed in each sample/beach/month with an overall abundance of 241 particles/number weighs 89.15 g in total and with a mean abundance of 2 particles/m<sup>2</sup> (0.69 g/m<sup>2</sup>) and 6 particles/month (2.0 g/m<sup>2</sup>). The accumulation of beach shoreline MPs rose dramatically towards decreasing size with microbeads and fiber only found in the < 1 mm size fraction. Approximately 75% of beach MPs contamination were found in LDB 2, LDB 1 and IDN beaches/average particles/number while the most dominant polymer type frequently observed also were PP, PE, and PS in all morphologically parameters analysed. Beach MPs accumulation significantly varied temporally and spatially at p = 0.05. ANOVA and Spearman's rank correlation used shows linear relationships between the sizes categories considered in this study. In terms of polymer MPs analysis, the colour class recorded that white coloured MPs was dominant, 50 particles/number (22.25 g) with recorded abundance/number in PP (25), PE (15) and PS (5). The shape class also revealed that irregularly shaped MPs was dominant, 98 particles/number (30.5 g) with higher abundance/number in PP (39), PE (33), and PS (11). Similarly, MPs type class shows that fragmented MPs type was also dominant, 80 particles/number (25.25 g) with higher abundance/number in PP (30), PE (28) and PS (15). Equally, the sized class forward revealed that 1.5 - 1.99 mm sized ranged MPs had the highest abundance of 102 particles/number (51.77 g) with higher concentration observed in PP (47), PE (41), and PS (7) as well and finally, the weight class also show that 0.01 g weighs MPs was dominated by 98 particles/number (56.57 g) with varied numeric abundance seen in PP (49), PE (29) and PS (13). The forensic investigation of the pollution indicated that majority of the beach microplastic is sourced from the site/nearby area. The investigation could draw useful conclusions regarding the pathways of pollution. The fragmented microplastic, a significant component in the sample, was found to be sourced from recreational activities and partly from fishing boat installations and repairs activities carried out close to the shore.

**Keywords :** forensic analysis, beach MPs, particle/number, polymer composition, cameroon

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