CHARACTERIZATION OF MICROPLASTICS IN SEDIMENTS FROM THE SUBMARINE OUTFALL OF THE WASTEWATER TREATMENT PLANT, MAR DEL PLATA CITY (ARGENTINA).

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Despite widespread detection of microplastic (MPs) pollution in the marine environment, data describing point sources into to the South Atlantic coast are scarce. Particularly, the discharge of municipal wastewater treatment plants (WWTP) is considered an important pathway for MPs entering to aquatic environments. Mar del Plata city (38º S, 57º W) with a population of 750.000 people, is the main touristic resort of the Argentinian coast and its WWTP discharges their effluents into the marine environment by a submarine outfall (4 km offshore). Although this outfall is working since 2014, diminishing the biological and chemical pollution of nearest coastal areas, but their role as MPs source to the marine environment was not yet evaluated. This work represents the first approach in the study of MPs occurrence/characteristics in subtidal sediments (11-21 mt deep) from different sites differing in their proximity to the WWTP submarine outfall.

Methods

2 MPs analysis

Sediment sampling
Storage at -20ºC

MPs extraction
$ZnCl_2$ solution
density 1.6 g/cm^3

Filtration and organic matter digestion
100 µm filter
H_2O_2 30%

Visual analysis
Stereomicroscope
Quantification/Characterization

Chemical analysis
ATR-FT-IR
Polymer Characterization
(not yet assessed due by COVID-19 restrictions)

1 Study area

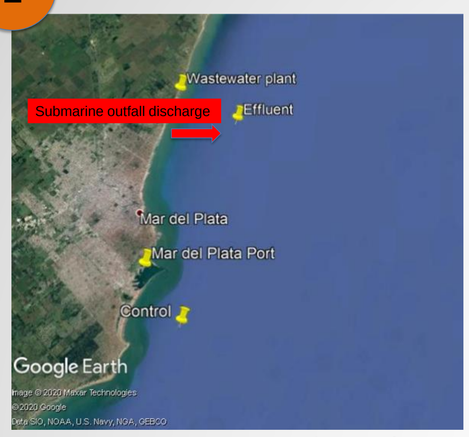

Fig. 1. Study Area.

1

The study area is located in the coastal area of Mar del Plata city, Buenos Aires, Argentina (Fig.1).

Three sampling sites differing in their distance from the submarine outfall of the city's WWTP were assessed (Effluent, Harbour and Control). Samples from subtidal sediments (n=3 per sampling sites) were obtained with a Van-Veen grab sampler. Surficial sediment was stored at -20 ºC for subsequent MPs analysis..

Fig. 2. MPs extraction with the Sediment Microplastic´s isolation (SMI) unit..

2

MPs were extracted using a SMI unit (Fig.2) as a single step method for density MPs isolation from marine sediments, (according to Coppock et al., 2017, Environmental Pollution).

Once extracted, the denser fraction followed different steps for quantification and characterization.

3 Quality assurance

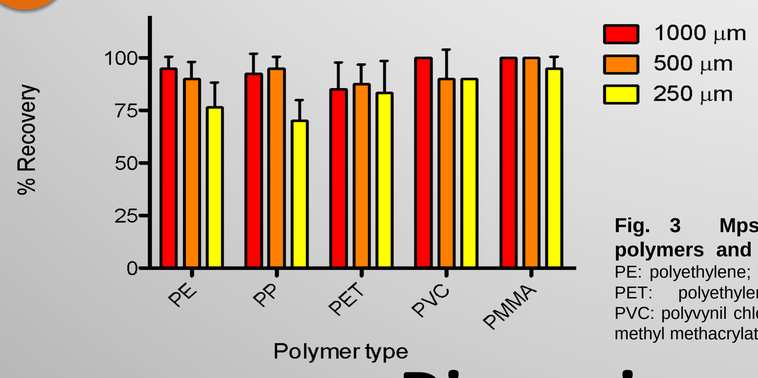

Fig. 3 Mps recovery by polymers and fragment size. PE: polyethylene; PP: polypropylene; PET: polyethylene terephthalate; PVC: polyvynil chloride; PMMA: poly methyl methacrylate

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Quality assurance was assessed by setting different types of procedural blanks in order to eliminate false positives and/or external contamination.

Additionally, the extraction efficiency was checked using spiked sediments with MPs of different sizes and polymers. Our results showed good recovery rates mainly in large particles (Fig.3)

Results

4 Microplastic Quantification

Sites	Mean total MPs abundance as n° ítems/Kg.d.w (SD)	Reference
Effluent	**546.88 (182.14**	*this work*
Control	**410.65 (93.29)**	*this work*
Harbour (*)	**970.98 (208.64)**	*this work*
(**) Vistula River. Poland.	580	Ilona Sekudewicz *et al* 2020
(**) Haihe River Basin. China.	5.767(2300)	(Yang Liu *et al* 2020)

Table 1. Mean abundance of MPs obtained in this work and comparative bibliography.

4

No significant differences were found between Effluent and Control sites in total abundance of MPs (KW; p> 0.05).

Nevertheless, the mean total abundances found in both sites were lower than those observed in the Harbor (Table 1).

(*) For more information about Mar del Plata's Harbor data see: Spatial distribution and characterization of microplastic in subtidal sediment under stormwater discharge influence. Diaz-Jaramillo *et al* 2020. POSTER PRESENTATION MICRO 2020.
(**) Comparative bibliography for other studies on sediments under the influence of WWTP.

5 Microplastic Characterization

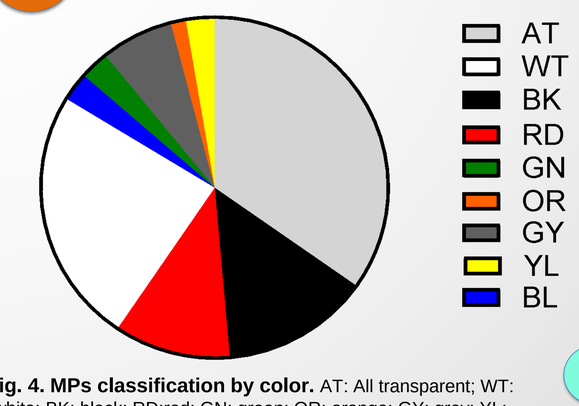

Fig. 4. MPs classification by color. AT: All transparent; WT: white; BK: black; RD:red; GN: green; OR: orange; GY: grey; YL: yellow; BL: blue.

In terms of color, transparent (34.7%), white (24.2%), black (13.8%) and red (10.8%) type particles were the main color contribution to all MPs particles (Fig. 4).

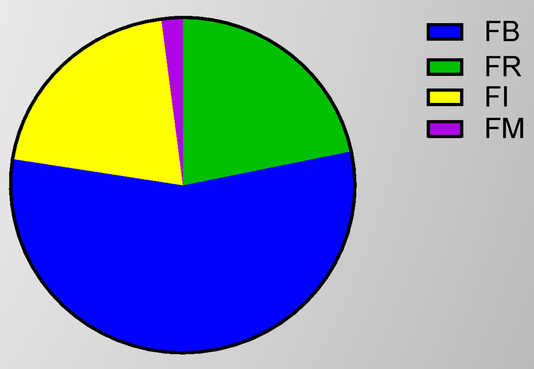

Fig. 5. MPs classification by shape. FB: fiber; FR: fragment; FI: film; FM: foam.

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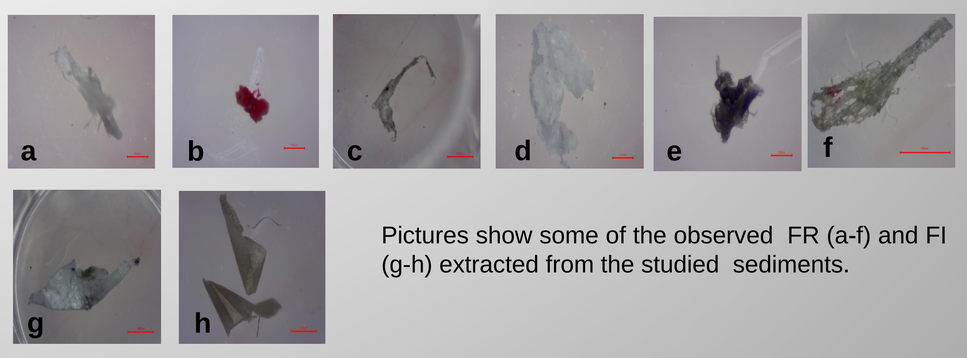
In terms of shape, fibers (40-72%), fragments (12-31.5%), films (12.1-29%) and foam (0-4%) were detected as probable MPs particles (Fig. 5).



Pictures show some of the observed FR (a-f) and FI (g-h) extracted from the studied sediments.

Discussion and Conclusions

- Quality assurances showed good recovery rates. However, data obtained with handmade artificial sediments from translucent colored bottle/lids (PP,PET) pointed out that the visual examination and recovery of small particles might represent a source of underestimation for real samples.
- The lack of differences between the effluent and control site, as well as the lower abundance of MPs related to the Harbour indicates that the WWTP outfall do not represent a point source of MPs to closer sediments. However, due to the high hydrodynamics in the area with the main litoral current flowing from south to north, is complex to estimate the real influence of the submarine outfall as a MPs source.
- The abundances of MPs observed in this study are in the range or lower than those reported for other areas under WWTP influence. This result, highlights the need of more studies related to MPs abundances in the influent and effluent lines of WWTP in order to estimate its real contribution. Nevertheless, this work contribute to the study of MPs deposition in areas influenced by submarine outfalls of WWTP that is poorly studied or unknown.
- The main colors present in this work (transparent, white and black) are the same found in previous studies in the same area. In addition, fragments and fibers were the dominant shapes, similar to those reported in other studies for sediment and water influenced by WWTP discharges.
- This preliminary study corresponded to the first approach to determine the occurrence of MPs in sediments under the influence of the submarine outfall from one of the main WWTP located in southwestern atlantic coastal cities.