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LIFE Blue Lakes Capacity Building Workshop

Do we know occurrence, removal and fate of microplastics in municipal drinking and wastewater treatment plants?

Francesco Fatone, Polytechnical University Marche



BENEFICIARIO COORDINATORE



BENEFICIARI ASSOCIATI

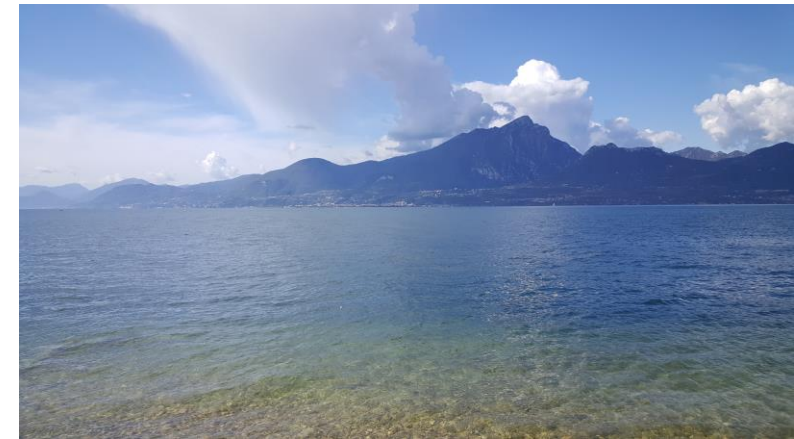
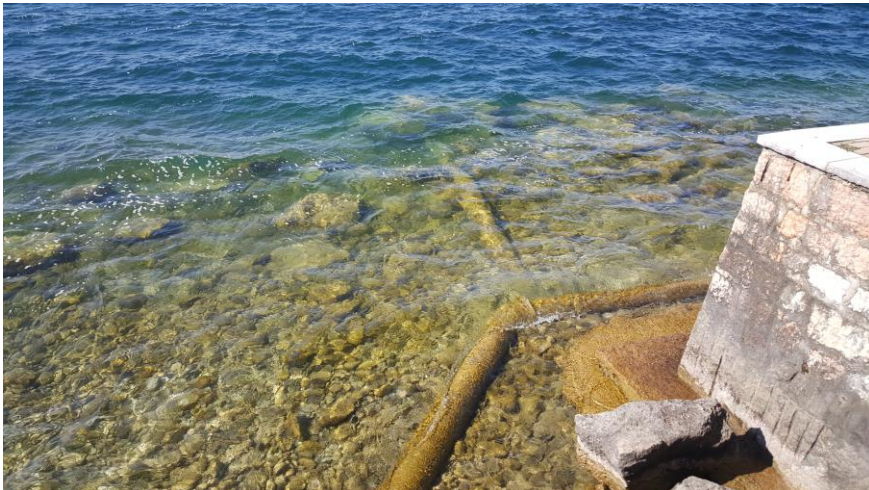


PROGETTO COFINANZIATO DA



Lake Garda as a strategic water basin

- Strategic drinking water and wastewater catchment
- Presence of Combined Sewer Overflows (CSOs), Drinking Water Treatment Plants (DWTPs) and Wastewater Treatment Plants (WWTPs)
- Upgrading of sewage wastewater collection and treatment
- Water service managed by different utilities
- High variations for anthropic and natural pressures



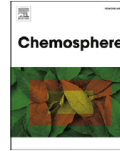
Our experience in microplastics sampling and characterization in wastewater treatment plants

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Microplastics in real wastewater treatment schemes: Comparative assessment and relevant inhibition effects on anaerobic processes

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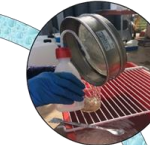
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1. Collection using automatic samplers or steel bucket.



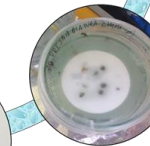
2. Filtration on sieves battery: 5mm, 2mm, 63 µm mesh sizes.



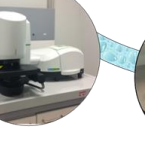
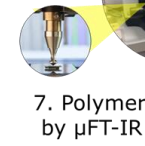
3. Recovery of materials retained on 2 mm and 63 µm sieves with MilliQ water.



4. Vacuum filtration on CN membranes (8 µm pore size).



5. Filter recovery and organic matter digestion in 15% H₂O₂ solution.



7. Polymers identification by µFT-IR in ATR mode.

6. Visual examination and collection of fibers and particles.

- MOST FREQUENT MPs ARE POLYETHYLENE E POLYPROPYLENE
- ALONG THE TREATMENT LAYOUT MPs DECREASE AND CAN BE FOUND IN SLUDGE >> ATTENTION TO SLUDGE DISPOSAL / VALORIZATION!
- **REMOVAL EFFICIENCY OF CONVENTIONAL WWTPs = 86% >> UP TO 94% FOR INNOVATIVE UASB ANMBR CONFIGURATIONS**

Our activity in LIFE Blue Lakes project: sampling campaign of MPs in water and wastewater treatment plants

- 2 WASTEWATER TREATMENT PLANTS (WWTPs)
- 2 DRINKING WATER TREATMENT PLANTS (DWTPs)
- 1 COMBINED SEWER OVERFLOW (CSO)

Sampling in real environment

- ✓ assessment of the sampling systems and protocols
- ✓ assure the transferability and replicability of the project results

MPs sample preparation and characterization

Optimization guidelines for the treatment stages

- ✓ critical audit of the treatment technologies to improve the MPs abatement

➔ TECHNICAL PROTOCOLS FOR WATER AND WASTEWATER TREATMENT PLANTS

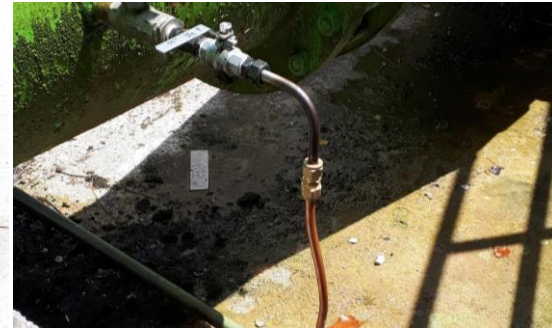
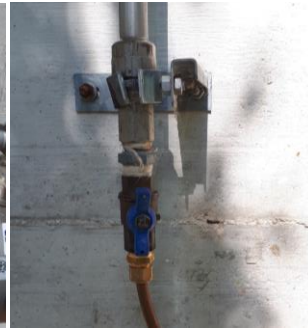


Lakes as strategic drinking water basin

- ✓ LAKE GARDA
- ✓ LAKE CASTRECCIONI



PUMPING AND SEIVING
(50 micron)
About 1000 l sampled in
drinking water



STEEL FILTERS (50 micron) About 1000 l sampled in drinking water



AUTOMATIC SAMPLER
(50 and 25 micron)
Tested in wastewater

NEW PROTOTYPE OF AUTOMATIC SAMPLER TESTED IN A FULL-SCALE WWTP

- Possibility to sample higher volumes (order of magnitude \approx m³)
- Representativeness of WWTPs variations
- Ready to use for plant operators



50 µm filter



25 µm filter



Filtered volumes registration

UNIVPM activity in microplastics sampling and characterization in drinking water treatment plants



LIFE Blue Lakes

10 giugno alle ore 16:27 · 🌐

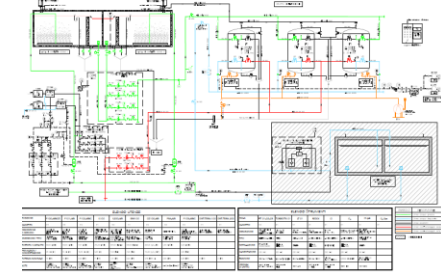
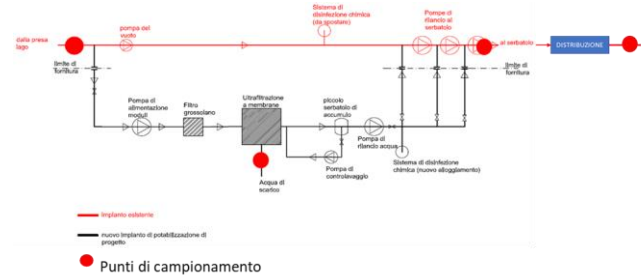
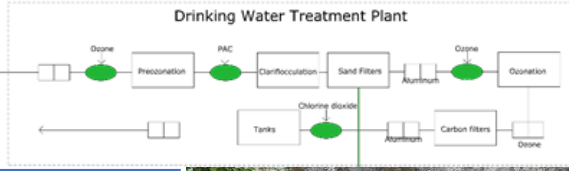
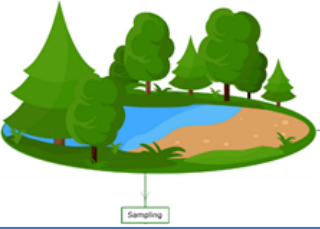
Univpm Università Politecnica delle Marche al #LagodiGarda impegnata nelle visite tecniche presso gli impianti di depurazione di Limone Tremosine e Peschiera del Garda e nei campionamenti presso i potabilizzatori di Garda Molinet.

La progettazione e sperimentazione di un protocollo tecnico per il trattamento delle acque reflue nell'area pilota del Lago di Garda ha l'obiettivo di identificare soluzioni tecniche volte a ridurre l'input di #microplastica sui bacini lacustri a valle degli impianti. Una volta definito, il protocollo tecnico sarà divulgato attraverso seminari di formazione per i dirigenti e i tecnici dei principali impianti di depurazione delle acque reflue, in Italia e in Germania

Arpa Umbria Autorità Distretto Italia Centrale ENEA - Agenzia nazionale Legambiente Onlus Legambiente Lombardia Legambiente Veneto [Gli Amici del Lago - Circolo di Legambiente](#) Legambiente Verona



UNIVPM activity in microplastics sampling and characterization in drinking water treatment plants



Castreccioni
Influent – quote 314 m and quote 324 m
Out pre-ozonation
Out flocculatione fanghi flocculati
Sludges from flocculation
Out filtration
Backwash
Out post-ozonation
Out GAC
Effluent
Distribution 1
Distribution 2



Brenzone Castelletto
Influent
Backwash
Backwash Ultrafiltration
Effluent
Distribution



Garda Molinet
Influent
Out ozonation
Out filtration
Effluent
Distribution



PRELIMINARY RESULTS IN LINE WITH LITERATURE

Monitoring of project impact >> Surveys to water utilities

Il mio Drive - Google Drive x LIFE Blue Lakes Survey - Moduli x +

docs.google.com/forms/d/18mTcAyUgFN7580z3FEFC...JKvCUhpEpTF-VBNTJgo/edit

LIFE Blue Lakes Survey

Domande Risposte

LIFE Blue Lakes Survey

Methodologies applied by Italian and German treatment plants to reduce microplastics (MPs) in the environment

Indirizzo email *

Indirizzo email valido

Questo modulo raccoglie gli indirizzi email. [Modifica impostazioni](#)

What is the treatment plant typology for which you are compiling the survey? *

Wastewater treatment plant

Potabilization treatment plant

The selected configuration is typical for how many plants and for which treatment capacity? *

Testo risposta lunga

41 Italian and 23 German water utilities contacted >> 24 surveys collected from 17 Italian water utilities and 5 surveys from German WWTPs

- Even if the most common WWTP and DWTP configurations are not specifically designed for MPs, the current units can affect the MPs removal from water fluxes.
- Even most of the interviewed is not considering MPs removal as a priority, the presence of MPs in water environment has already been considered in activities conducted in the territory by research institutes or Universities (VALUE CE-IN project, ENEA, UNICT)
- Utilities interviewed showed their availability to organize sampling campaigns to detect MPs in their plants
- Utilities expressed their interest to have a specific free training on the occurrence and removal of MPs

UNIVPM activity in LIFE Blue Lakes project: training activity

Training Modules

- ✓ Wastewater treatment processes, technologies and MPs occurrence
- ✓ MPs characterization and sampling in urban water cycle
- ✓ Removal and fate of MPs

Training Module specific for water professionals

- ✓ MPs mass balances in water and wastewater plant and in CSOs
- ✓ MPs removal in treatment units
- ✓ Case studies and practical examples



guidelines for optimal design for MPs minimization



Training Module specific for public authorities and environmental protection agencies

- ✓ Operation and maintenance of urban water cycle infrastructures
- ✓ Optimal flow scheme configurations in urban water cycle
- ✓ Risk associated to MPs



BlueLake Label (BLL) certificate best practices for MPs Minimization

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Thank you for the attention!



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Autorità di Bacino
Distrettuale
dell'Appennino Centrale



Agenzia Regionale
per la Protezione
Ambientale dell'Umbria



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