LIFE Blue Lakes Capacity Building Workshop

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

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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

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

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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.

CAS system:
Influent after screening (IN)
Effluent primary settling (I EFF)
Effluent after biological treatment (II EFF)
Final effluent after disinfection (FINAL EFF)
AnMBR system:
Effluent after UASB reactor (UASB EFF)
Effluent after UF unit (AnMBR EFF)

• 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

Lakes as strategic drinking water basin
- LAKE GARDA
- LAKE CASTRECCIONI

TECHNICAL PROTOCOLS FOR WATER AND WASTEWATER TREATMENT PLANTS
UNIVPM activity in microplastics sampling and characterization

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

AUTOMATIC SAMPLER
(50 and 25 micron)
Tested in wastewater

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

www.lifebluelakes.eu
NEW PROTOTYPE OF AUTOMATIC SAMPLER
TESTED IN A FULL-SCALE WWTP

• Possibility to sample higher volumes (order of magnitude ≈ m³)
• Representativeness of WWTPs variations
• Ready to use for plant operators
LIFE Blue Lakes

10 giugno alle ore 16:27 - 📢

Univpm Università Politecnica delle Marche al #LagodiGarda impiegata 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.

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 flocculation fanghi floculati
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

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!