Microplastics and urban water

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Microplastics and urban water

Rachid Dris, Johnny Gasperi, Vincent Rocher, Mohamed Saad, **Bruno Tassin**

Introduction

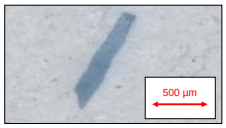
Macroplastics (>5mm)

In oceans

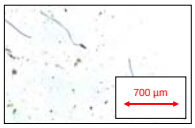
In rivers

Microplastics (<5mm)

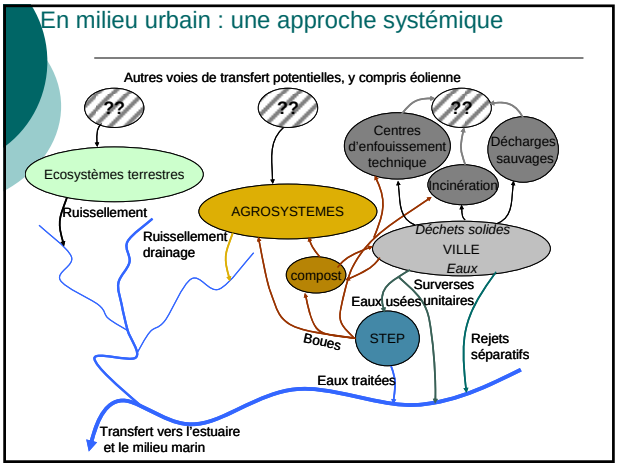
Fragments/Spheres

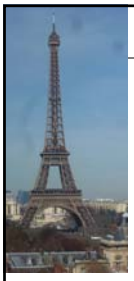


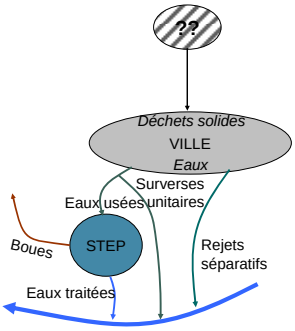
Fibers



En milieu urbain : une approche systémique







Transfert vers l'estuaire et le milieu marin

Materials and methods

- Sampling
- Samples treatment
- Observation
- Characterization

Materials and methods

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Materials and methods

Sampling

Samples treatment

Remove natural organic fraction: SDS, H_2O_2, Lipase, Protéase, Amylase

Remove mineral fraction: $ZnCl_2$, Density = 1.6 g/cm³

Observation

Characterization

Materials and methods

Sampling

Samples treatment

Remove natural organic fraction: SDS, H_2O_2, Lipase, Protéase, Amylase

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Observation

Characterization

Materials and methods

Sampling

Samples treatment

Remove natural organic fraction: SDS, H_2O_2, Lipase, Protéase, Amylase

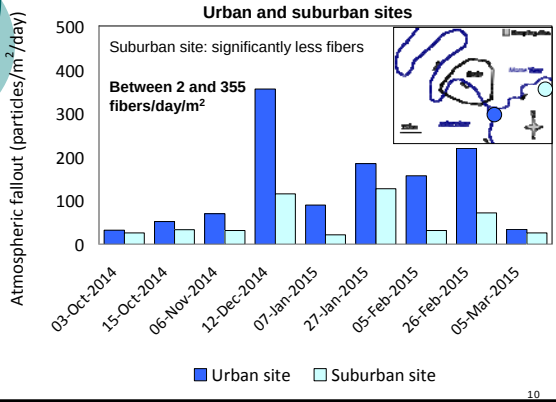
Remove mineral fraction: $ZnCl_2$, Density = 1.6 g/cm³

Observation

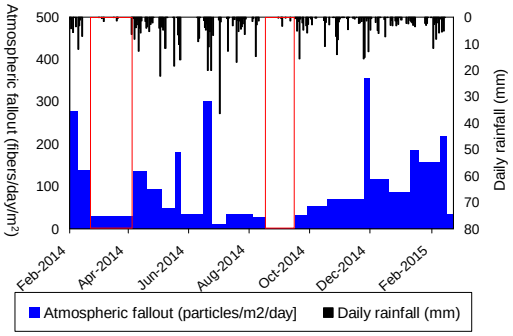
Characterization

Transform infrared (FT-IR) micro spectroscopy (Microscope LUMOS FT-IR – Brucker)

Results – Atmospheric fallout



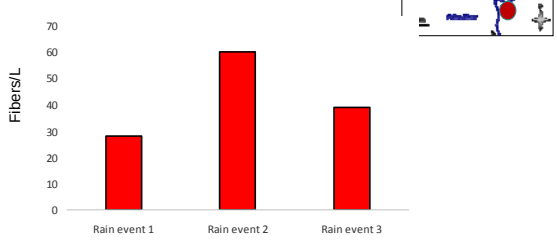
Results – Atmospheric fallout



- Microplastics in rainwater?

Results – Rainwater

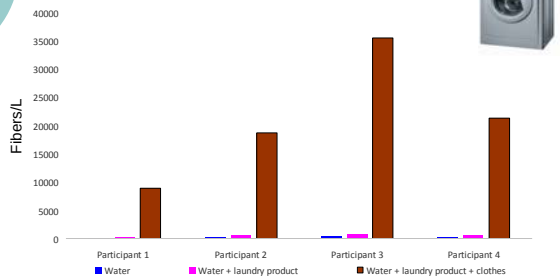
Stormwater at the outlet of an urban catchment
Between 28 and 60 fibers/L



- The fibers either come from the runoff or are directly washed down by rain

Results – Washing machine effluents

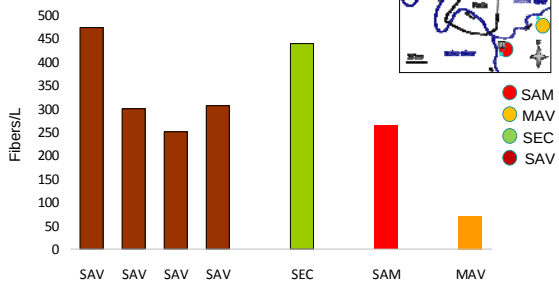
Four volunteers participated in this study
Between 8000 and 35000 fibers/L



- Clothes are a major source of the fibers

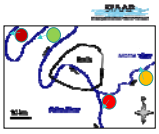
Results – Wastewater treatment plants

Fibers in wastewater
Between 70 and 450 fibers/L



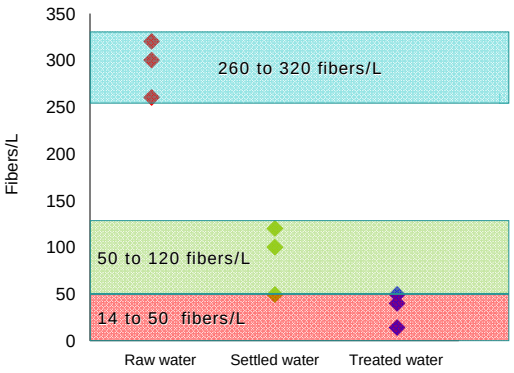
- Very high number of fibers probably coming mainly from washing machines

Results – Wastewater treatment plants



SAM
MAV
SEC
SAV

Results - Wastewater treatment plants



Characterization

Which proportion corresponds to microplastics?
30 fibers randomly selected – Atmospheric fallout

Petrochemicals

Polyamide

Polyester (100%)

Polyethylene

Blend of Polyester and Polyurethane

Natural material

Cellulose (Mainly Rayon or cotton)

Rarely wool

- More fibers from natural material than from petrochemicals
- Mainly polymers used in the textile industry

Results – surface water

Plankton net vs Manta net

80 µm mesh size

High fiber concentrations

"Only" up to 2,500 L sampled

Concentration levels of fragments are too low

Better for fibers

300 µm mesh size

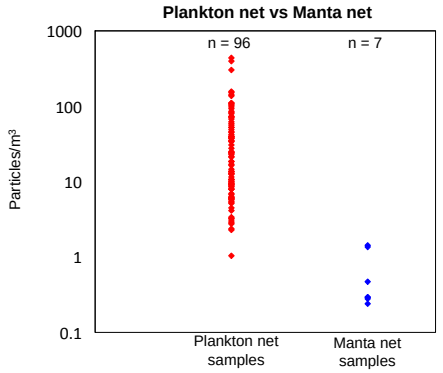
Fibers pass more easily through the net

Up to 200,000 L sampled

The more "rare" particles can be collected

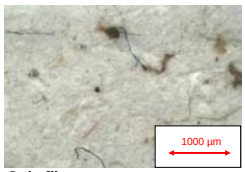
Better for fragments

Results – surface water



Results – surface water

80 µm net samples



Only fibers

Chemical characterization in progress

So far:

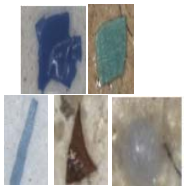
2 Rayon fibers (among 19 particles)

Polyester mainly

Polyamide and Polypropylene

Results – surface water

300 µm net samples



Fragments, films and spheres

Chemical characterization in progress

So far:

Only plastic particles

Only Polyethylene and Polypropylene

Synthèse

Retombées atmosphériques	10^2/m²/jour
Eaux de ruissellement	10^1/L
Lave linge	10^4/L
Station d'épuration (entrée)	10^2/L
Station d'épuration (sortie)	10^1/L
Rivière	10^{-2} – 10^0/L

Conclusions et perspectives

- Présence ubiquiste en milieu urbain
- Bilans encore très lacunaires
- Méthodes d'analyse non stabilisées
- Cas des fibres
  - Difficiles à caractériser
  - Très présentes, (contamination)
- Question de l'impact écologique

Microplastics in various compartments of the urban water cycle

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Dris, R., Gasperi, J., Saad, M., Mirande, C., Tassin, B., 2016. **Synthetic fibers in atmospheric fallout: A source of microplastics in the environment?** Mar. Pollut. Bull. doi:10.1016/j.marpolbul.2016.01.006

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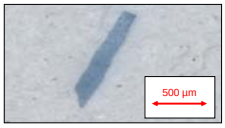
Dris, R., Imhof, H., Sanchez, W., Gasperi, J., Galgani, F., Tassin, B., Laforsch, C., 2015b. **Beyond the ocean: Contamination of freshwater ecosystems with (micro-) plastic particles.** Environ. Chem. 12, 539–550.

Gasperi, J., Dris, R, Bonin, T., Rocher,V., Tassin, B., 2014 **Assessment of floating plastic debris in surface water along the Seine River.** Environ. Poll. 195, 163-166.

Introduction

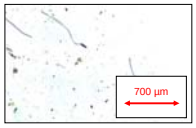
Previous investigations in the Seine River

Fragments/Spheres



Less than 2 fragments/m^3

Fibers



Up to 400 fibers/m^3