Aimed at Chemical Analysis

Sampling of Suspended Solids Flowing in a River: Design and Test of Methodologies Aimed at Chemical Analysis

INTRODUCTION

The evaluation of suspended solids (SS) and related chemical content flowing in river waters plays an important role during the characterisation and monitoring of a complex river-lake system where historical contamination has occurred. However, SS investigations can be challenging due to the complex sampling process, seasonal and hydrological variability, analytical limitations and the lack of consolidated standards.

A number of SS sampling methodologies were tested at different locations during an environmental characterisation conducted by ARPA and Ramboll Environ (on behalf of Syndial SpA) on the Toce river in Piedmont, Italy. The results presented here relate to sampling sites located near the small town of Canavà Toce.

MATERIALS AND METHODS

ARPA device (Figures 1 and 2)

ARPA developed a device composed of the following elements:

- Two shopping bags made from malt-bar® biodegradable and compostable bioplastics were placed one inside the other. Three horizontal cuts were made to the external one and three vertical cuts to the internal one to let the water current flow in.
- A concrete parallelepiped (1.0 x 0.10 x 0.0005 m) occupied the void in the bags to anchor the device to the river bed.
- Folded high-density polyethylene (HDPE) strips (1.0 x 0.03 x 0.0005 m) were placed at the bottom of the bags to anchor the device to the bottom of the river.

In order to collect a representative sample from different water depths, three devices were connected, placed one inside the other. Three horizontal cuts were made to the external one and three vertical cuts to the internal one to let the water current flow in. The whole device was inserted into a PVC net with a mesh size of 2 cm.

- A floatation device (0.5 L PET bottle) was fixed to the net to make it easier to recover the device in case of a flood.

Ramboll Environ device (Figures 3 and 4)

Ramboll Environ modified a device designed by Galas et al., which was similar to that developed by ARPA, except for the way it was anchored. ARPA’s device was posed and anchored to the river bed, while Ramboll Environ’s device floated and was anchored to a bridge using ropes. ARPA’s devices were lost, which resulted in only a little solid mass being collected. After this, Ramboll Environ made some adjustments, such as incorporating an external protective net to improve the device’s mechanical strength.

MOUTH OF THE TOCE RIVER

ARPA's devices were put in place at the mouth of the Toce river. They were left in place from the bridge and left for two weeks (‘exposure period’). During recurrent floods some devices were lost, which resulted in only a little solid mass being collected. After this, Ramboll Environ's device was posed and anchored to the river bed, while Ramboll Environ's device floated and was anchored to a bridge using ropes. Both ARPA and Ramboll Environ’s sampling devices were left submerged by bedload. In several cases it was evident that the ARPA device was trapped in certain conditions (evidenced in Tables 1 and 2).

DISCUSSION AND PERSPECTIVES

The SS sampling techniques described are practical and cheap, and allow the collection of enough mass to perform chemical analysis and preliminary characterisation of mean size distribution over a range of time periods. Both techniques also allow the collection of a SS fraction, which is the prevalent fraction in certain conditions (evidenced in Tables 1 and 2).

The main limitations and uncertainties are:

- Lack of quantification of water volume that flowed into the devices.
- Grain size representativeness and possible problem of selection/exclusion.
- New tests are planned for 2017 that apply different sampling techniques including:
  - Active isokinetic sampling based on pumping and filtration system.
  - Floating passive sampler that allows water flow-rate measurements.

The overall aim will be to identify a sampling technique suitable for long-term SS monitoring.

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REFERENCES