# MONITORING OF LAS (LINEAR ALKYLBENZENE SULFONATE) CONCENTRATIONS IN A REACH OF THE LLOBREGAT RIVER

GODÉ, L.[1] ; POCH, M.[2] ; VERGE, C.[3] ; WIND, T [4]. ; DEVESA, F.[2]*
*Corresponding author
[1] Catalan Water Agency (ACA).C/ Provença, 204-208, Barcelona, 08036, Spain
[2] Chemical and Environmental Engineering Laboratory (LEQUIA). Universitat de Girona. Campus Montilivi, s/n, Girona, 17071, Spain
[3] PETRESA. Puente Mayorga s/n, 11360 San Roque (Cádiz). Spain
[4] Henkel KGaA, D-40191. Düsseldorf. Germany

## Introduction

For the assessment of a potential risk of a chemical to the environment, it is essential to determine the degree of chemical exposure. Environmental exposure models can be a useful tool to obtain accurate information about the fate of a specific substance in the environment. Depending on the level of complexity, different models demands different level of data availability. Geo-referenced models, which require substantial geographical and substance-specific information, shows a high accuracy of chemical exposure prediction. With the aid of such models spatial chemical concentrations are simulated, which enables to identify geographical hot spots of chemical exposure. In this paper, we present a study of the geo-referenced exposure assessment of Linear Alkylbenzene Sulfonate (LAS) in a heavily loaded Spanish river catchment. We designed a sampling campaign to determine LAS concentrations in a middle course of the Llobregat River, to verify and calibrate the Llobregat catchment integration in the GREAT-ER model (Geo-referenced Exposure Assessment Tool for European Rivers), that is used to simulate predicted environmental concentrations (PEC) of LAS along the river.

## Exposure Assessment of LAS

Used in cleaning products — Per capita consumption + Industrial uses → Discharged in wastewater → Treatment (removal) → Discharged in rivers

Determination of exposure level — **PEC** Predicted Environmental Concentration

GREAT-ER ← Simulation

## Sampling Campaign

In a week-long campaign, composite and isolated samples were collected at six different points. Some sampling locations (CAR, VILO and ABRE) were conditioned to the Water Catalan Agency control stations, where automatic samplers took river water, each hour, to obtain a 24-h composite sample per day.

### Automatic sampler
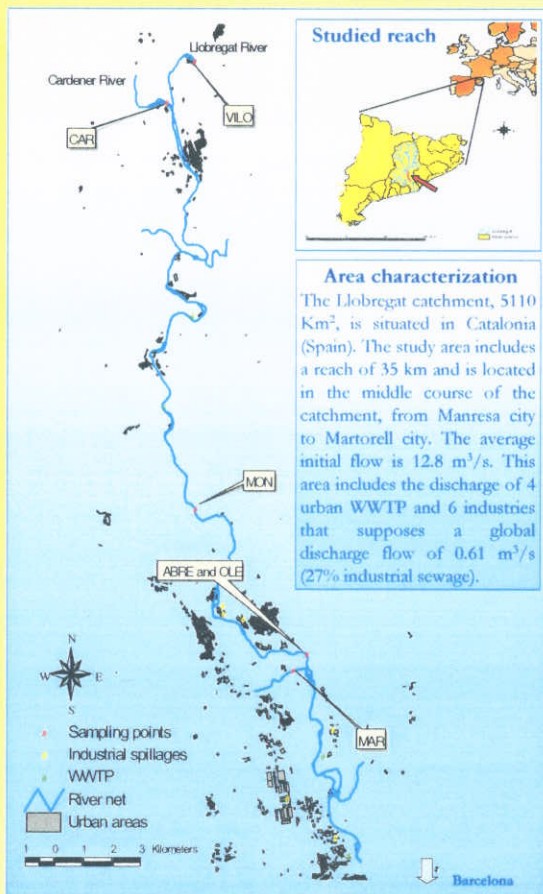
## Studied reach

## Area characterization

The Llobregat catchment, 5110 Km², is situated in Catalonia (Spain). The study area includes a reach of 35 km and is located in the middle course of the catchment, from Manresa city to Martorell city. The average initial flow is 12.8 m³/s. This area includes the discharge of 4 urban WWTP and 6 industries that supposes a global discharge flow of 0.61 m³/s (27% industrial sewage).

Sampling points
Industrial spillages
WWTP
River net
Urban areas

Barcelona

## LAS analysis

LAS concentrations were determined following the method developed by Matthijs and De Henau (1). In this method, LAS is quantitatively retained from water samples on a C18 reversed phase silica column. Subsequent rinsing and elution steps results in a complete separation of the adsorbed LAS. HPLC Technique was used with a fluorescence detector for identification, Ex: 232 nm and Em: 290 nm. Detection limit: 0.05 ppm.

1. Matthijs E., De Henau H. 1987. Determination of LAS. Tenside 4: 193-199.

## GREAT-ER model

LAS values found in Llobregat samples were used to calibrate the GREAT-ER model in this area considering:
LAS consumption: 2 Kg/cap/y
In-stream removal: 0.06 h$^{-1}$
WWTP (activated sludge) elimination efficiency: 98-99.5%
WWTP (trickling filter) elimination efficiency: 94-98%

**G**eo **R**eferenced **E**xposure **A**ssessment **T**ool for **E**uropean **R**ivers

PEC concentration

Coded-colour map showing LAS concentration
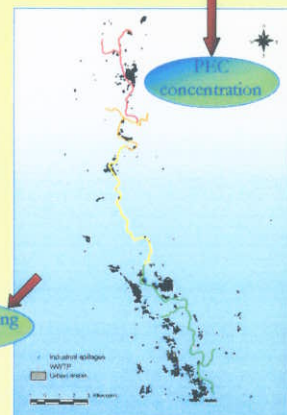
## Results and discussion

The highest LAS concentrations (0.103 ppm) measured in the studied zone were found in the Cardener River, the main affluent of the Llobregat (12.8 m³/s). The Cardener, with an average flow of 5.2 m³/s, receives the effluent from the Manresa Waste Water Treatment Plant (WWTP) just before its confluence with the Llobregat River and thus shows higher concentrations of many water quality parameters (BOD, ammonia, phosphorus etc.). The highly loaded Cardener river contributes to an increase of LAS concentration in the Llobregat, from 0.035 ppm at VILO location, to 0.055 ppm downstream the confluence of the two rivers. The LAS concentration, however, decrease again to 0.034 ppm at the ABRE location, although the Llobregat receives additional LAS loads by further point sources. Thus, LAS concentration remains similar at the first and the last sampling points, which is probably due to the good biodegradability of LAS (high in-stream removal).

The monitoring results were used for the catchment calibration of the Great-er model. The model was successfully applied with a considerable accuracy to predict the LAS concentration in the studied area, showing the effects of the industrial and municipal discharges.

### LAS concentration at the main sampling points (24h-composite samples)

| Date | Day | Sample | Result (ppm) | Sample | Result (ppm) | Sample | Result (ppm) |
|---|---|---|---|---|---|---|---|
| 8/5/03 | Thursday | CAR 1 | 0.210 | VILO 1 | 0.058 | ABRE 1 | 0.064 |
| 9/5/03 | Friday | CAR 2 | 0.140 | VILO 2 | 0.073 | ABRE 2 | 0.031 |
| 10/5/03 | Saturday | CAR 3 | 0.034 | VILO 3 | 0.025 | ABRE 3 | 0.024 |
| 11/5/03 | Sunday | CAR 4 | 0.074 | VILO 4 | 0.022 | ABRE 4 | 0.028 |
| 12/5/03 | Monday | CAR 5 | 0.073 | VILO 5 | 0.020 | ABRE 5 | 0.019 |
| 13/5/03 | Tuesday | CAR 6 | 0.091 | VILO 6 | 0.019 | ABRE 6 | 0.048 |
| 14/5/03 | Wednesday | CAR 7 | 0.100 | VILO 7 | 0.029 | ABRE 7 | 0.025 |
| Mean | | Mean CAR | 0.103 | Mean VILO | 0.035 | Mean ABRE | 0.034 |