

# COMPARATIVE GC/MS AND LC/MS DETECTION OF HEXABROMOCYCLODODECANE (HBCD) IN SOIL AND WATER SAMPLES

Malte Petersen<sup>1</sup>, Ulrich Esser<sup>2</sup>, Angela Schäfer<sup>3</sup> and Stephan Hamm<sup>1</sup>

- 1 Eurofins / GfA Gesellschaft für Arbeitsplatz- und Umweltanalytik mbH, P.O. Box 41 01 28, D-48065 Münster, Germany
- 2 GfA Consult GmbH, Otto-Hahn-Str. 22, 48161 Münster, Germany
- 3 Eurofins / Dr. Wiertz – Dipl.-Chem. Eggert – Dr. Jörissen GmbH, D-21107 Hamburg, Germany

## Introduction

Hexabromocyclododecane (HBCD) is a crucial additive flame retardant (FR) for FR Polystyrene insulation foams (both expandable (EPS) as well as extrudable polystyrene (XPS)), polystyrene masterbatches and textile FR coatings. The total consumption of HBCD within the European Union (EU) is estimated to be about 10,000 tons out of 16,700 worldwide per year<sup>1</sup>. The technical HBCD product usually is a mixture of the three diastereoisomers  $\alpha$ -,  $\beta$ - and  $\gamma$ -HBCD with the  $\gamma$ -isomer as main component. Compared to other flame retardants only few data on HBCD levels in the environment have been published<sup>e.g. 2, 3, 4</sup>.

BSEF (Bromine Science and Environmental Forum) representing the major HBCD producers, launched, in coordination with user industries, a product-stewardship (PS) programme for the major brominated flame retardants, including HBCD. Objective of this voluntary industry PS programme is to minimise and continuously reduce environmental exposure.

As first step an environmental monitoring study in five EU member states was carried out for BSEF by the Dutch National Institute for Fishery Research (RIVO). These findings triggered the second step carried out by our institute; a plant emission monitoring programme at 7 representative user sites in five different EU member states, covering all known applications. Complementary to the efforts of BSEF, the EPS and XPS foam producers, associated within CEFIC (European Chemical Industry Council) carried out a similar monitoring programme under their own responsibilities.

Results from our study demonstrate that emission control of HBCD is both feasible, also for small/medium sized enterprises, the typical customer basket outside the EPS and XPS foam industry, and effective.

Within this study a series of soil and water samples from HBCD processing plants was analysed by GC/MS (LRMS-EI). Besides GC/MS, also liquid chromatography coupled to mass spectrometry (LC/MS) is often used for HBCD detection in environmental samples. Whilst GC/MS only provides information about the total of the three HBCD isomers, LC/MS is able to selectively monitor and quantify the three components. On the other hand GC/MS usually has the advantage of a higher sensitivity<sup>5,6</sup>.

In order to verify the GC/MS results and to check the comparability to LC/MS analytical data, five soil and five water samples showing a wide range of HBCD concentrations were analysed by using