SCREENING METHODS FOR POLYFLUORINATED COATINGS OF TEXTILES

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Introduction

Perfluorinated chemicals (PFCs) and their precursors are a group of chemicals widely used for surface treatment. In 2010 a work was presented with the aim to develop screening methods to identify fluorinated coatings on food contact materials and other everyday commodities.[1] The screening methods described there and a WD-XRF-system were used for the detection of polyfluorinated coatings of textiles.

Materials and methods

Investigated samples

19 textiles from the German market were investigated at the time point of the preparation of this abstract. The work is ongoing.

In this work three fast screening methods are compared.

Sliding spark spectroscopy (SSS)

SSS (SSS2, IoSys, Ratingen) is normally used for plastic characterization and sorting. The basic principle of the method is the thermal vaporization of a small amount of the sample surface using a train of defined high-current sliding sparks. The material components in the spark plasma are vaporized, atomized and activated to emit radiation[2]. Software analysis of the delivered spectra gives information on the content of elementary fluorine on top of the surface. For fluorine a typical double-peak at a wavelength of about 350nm is obtained. In defining special hardware setup, it is possible to get the absolute intensities of the fluorine emission line. The measurement is repeatedly done.

WD-XRF-Analysis

WD-XRF-systems are able to detect fluorine in vacuum mode. Newly installed in Freising and normally used to screen different incoming samples on their elemental composition, an S8-TIGER (Bruker AXS, Karlsruhe) is used to analyze the above mentioned matrices on their fluorine content. It is important to understand that for fluorine the depth of signal saturation is limited to a couple of micrometers, caused by the very low energy of the obtained fluorescence radiation.

P&T-GC-EPED

The Plasma Emission Detector with Echelle Spectrometer (EPED, IMT Innovative Messtechnik GmbH) was coupled with gas chromatography (AG6890, Agilent) and a purge & trap sampler (PTA3000, IMT, Moosbach)[3]. The EPED detector combines a long term stable pulsing plasma cell with a high resolution Echelle spectrometer. The resulting multi-element gas chromatographic detector shows high sensitivity and selectivity for sulphur and the halogens chlorine, bromine, fluorine and iodine with detection limits for the above elements < 10 pg/s and a linearity about 3-4 decades.

Results and discussion:

SSS and WD-XRF-Analysis were compared for a set of 19 samples. In 5 of 19 investigated materials both methods show equivocally the absence of fluorinated compounds. In 8 cases both methods identified fluorinated compounds. For six cases results differed for both methods.

Table 1.: Comparison of XRF- and SSS screening results.

XRF	**+**	**8**	**4**
	-	**2**	**5**
		+	-
		S S S	

6 samples positively identified by SSS (4 of them also positively identified by XRF) were analyzed with P&T GC-EPED for FTOH (fluorotelomer alcohols). The results were in coincidence with the results of the SSS method. The average concentration for the sum of the 4:2 to 10:2 FTOHs was 199 ng / g. The maximum value (for an outdoor jacket) was 618 ng / g ∑FTOH.

It seems that XRF is not such a reliable screening method as SSS due to the fact that the XRF signal saturation for fluorine is limited to a couple of micrometers. Further work may improve the method.

2 negatively identified textile samples showed values of about 1 ng / g for the sum of the 4:2 to 10:2 FTOHs.

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