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Research area: Process aims

Process measuring and control technology

Key words:

Analytics, analytical methods, mineral oil, monitoring

TITLE:**A feasibility study for a rapid method for quantifying traces of hydrocarbons in mineral oils in papermaking****Background/Problem area**

In preparation for the scheduled legal regulation of the migration of mineral oil from paper packaging to foodstuffs, many raw materials and papers are currently being examined for their mineral oil contents in different process and production stages. Current determination procedures are slow and costly from the human resources point of view. There is a basic lack of a method that would allow for rapid detection and estimation of the quantities contained in the individual process stages of a production plant. The development of such a procedure poses a challenge to the currently available analysis and sensor technology owing to the small quantities to be detected, the complex composition of mineral oils and any existing interference of the matrix. Yet it should be borne in mind that since solutions have already been found in other fields with comparably difficult with comparably difficult issues (e.g. the detection of noxious, odorous and explosive substances), this ought to be possible as well in the case of aromatic hydrocarbon traces.

Objectives/Research results

The objective of the research project is to verify the technical feasibility of a rapid procedure for determining mineral oil traces. The verification should provide evidence within the framework of a feasibility study comprising the following work packages:

WP1: Drawing up a requirements profile as the basis for assessing any eligible methods

WP2: Literature searches for potentially suitable methods

WP3: Collection and evaluation of the search results

WP4: Determination of benchmark figures for the technical implementation of correspondingly suitable measuring instruments

In coordination with the Supervising Committee, it was decided that the feasibility study was to focus in particular on a faster laboratory procedure designed to improve the shortcomings of current gas chromatographic methods. The current method is unsatisfactory because it is slow, requires a major personnel effort and produces multiple results in some cases.

The basic components required for a rapid method include a device for detecting and concentrating mineral oil traces (sampler), a device for separating interfering substances and fast-response detectors. The more sensitive and selective the detectors are, the less effective the other two basic components have to be.

According to past literature searches, thermodesorption appears to be a promising method for detecting and concentrating mineral oil traces. Accordingly, further project work should give more detailed consideration to automated procedures such as adsorption/thermodesorption, SPME (Solid Phase Micro-Extraction) and Purge&Trap. These are also capable of separating interfering compounds. Besides water, the latter include in particular low-molecular-weight hydrocarbons (< 16 C atoms), fatty acids, resin acids and their esters.

The following detectors and detection procedures were also taken into consideration: semiconductor gas sensors, especially metal oxide sensors, oscillating quartz sensors such as SAW (Surface Acoustic Wave) sensors, ion mobility spectroscopy (IMS), infrared spectroscopy (FTIR), flame ionisation detectors (FID) and photoionization detectors (PIDs).

In the course of the literature searches, many mobile devices were found that are easy and simple to handle and already contain the three basic components listed above.

In the course of the project work several suppliers of measuring devices were selected and contacted. With selected devices of these suppliers test measurements were conducted using paper samples analysed for their mineral oil content by conventional gas chromatographic method. The results are evaluated at the moment. It becomes apparent that thermo-extraction methods coupled with gas-chromatographic detection could be the wanted solution.

Application/Economic benefits

The planned method should allow for a quick classification of raw materials and the papers produced in respect of the contents of aromatic and aliphatic mineral oil hydrocarbons. The method should contribute to a more flexible utilisation of existing raw materials and should also be able to be used as an instrument in quality assurance. The rapid method should not only replace existing methods recommended by the BfR (German Federal Institute for Risk Assessment) but also independently make fast pre-evaluation of sample materials possible.

Period of time: 01.04.2015 – 31.03.2016

Remarks

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