Standardized Technical Pollen Sampling for Monitoring of GMO - Pollen Mass Filter PMF and Sigma-2 -

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I. Introduction

Pollen dispersal plays a significant role in the spread of genetically modified organisms (GMO). Therefore a procedure is required that enables quantification and documentation of GMO input and spread through pollen.

For this, a research project was carried out [1] leading to a standardized method for technical and biological pollen sampling combined with microscopic and molecular-biological pollen analysis using PCR-screening procedures to proof GMO input [2,3,4]. Here we present the technical pollen sampler consisting of the deposition sampler Sigma-2 [5] and the new developed pollen mass filter PMF.

II. Method

The **Sigma-2** sampler is designed for determining the pollen deposition rate.

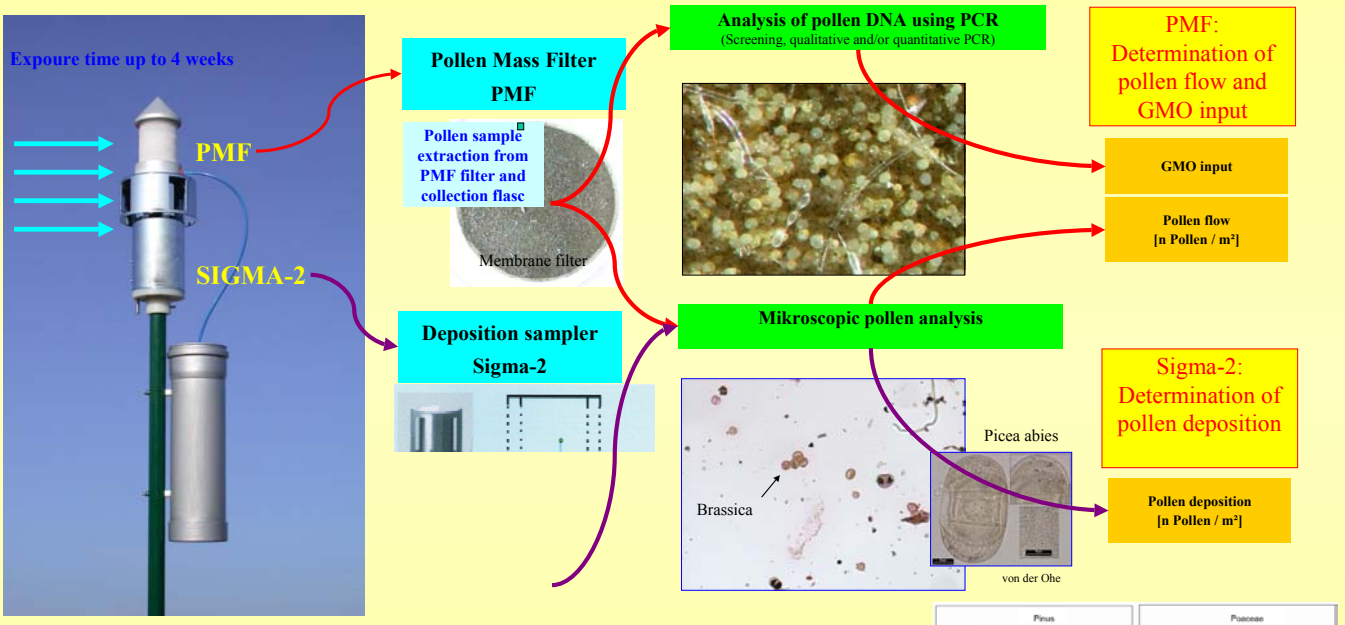
Wind-dispersed pollen grains enter the interior through the laterally shifted slits of the deposition sampler and, together with other aerosol particles, then sediment on the adhesive foil at the bottom. Thus, the deposition takes place in the turbulence-depleted interior of the sampler which provides protection from wind and rain. Pollen adhering to the deposition area is directly analysed with regard to species and amount by means of light microscopy. For this purpose, image-analysis methods can be employed for automated identification.

III. Results

Field experiments have shown that the combined use of PMF and Sigma-2 pollen samplers is well suited for environmental monitoring of GMO [1].

The results prove that detection with a technical sampler covers a wide pollen spectrum that extends significantly further than maize, rape, and sugar beet – the GMO currently of highest priority. The pollen spectrum of the technical sampler complements the spectrum found in the biological sample bee honey (VDI 4330 Part 4) and gives rise to a total of approx. 150 pollen species detected to date [1].

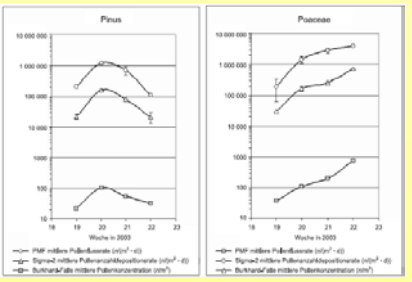
The method shows good reproducibility, sensitivity and low detection limits. The method has been standardized actually in the VDI guideline 4330 part 3 [2].



Presently known pollen traps are only partially suited for this purpose, since they can neither be standardised nor is the instrumentation designed for exposure times that are suitable for GMO monitoring. Another limitation of commonly used pollen samplers is the requirement for a power supply, e.g. as for the Burkard-type of pollen trap. The use of these instruments is therefore restricted to a limited exposure area. For these reasons, a new type of pollen sampler, the pollen mass filter (PMF), was developed. The PMF is used in combination as accessory device to the Sigma-2 deposition sampler according to VDI 2119 Part 4.

The **pollen mass filter (PMF)** exhibits an approx. 50 to 100 times higher sampling efficiency, so that pollen samples can be analysed with regard to possible GMO input using molecular-biological DNA-based methods (PCR). The PMF consists of a layered hollow filter that is constructed in such a way as to let the air pass through nearly unopposed. However, pollen and aerosol particle fraction greater than 10 µm are retained. A laterally mounted collection flask is used for collecting precipitates.

For GMO monitoring, exposure times of four weeks are recommended, so that only a few samples are needed to cover the relevant blooming phases.



Comparison of PMF and Sigma-2 samplers with the standard volumetric pollen trap (Burkard-type) used at monitoring site Westerloge in 2003. Mean values and standard deviation from parallel measurements for PMF and Sigma-2; single measurements in case of Burkard trap. Exposure time: 10 days in week 19 (30 April through 9 May, 2003), 7 days in the following weeks. (Data: Wachter, Hofmann, Dietze).

1 Hofmann, Schlechtriemen, Wosniok, Foth (2005): GVO-Pollenmonitoring – Technische und biologische Pollensammler und PCR-Screening für ein Monitoring von gentechnisch veränderten Organismen. BfN Scripten 139, 275p. URL: www.beuth.de
2 VDI guideline 4330 part 3 (2005-07): Monitoring the effects of GMO – Pollen monitoring – Technical pollen sampling using pollen mass filter (PMF) and Sigma-2 samplers. VDI, Beuth Verlag, Berlin. URL: www.beuth.de
3 VDI guideline 4330 part 4 (2005-07): Monitoring the effects of GMO – Pollen monitoring – Biological pollen sampling using colonies of honey bees. VDI, Beuth Verlag, Berlin. URL:www.beuth.de
4 VDI guideline 4330 part 7 (2005-08): Monitoring the effects of GMO – Qualitative methods for the detection of genetically modified nucleic acids in the environment. VDI, Beuth Verlag, Berlin. URL: www.beuth.de
5 VDI gudieline 2119 part 4 (1997): Messung partikelförmiger Niederschläge. Mikroskopische Unterscheidung und größenfraktionierte Bestimmung der Partikeldeposition auf Haftfolien. Probenahmegerät Sigma-2. VDI, Beuth Verlag, Berlin. URL:www.beuth.de

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Supported by the Federal State of Bremen and the Federal Ministry for the Environment (BMU). On behalf of the Federal Agency for the Environment (UBA).

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit
Umwelt Bundes Amt für Mensch und Umwelt
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Land Bremen
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