The use of Hirst volumetric trap, preparation of drums and slides

Zastosowanie urządzenia wolumetrycznego Hirsta, przygotowanie bębna i preparatów

ALICJA STACH

Quaternary and Geoecology Research Institute, Department of Geomorphology, Poznań, PL,
e-mail: ambrozja@man.poznan.pl

Abstract

The monitoring of airborne particles in many European countries is carried out using Hirst volumetric trap. The method which was described and elaborated on for the first time by Hirst in 1952 allows physiological measurement of content of pollen grains at normal human breathing rates.

This paper describes the operation of Hirst volumetric trap, discusses an adequate location of the trap and preparation of the drum and microscope slides.

Key words: *pollens, monitoring, volumetric method of Hirst.*

Streszczenie

Monitorowanie stężenia cząstek zawieszonych w powietrzu w wielu krajach europejskich odbywa się przy wykorzystaniu metody wolumetrycznej. Metoda ta, którą opracował i opisał po raz pierwszy Hirst w 1952 r. pozwala na pomiar stężenia ziaren pyłków w objętości powietrza, jaką wdycha człowiek w czasie minuty w warunkach fizjologicznych.

Praca przedstawia zasadę działania urządzenia Hirsta, omawia jego odpowiednią lokalizację oraz opisuje sposób przygotowania bębna i ostatecznych preparatów mikroskopowych.

Słowa kluczowe: *pyłki, monitorowanie, metoda wolumetryczna Hirsta.*

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In most European countries the monitoring of airborne particles is carried out using the volumetric method. The method of samplings designed to mimic the inhalation of pollen grains at normal human breathing rates. The instrument and method was designed by Hirst (1952). Two models of Hirst sampler are currently available on the market; they have the same sampling features, but differ as regards resistance, reliability and spore parts. There are:

- 1 to 7 Day Recording Volumetric Spore Trap, manufactures by Burkard Manufacturing Co., Ltd, Hertfordshire, U.K. (fig. 1), and
- 1 to 7 Day Volumetric Pollen and Particle Sampler, named VPPS 2000 manufactured by Lanzoni srI, Bologna, Italy.

Fig. 1. Burkard volumetric trap

This types of samplers are used for continuous monitoring of airborne pollen concentration. The sample is sacked in by vacuum pump and air with pollen grains, fungy spores and another particles is

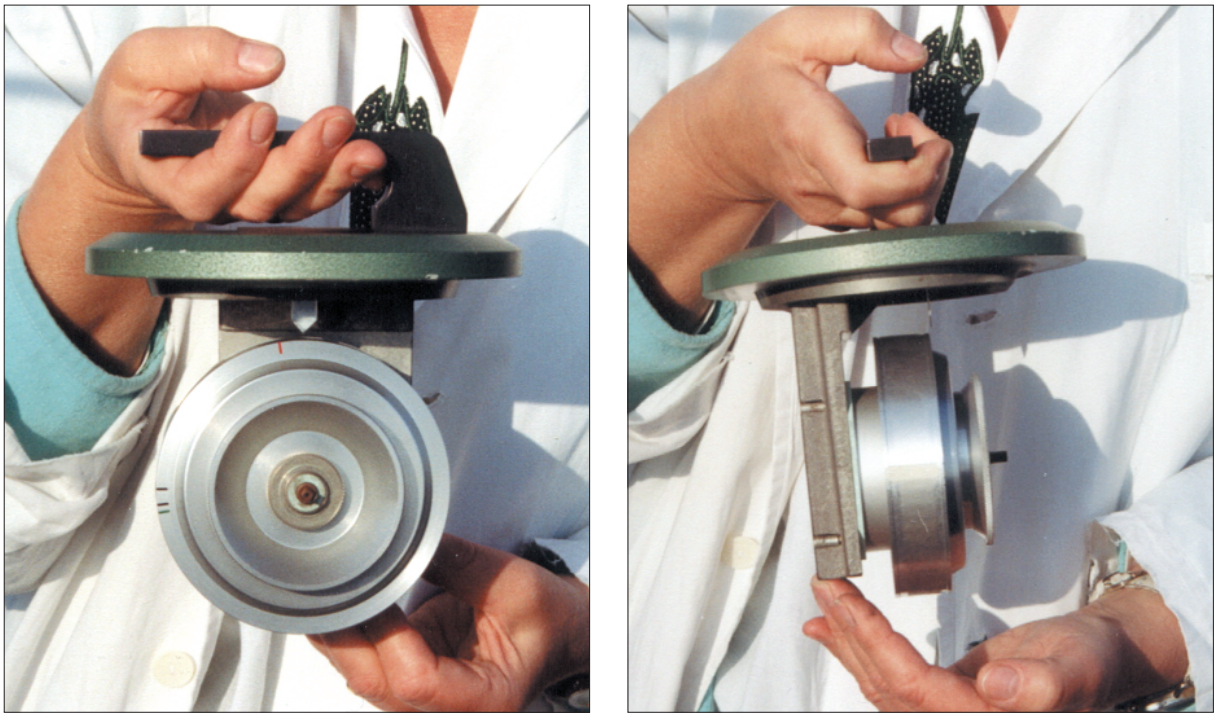

Fig. 2. 7-day volumetric trap

deposited by inpaction on tape. The air flow is provided by an external vacuum pump and it must be constant, it is usually 10l/min. Therefore the spore trap samples 0.6 m^3 of air per hour (14.4 m^3 every day). In the Hirst volumetric type traps, the samplers can be obtained weekly (fig. 2) or daily (fig. 3). In 7-day trap sampling is carried out weekly. A polyester Melinex tape, about 345 mm long (48 mm/day x 7 + 9 mm for mounting a tape) which corresponds with seven days of week.

Location of the trap

The instrument should be located at 15–25 m above ground level, without briers which may obstruct free air passage. The best location of the trap is in representative part of city, far from parks or woods to avoid extremely high concentration coming from this sources.

Adhesive coating

Using a good adhesives gives good survey and the data should be comparable. It is very important to used adhesive that does not vary with different meteorological conditions. They have been done comparative studies using different media (Solomon et al. 1890, Käpylä 1989, Comtois and Mandrioli 1994, Galan and Dominguez-Vilches 1997).

In different aerobiological laboratories different adhesive coatings are used for collecting airborne particles among other: vaseline, mixture of vaseline and paraffin, white petrolatum, silicone fluid an also glycerol, glycerol jelly and gum resins.

Drum preparation and changing

- The clean area is necessary for preparation and mounting of the trapping surfaces to avoid contamination.
- The trapping tape is held on a drum with double-sided tape. When the tape is on the drum, then the adhesive may be applied with aid of a brush. It is very important to cover the tape with very thin and uniform layer adhesive coating.

Changing the drum in the trap

- Always anchor the rotating part of the trap while you are attending to it.
- The ends of the trace should be marked with dissecting needle inserted through the inlet orifice or a puff of *Lycopodium* spores at the beginning and end of the samples period.
- Removing the drum to storage box remember not to touch the trapping surface. It is also good idea to clean the orifice with a strip of card every week.
- Make sure the clock is fully wound, turn the key anti-clockwise, but do not overwind it.

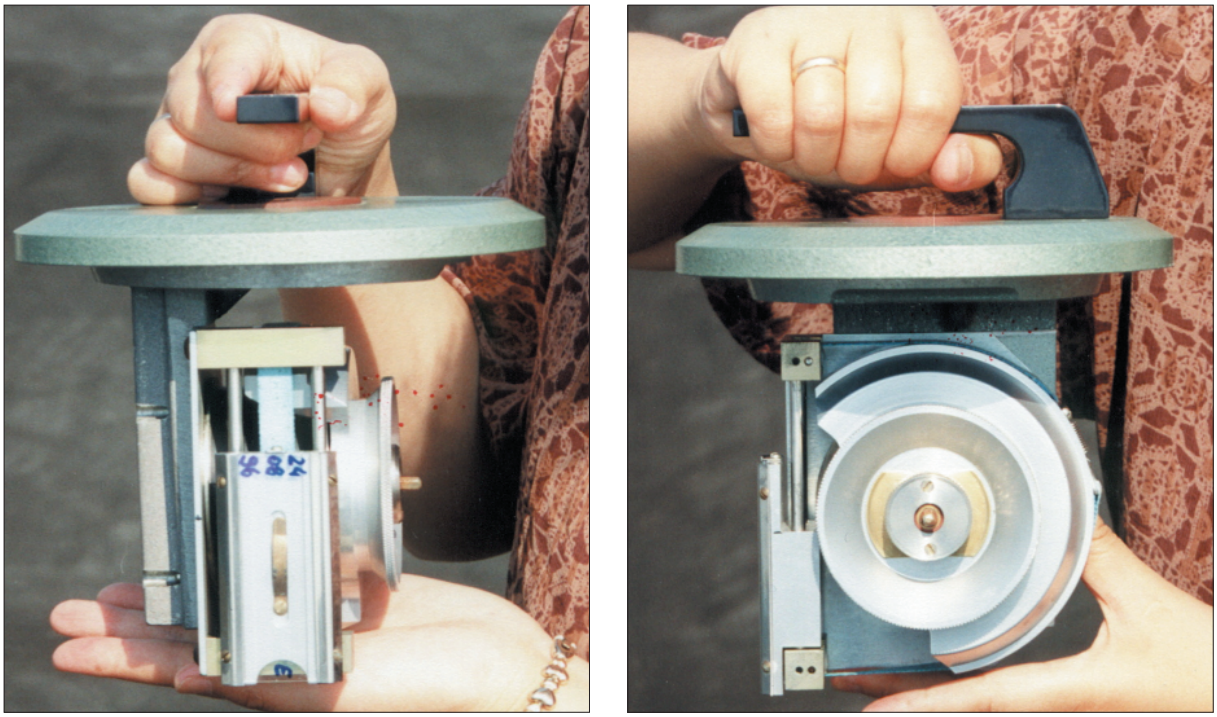

Fig. 3. 24-hours volumetric trap

Slide mounting

After one week the tape has been exposed to impacting particles from start to finish. Then the tape has to be removed, and microscope slide preparations have to be made to count pollen grains and fungy spores. Using 24-hours trap (Fig. 3) the slides are changing every day at the same time.

Material

1. Rotatable stand for drum,
2. Cutting block,
3. Sharp dissecting scissors, scalpel or razor-blade,
4. Microscopic slides (26x76mm),
5. Cover glasses (24x60mm),
6. Preparation needles,
7. Embedding medium in bottles with dropping pipettes,
8. Labels with dates (if slides have not frosted end for writing dates),
9. Measuring scale,
10. Canadian balsam or a nail polish,
11. Slide boxes.

commonly used embedding media are glycerol jelly, or gelvatol

commonly used staining dyes are basic fuchsine or saffranine

glycerin jelly: glycerin – distilled water – gelatine =6:6:1

gelvatol: 35 g Gelvatol, 100 ml aqua dest., 50 ml Glycerin, 2 g Phenol,

Add Gelvatol to water and glycerol, warm slightly and stir, until the gelvatol is in solution (may last several days!!!!) then add the phenol)

preservative: phenol 2%

staining dyes: basic fuchsine (saturated aqueous solution) 0.25%

saffranin (pure) 0.003%; (0.1% stock sol.) 3%

Method

1. Place drum on rotatable stand.
2. Remove tape from drum, and place it on cutting block (make sure which end is start, which end is finish – is possible to mark a letter „b" at the beginning when the tape is mounting on the drum).
3. Have ready: seven (or eight) microscope slides with data, seven (eight) cover glasses; melted embedding medium (with and without dye) in dropper bottles.
4. Apply medium, on microscopic slide (avoid superfluity of medium).
5. Cut the tape for seven (or eight pieces), mark before the left bottom part of every day piece of the tape with waterproof pen.
6. Place the pieces of tape on the slides covered with gelvatol, the left part of the tape with marking point put near the label part of slide (fig. 4).

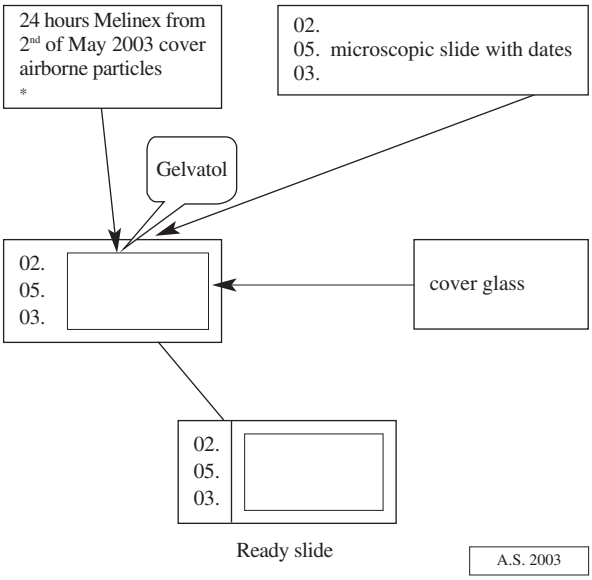

Fig. 4. Schematic diagram of laboratory preparing slide with diurnal record of airborne particles

7. Wait about 15 minutes to allow medium to harden.
8. Apply dye containing medium on cover glasses and cover the tape using preparation needle (do not touch the tape, avoid superfluity of medium, avoid air bubbles, don't press).

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The 6th European Course On Basic Aerobiology,
Poznan, Poland
A. Stach