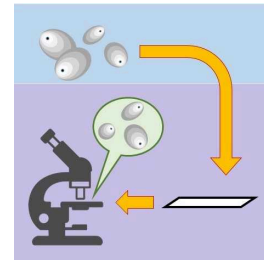


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Techniques for the detection and counting of starch particles in the atmosphere

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We use this protocol and it's working

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Abstract

Suspended particles in the atmosphere (aerosols) can impact visibility, the radiation budget, architectural heritage, agricultural activity, and human health (Pérez *et al.*, 2020). Recent studies suggest that flour derivatives like starch are present in the environment (de Diego *et al.*, under revision). This research protocol outlines a list of suitable techniques for detecting and recording the presence of starch in the air.

Image Attribution

Images drawn and provided by the authors.

Materials

-  Silicone grease
-  Acetone
-  Phenol
-  Carbon tetrachloride **Merck MilliporeSigma (Sigma-Aldrich)**
-  Glycerol **Bio Basic Inc. Catalog #GB0232.SIZE.500ml**
-  Distilled Water
-  Polyvinyl Alcohol
-  Ethanol 10%

Safety warnings

-  Manipulation and preparation of the adhesive mix require following safety guidelines such as using gloves in well-ventilated spaces far from any ignition source.

Ethics statement

Not applicable

Before start

Carefully wipe all surfaces, materials, and tools with ethanol to avoid any starch contamination during the preparation of samples.

Preparation of the adhesive mixture and mounting media

- 1 Several recipes are in the literature (eg. Käpylä, 1989). But we recommend the following one.

🧴 20 g Silicone grease

🧴 500 mL Acetone

🧴 500 mL Carbon tetrachloride (optional)

🔄 60 rpm, Room temperature , 48:00:00 or intermittent manual procedure

Weigh 20 g of silicone grease and add to a 1L caramel-colored jar.

Pour the carbon tetrachloride into the jar and gently shake the bottle by opening the lid from time to time to evacuate any vapors that accumulate inside. Let it rest for a day and repeat the shaking operation. Generally, between 24 and 48 hours of this procedure are required until the silicone is completely dissolved. Once the silicone grease has completely dissolved, fill up with 500 mL of acetone.

Carbon tetrachloride can be replaced with 500 mL of acetone, although the silicone solubility is lower and the procedure will require more time.

Note

This adhesive mixture can be prepared and stored in a cool place. It is useful for studying aerosols using gravimetric or volumetric methods. Depending on the ambient temperature, the solution may appear cloudy. This does not affect its use.

- 2 The preferred mounting media is glycerine with a small amount of phenol to prevent fungal growth. Store in a bottle.

🧴 50 mL Glycerol

🧴 2 mg Phenol

- 3 Decide what type of sampling to deploy in the field (**fig.1**).

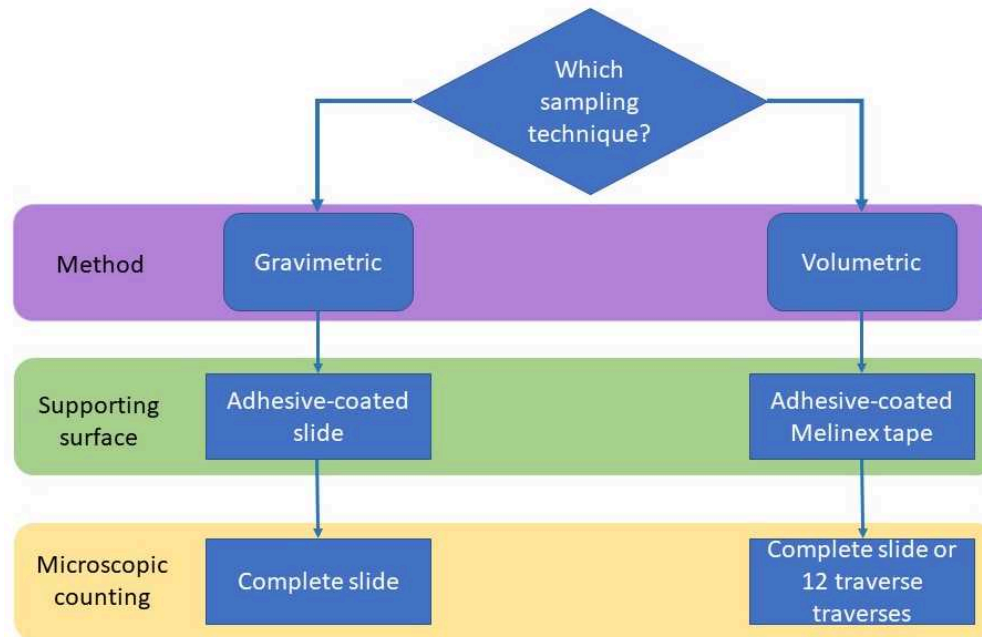


Figure 1. Types of sampling methodologies, supporting surfaces, and counting techniques for airborne starch sampling

STEP CASE

Gravimetric sampling 4 steps

Instructions to perform a gravimetric sampling

- 4 This technique relies on gravity to deposit aerosols suspended in the air. We developed a wooden box trap that prevents the repulsion or attraction of aerosols caused by static charges (**Fig. 2, 3**). The collected material is supported on a coated slide, and the particles enter through a known size slot. The box trap is positioned horizontally without any surrounding obstacles.

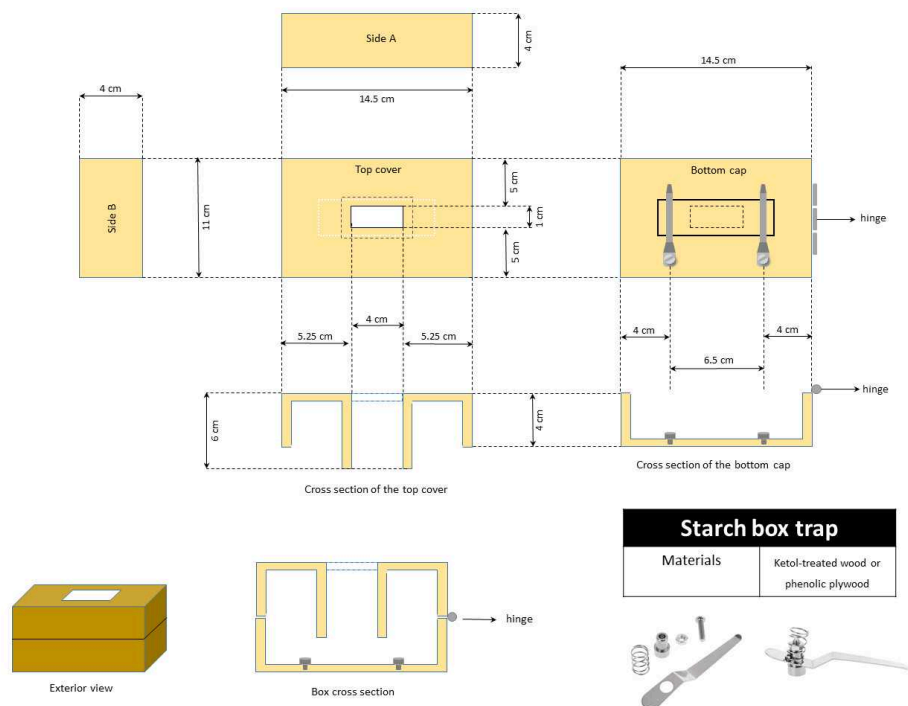


Figure 2. Box trap scheme

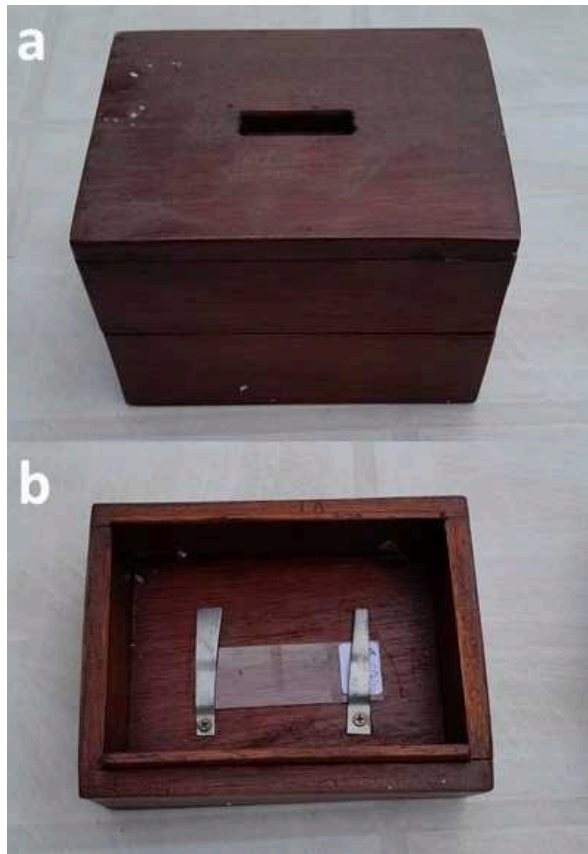


Figure 3. Wooden box trap. **(a)** Exterior and **(b)** interior view with the slide

Preparation of adhesive surfaces

- 5 Prepare sticky slides spreading the adhesive mixture with a soft brush. The duration of exposure varies according to the research goals.

Preparation of slides

- 6 Add 5 to 6 drops of mounting media (glycerol + phenol) to each exposed slide, cover them with a clean coverslip, and seal them with nail polish.

Note

To increase the fluidity of the mounting medium, it can be gently heated no more than 35 or 40°C in a water bath.

Detection and counting of starch particles

- 7 Samples are studied with an optical microscope with a final magnification of 400 or 1000X according to particle size.



Equipment

Binocular microscope

NAME

DM750

TYPE

Leica

BRAND

1

SKU

<https://www.leicabiosystems.com/es/>

LINK



Gravimetric samples require inspection of the total surface of the slide. By performing a simple calculation, we can determine the deposition rates in terms of the number of particles per square centimeter over a specific period. The reference area for this calculation is the area of the wooden slot. We performed one-month exposure periods.

Starch granules appear under the optical microscope as hyaline particles that are difficult to separate from mineral dust like quartz crystals, which are very common in aerosol samples (**Fig. 4 a,c,e**) However, polarized light illumination allows starch to be recognized from a cross-shaped mark (**Fig. 4 b,d,f**) that identifies it among the rest of the aerosols in the sample (Moss, 1976).

Expected result

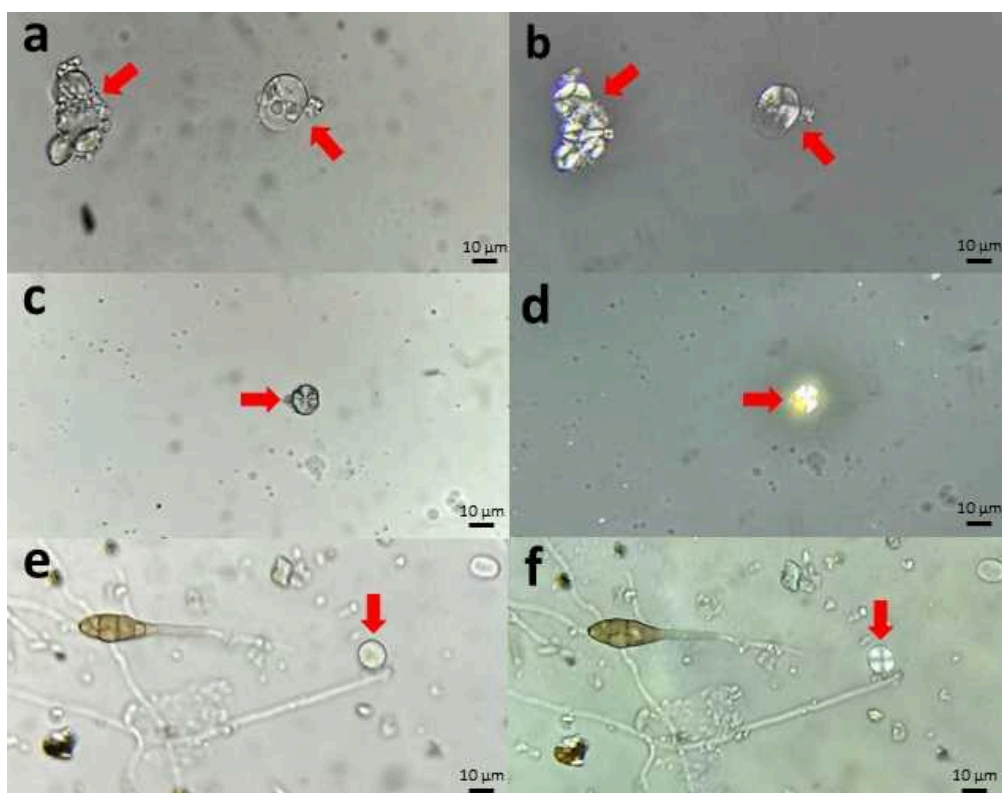


Figure 4. Starch granules at 400 x magnification. Reference flour starch without (a) and with (b) polarized light. Starch granules from gravimetric samples without (c) and with (d) polarized light. Starch granules from volumetric samples without (e) and with (f) polarized light. Red arrows show starch granules.



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