

Superhydrophobic Coating using Candle Soot

Abstract

In recent years, the development of superhydrophobic surfaces has attracted attention due to their applications in self-cleaning, anti-fogging, and water-repellent materials. Commercial methods of fabricating superhydrophobic surfaces are often expensive and complex. This project demonstrates a simple, budget-friendly method of preparing superhydrophobic coatings using candle soot, which consists of carbon nanoparticles. When a surface such as glass is exposed to candle flame, a thin layer of soot is deposited, creating a rough, nanostructured coating. This coating repels water strongly, as observed by the beading of water droplets. The project highlights nanoscience principles and provides a sustainable, low-cost way of replicating the lotus effect in nature.

Objectives

To demonstrate the creation of a superhydrophobic surface using candle soot.

To study the water-repellent (lotus effect) properties of the soot-coated surface.

To compare wettability between coated and uncoated surfaces.

To explore practical applications of superhydrophobic coatings in daily life (self-cleaning, waterproofing).

Hypothesis

If a glass surface is coated with candle soot, then water droplets placed on it will form near-spherical beads and roll off easily compared to uncoated glass, because the nanostructured soot layer creates air pockets that minimize contact between water and the surface, demonstrating superhydrophobic behavior.

Materials Required

Candle (any household candle).

Glass slides / microscope slides / glass beaker.

Lighter or matchbox.

Dropper or syringe (for placing water drops).

Distilled water.

Protractor or smartphone (to measure contact angle, optional).

Safety gloves and goggles.

Procedure

Light a candle in a well-ventilated area.

Hold a clean glass slide above the candle flame (black zone) without touching the flame directly.

Allow black soot to deposit on the glass surface for a few seconds until a uniform coating is visible.

Carefully remove the slide and allow it to cool.

Using a dropper, place a few drops of water on the coated slide.

Observe the shape and movement of the water droplets (they should bead and roll off).

Repeat the same with an uncoated glass slide and compare results.

Optional: Measure the contact angle of droplets using a protractor or smartphone image analysis.