

Unknown Material Characterization

Preliminary Results and Potential Candidates

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Introduction

The purpose of this preliminary phase is not immediate identification, but the **logical restriction** of the search space.

We aim to classify the material based on:

- Physical Properties
- Chemical Behavior
- Spectroscopic Data (XRF)




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Experimental Results

Key Observation: Dermal Reaction

Upon accidental contact with skin, the grains leave persistent **dark/black spots**.

- Indicates photoreduction of metal ions to elemental metal.

Morphology

- White microcrystalline powder.
- *Markedly hygroscopic* (forms clumps).

Thermal Properties

- Low melting point.
- **No carbonization.**
- **Conclusion:** Inorganic Compound.

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Visual Evidence: Dermal Reaction

Photoreduction of the sample on organic tissue



Figure 1: Sebastian's Hand



Figure 2: Adriano's Finger

The Elemental “Fingerprint”

X-Ray Fluorescence (XRF) spectroscopy provided the most conclusive data:



Primary Constituent:
SILVER

This explains the skin stains: $\text{Ag}^+ \longrightarrow \text{Ag}^0$ (Black metallic silver).

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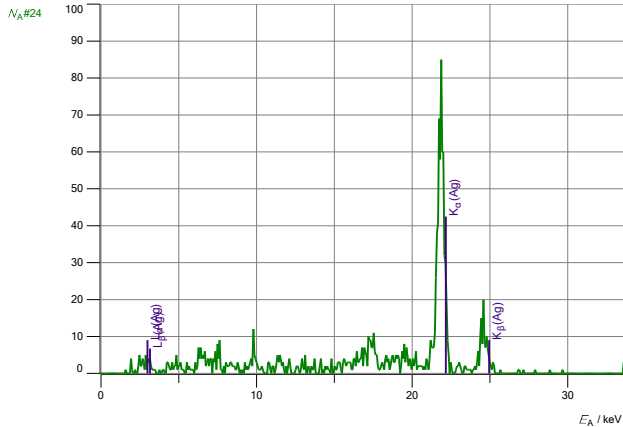


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XRF Spectrum Analysis

Estándar - Materiales Grupo 1 - CASSY Lab 2



Spectrum confirming characteristic Silver (Ag) emission lines.

The Solubility Paradox

Solubility results presented an apparent contradiction:

Deionized Water

High Solubility

Clear, colorless solution.

Sulfuric Acid (H_2SO_4)

“Insolubility”

Formation of a white solid.

How can it be soluble in water but insoluble in dilute acid?

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Analysis

Solving the Paradox

It is not physical insolubility; it is a **Precipitation Reaction**.

Upon dissolving, the sample releases Ag^+ ions, which encounter sulfate SO_4^{2-} ions in the acid.



Conclusion: The unknown is a water-soluble silver salt.

Candidates

The 3 Main Candidates

Candidate 1: Silver Nitrate (AgNO_3)

Probability: High

- ✓ **Solubility:** Extremely high in water (2560 g L^{-1}).
- ✓ **Skin:** Causes characteristic black stains (chemical burn via reduction).
- ✓ **Thermal:** Low melting point (212°C).
- ✓ **Chemical:** Reacts with H_2SO_4 to precipitate sulfate.

This is the most common soluble silver salt in laboratories.

Candidate 2: Silver Fluoride (AgF)

Probability: Medium

- ✓ **Hygroscopicity:** Matches perfectly (AgF is deliquescent, absorbs water voraciously).
- ✓ **Solubility:** The only water-soluble silver halide.
- × **Rarity:** Less common than nitrate.
- × **Appearance:** Often has a yellowish tint (though can be pure white).

Candidate 3: Silver Perchlorate (AgClO_4)

Probability: Low/Medium

- ✓ **Solubility:** Extreme solubility (5570 g L^{-1}), even higher than nitrate.
- ✓ **Inorganic:** Consistent with lack of carbonization.
- × **Risk:** Potentially explosive under certain conditions (organic shock), requiring special handling not reported.

Future Work

To distinguish between NO_3^- , F^- , and ClO_4^- :

1. **Brown Ring Test:** Specific confirmation for Nitrates.
2. **X-Ray Diffraction (XRD):** Definitive identification of the crystalline phase.
3. **Raman Spectroscopy:** Differentiation of anion vibrational modes.

Thank you!

Questions or Comments?

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