

Fingerprints: Iodine Fuming and Electron-Donor-Acceptor Complexes

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Experiment Overview

The experiment is divided into three parts:

- ☐ Visualising a fingerprint using the iodine-fuming procedure and characterising the print using solid-state UV-Vis;
- ☐ Synthesis and characterisation of a iodine-donor complex; and,
- ☐ Comparison of the thermodynamic (equilibrium constant and molar extinction coefficient) values for several donors and iodine by solution UV-Vis.

Iodine fuming is one of the first methods used to acquire fingerprints; however, this has been replaced by better methods. The exposure of iodine to fingerprint residue allows the visualisation of the “invisible” print. The reaction between iodine and fingerprint residue (amino acids) leads to the formation of charge transfer complexes. Charge transfer complexes exhibit very high equilibrium constants, and thus, are easy to study.

Once the fingerprint is developed using “iodine-fuming” procedure, various other donors will be examined and their thermodynamic properties discussed in relation to the donor. It is hoped that the students will be able to appreciate that fingerprint development using iodine fuming is based on electron-donor-acceptor complexes.

Level of Experiment

Second year undergraduate

Keyword Descriptions of the Experiment

Domain

analytical chemistry

Specific Descriptors

fingerprints, iodine-fuming, charge transfer complexes

Course Context

This experiment is part of a recent “Forensics and Environmental Chemistry” course. It looks at one of the techniques used to visualise fingerprints on porous surfaces.

Prerequisite Knowledge and Skills

The students are required to have a basic understanding of UV-Vis spectrophotometry. Skills that are specifically required include the ability to accurately prepare and dilute solutions and use of

standard laboratory equipment (beakers, measuring cylinders) to synthesize and isolate their products.

Time Required to Complete

Prior to Lab: N/A

In Laboratory: 3 h

After Laboratory: 1 h

Experiment History

Several papers¹⁻⁵ were used to prepare this experiment. Literature data needed for the discussion is based on these investigations, and on work done in the laboratory to verify all aspects of the experiment. The experiment was developed by the authors of the educational analysis.

References

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2. Devillanova, F. A. & Verani, G. (1979). Charge-transfer complexes between I₂ and 1,3-imidazolidine-2-thione and its *N*-mono-substituted and *N,N'*-di-substituted derivatives. *Tetrahedron*, **35**, 511-514.
3. Lang, R. P. (1968). Molecular complexes of iodine with tetramethylurea and tetramethylthiourea. *Journal of Physical Chemistry*, **72**, 2129-2135.
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5. Brandon, M., Tamres, M., & Searles, S. (1960). The iodine complexes of some saturated cyclic ethers 1. The visible region. *Journal of the American Chemical Society*, **82**, 2129-2134.