

ABSTRACTS

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Letter to the Editor

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Ink Dating – Essentials and Scope of Applicability of the Solvent Loss Ratio Method (SLRM)

Black Toner Comparison using Solubility Tests: A Case Report

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This paper describes an actual case examination in which optical methods, solubility tests, and thin-layer chromatography (TLC) were used to determine whether two questioned documents, printed/copied on an office machine(s) using black toner, were produced on or around their purported dates (several years apart), or whether the documents were produced contemporaneously (in close proximity in time, i.e. not several years apart, as dated). In this civil case, based on the results of the optical and TLC examinations of the toner on both questioned documents, the Defendant's expert found and testified that the *black toners in these documents had a connection and were consistent with each other*, and this finding was used as a *chemical* basis for the expert's opinion that the two documents were most probably produced contemporaneously—not several years apart, as dated. This author, retained as a rebuttal expert, repeated the above examinations conducted by the Defendant's expert, and determined that the only chemical *connection* and *consistency* between the two toners was that they both contained a common pigment—carbon black. While optical and TLC examinations could not distinguish between the black toners on the two documents (these results were in agreement with the finding of the Defendant's expert), the solubility tests (chemical extraction of toner samples in chloroform to prepare extracts to be applied on TLC plate for chromatographic analysis) showed that the two toners had significantly different extractability in chloroform; evidence that the toners were of differing chemical composition.

Two common parameters of solubility (extractability) of a solid substance in a solvent are the speed at which the solid dissolves (rate of dissolution/extraction) and the completeness of the dissolution (extent of dissolution/extraction). In this case, the difference in the solubility of the two toners in chloroform was clearly evident and very significant (as in, for example, the drastic difference between the solubility of instant coffee and ground coffee in hot water): one toner was extracted in chloroform almost instantly (within seconds) and completely, while the other toner dissolved only partially (not completely) and the process of dissolution (formation of a suspension of carbon black in chloroform) was slow. Thus, in this comparative examination of two documents produced by electrophotography using black toners, the solubility tests proved to be more discriminating (provided more discriminating power) than the optical and TLC methods.

Thin-Layer Chromatography of Inks—Efficiency of Separation of Ink Components

Valery N. Aginsky, PhD

There are numerous publications relating to the use of thin-layer chromatography (TLC) in the analysis of inks on documents. This paper compares the efficiencies of TLC separation of ink components when using several ‘developing’ solvents (solvent systems) commonly used for ink analysis in the forensic laboratory. The parameters chosen for this evaluation are the *shape of and distance between* chromatographic zones of separated dye components of ink, including components of Methyl Violet, a dye mixture often used in the manufacture of black, violet and blue ballpoint, fountain pen, and stamp pad inks. (This mixture typically consists of the dye Crystal Violet and its two or three homologues, which are triphenylmethane dyes of a similar chemical structure and hence similar physical and chemical properties, whose chemical structures differ only by one methylene [CH₂] group). The results obtained show that at least three solvent systems, one of which (ethyl acetate – isopropanol – water – acetic acid = 30:15:10:1) was developed and reported by this author in the 1980s, provide significantly improved TLC separation efficiency compared with the “Solvent System I” recommended in the current *SWGDOC Standard for Test Methods for Forensic Writing Ink Comparison*.

Microscopic Method for Determining the Size of Toner Particles in Page Substitution and Document Dating Cases

Valery N. Aginsky, PhD

Toner is typically a powder that is used in laser printers and photocopiers to form printed text and images on paper. During the printing process, toner particles are partially melted by the heat of the fuser, binding them to one another and onto the paper. This paper describes a microscopic method for determining the average particle size of the toner used to produce a printed (copied) document. The method can assist forensic document analysts in page substitution cases, as well as in document dating cases in which it is necessary to establish whether the toner was available on the date that the contested document bears.