World Academy of Science, Engineering and Technology
International Journal of Cognitive and Language Sciences
Vol:9, No:10, 2015

Statistical Discrimination of Blue Ballpoint Pen Inks by Diamond Attenuated Total Reflectance (ATR) FTIR

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Abstract : Determining the source of pen inks used on a variety of documents is impartial for forensic document examiners. The examination of inks is often performed to differentiate between inks in order to evaluate the authenticity of a document. A ballpoint pen ink consists of synthetic dyes in (acidic and/or basic), pigments (organic and/or inorganic) and a range of additives. Inks of similar color may consist of different composition and are frequently the subjects of forensic examinations. This study emphasizes on blue ballpoint pen inks available in the market because it is reported that approximately 80% of questioned documents analysis involving ballpoint pen ink. Analytical techniques such as thin layer chromatography, high-performance liquid chromatography, UV-vis spectroscopy, luminescence spectroscopy and infrared spectroscopy have been used in the analysis of ink samples. In this study, application of Diamond Attenuated Total Reflectance (ATR) FTIR is straightforward but preferable in forensic science as it offers no sample preparation and minimal analysis time. The data obtained from these techniques were further analyzed using multivariate chemometric methods which enable extraction of more information based on the similarities and differences among samples in a dataset. It was indicated that some pens from the same manufactures can be similar in composition, however, discrete types can be significantly different.

Keywords : ATR FTIR, ballpoint, multivariate chemometric, PCA
Conference Title : ICFST 2015 : International Conference on Forensic Science and Technology
Conference Location : Bali, Indonesia
Conference Dates : October 11-12, 2015