Charles A. Steele

Phone: 708-383-8320
Email: steele49@pnw.edu

Section 1: Summary

I am an eclectic scientist. I am product development and analytical consultant through my own company Aneval Inc. Until 2009 (concurrent with my consulting business) I was also the Laboratory Manager and Quality Manager for Keystone Aniline Corporation, the largest domestic dye and pigment company servicing many industries. In 2012 I began teaching and since then have also been an instructor of at Purdue University North Central and Purdue University Calumet Campus (These have now been combined as Purdue Northwest) as well as an adjunct instructor and researcher at the University of Illinois at Chicago. My professional and scientific experience, through these schools and corporations, expands into several industries with my primary focus being in cosmetic chemistry, plastics and forensic science.

At Keystone Aniline Corporation I was primarily responsible for designing and implementation of laboratory practices and procedures for several laboratories as well as product research and development. I was the primary architect of the corporate wide ISO and Quality Control/Quality Assurance system which resulted in a decrease in production overruns from 72% to 5%.

Through Aneval Inc. I provide product and process development consulting as well as analytical testing services. Primary services of the consultancy include: design and implementation of necessary methods to test the validity of patent claims both prior to patent filing and in defense of existing patents; Design and execute custom training programs in various technical areas from basic science to industry specific technology; Lead university and corporate research teams; Perform custom and standard analytical testing; Product design and development.

I have developed more than 1,300 consumer products. Designed quality and laboratory methods for multiple companies. My research has contributed to the areas of: Fingermarking, Compostable Plastics, “Green” Wood Colorants, Lightfastness, Security Tagging and Cosmetic Formulations. Notable products have included Fuming Orange, a one-step fuming and multi-wavelength excitable fluorescent coloring system for finger prints; Perma-Print - Axis Inversion Dyes, a method for permanently coloring the background behind fingermarks; A method for permanently coloring wood through incorporated pigmenting through the entire bulk; Eco-friendly water based massage treatments; the DataTrax™ Encoded Microparticle and Hair Dyes for Active Women.

I have conducted and published a variety of research and am currently working on a Ph.D. at the Krannert school at Purdue University.

Section 2: Education

Krannert School of Management, Purdue University Ph.D. student in *Quantitate Methods*	9/2015 to current
University of Illinois at Chicago M.S. *Forensic Science*	9/2013 to 5/2014
University of Illinois at Chicago *Criminalistics*	9/95 to 6/97
University of Illinois at Chicago B.S. *Physics*	9/91 to 12/94
Triton College	Spring 1990
University of Chicago	Summer 1988
Triton College	Fall, 1986
Illinois Institute of Technology	8/84 to 12/85
Fenwick High School	9/80 to 6/84

Section 3: Seminars & Workshops

International Association for Identification Education Conference *Facial Identification:* *The First Step to Becoming and Examiner (4Hrs)*	August, 2019
International Association for Identification Education Conference *Footwear Comparison for Beginners (4Hrs)*	August, 2019
International Association for Identification Education Conference *Composite Drawing Interviewing Essentials (3Hrs)*	August, 2019
Society of Cosmetic Chemists *Hair Color*	June, 2002

Packaging Manufacturers Institute *Packaging Line Security*	February, 2002
Society of Cosmetic Chemists *Ethnic Hair and Basic Hair Care*	March 2001
McCrone Research Institute *Hair Microscopy*	May, 1993
McCrone Research Institute *Microscopy of Man Made Fibers*	July, 1992
Newberry Library *Writing Fiction*	Fall 1988

Section 4: Professional History

Aneval Inc.
President 1996 to Current

Through Aneval Inc. I have worked as a private consultant doing analytical testing, patent claims validation and product and process development. In addition to personal care products, I have worked with accompanies like Tracking Technologies to develop security tagging products capable of meeting evidentiary requirements. I have also been employed as an expert witness in cases of product liability claims and patent infringement.

In addition to providing commercial services, Aneval Inc. is also actively engaged in researched and internal product development. Recent products have included the Mr. Lloyd's line of massage and bath treatments, Fuming Orange color fumes for fingermarks and the Perma-Print Axis inversion dyes.

University of Illinois at Chicago
Adjunct Instructor of Biopharmaceutical Sciences August 2014 to present

My function at the University of Illinois (UIC) is primarily research. As an Adjunct instructor I mentor graduate student research projects. I conduct primary research at UIC developing new laboratory and educational techniques.

Current projects include a new method of developing fingerprints on porous materials, improving of the quality of poor to moderate fingermarks developed with carbon black and producing an educational video series aimed at the mass market.

Purdue University Northwest
Visiting Instructor, Physical Sceince, Forensic Science Coordinator

I was a Limited Term Lecturer (LTL) from June of 2012 at the Westville Campus (Then Purdue North Central (PNC)). In Jan of 2015 I began teaching at Purdue University Calumet Campus (PUC). In September of 2018 I started teaching full time for as a visiting Lecturer for Purdue University Northwest (PNW). In this capacity I teach on both campuses and am the architect and coordinator for the forensic science curriculum. At PNW I have taught classes in: Chemistry, Foresnic Science, Math and Physics and developed the forensic science program.

Keystone Aniline Corporation
Laboratory Manager/Quality Manager/Product Chemist 1995 to 2009

At Keystone, my administrative responsibilities included: supervision of personnel, monitoring of workflow for thee laboratories, authoring operating procedures and upgrading laboratory capabilities. In addition to these, I also provide technical service to a variety of companies and government agencies in the United States and abroad. Technical responsibilities include: product line development, setting quality control practices and approximately 130 customer projects per year.

Among my achievements at Keystone have been the development of a product line for hair dyes including a technical guide and formulary, the development of a new automotive leak tracer (patent granted), the development of a new chemistry of now polymerized non-staining dyes (patent applied for) the development of a method to permanently pigment exterior grade wood (patent applied for).

Princeton Review
*Instructor*1995 to 1996
Instructor for ACT/SAT review classes

Section 5: Significant Publications & Presentations

Poster: Statistical Analysis of Depended Characteristics of Shoe Soles
International Association for Identification Education Conference, Reno 2019
With Sara Jerde

Summary:

A previous study shoe soles has shown that the occurrence of scratches and corner defects is lowest in sectors three and eight.[1] Therefore, the independence and likelihood of one, two and three incidents of either defect in these sectors was evaluated as a preliminary part of a study of shoeprints. Although the probability of the number of damage elements px is not Indapendent of the probability of damage pD. $p(X \mid D) \neq px$; the F-statistic of a one-way ANOVA strongly suggests that a difference does exist for at least some amount of damage. A Tukey HSD at an $\alpha = 0.01$, $Q_{critical} = 4.52$, showed that the sets with two or fewer damage elements were not significantly different total set of damaged shoes. A comparison set of shoes with three or more damage elements vs. the total set of damaged shoes however, produced a QIJ of 5.38 at a p-value < 0.01 showing that these sets are significantly different. The presence of three or more damage elements therefore can have statistically quantifiable value for identification.

Poster: Rapid Fingerprint Development with Oil Blue A and Oil Yellow 202
International Association for Identification Education Conference, Reno 2019

Summary:

The Oil Red O process for developing fingermarks on porous materials is time consuming and requires immersion of samples in solution baths. In addition, the process is only able to develop a light pink shade. The use of red shades on materials in the red to red-brown color space, like manila envelopes and colored paper, limits the resolution capability of the method to shade differences and variances in color intensity. This study adds Oil Blue A and Oil Yellow 202 to extend the pallet of available colors for dye-based fingermark detection and introduces a rapid single step spray application. This dye- based spray application offers an improvement over the existing technology both in available color space and in processing time. Samples can be processed in a few minutes

Introduction to Forensic Science: *Chapter 2 Crime Scene Processing and Analysis ad Forensic Technologies*
 ISBN:-13 1-62178-546-0

Summary:

Crime scene investigation begins with an understanding of the Locard principal and evolves into an integration with modern technology. An overview of the application of modern criminalistics to the task of identifying and processing evidence after a crime. Key points are actions at a crime scene, fourth amendment rights and educational considerations.

Integration of VR technology into a CSI learning environment *Evidence Technology Magazine, Vol 16 Number 4 Winter 2018*

With Karl Larsen and John Moreland

Summary:

Crime by The Fives is a virtual reality environment designed expose students to the steps and considerations needed for the processing of crime scenes. The scenario includes multiple pieces of evidence that need to be identified and collected. Real world copies of these evidence can then be processed in the real-world laboratory. This approach allows instructors to present a curated crime scene that meets an established standard.

A Forensic Scientists Guide to Color

Color Theory for the Crime Lab

 ISBN-13: 978-1505728675

Summary:

Forensic scientists encounter a variety of evidence that is hard to visually discriminate from the ambient background. Fortunately colorants using a many different chemistries are available to enhance visualization. This paper has three objectives. The first objective is to provide an explanation of color theory as it applies to forensic science. The second objective is to explain and categorize the chemistries available for visualization. The third objective is to provide an index of colorants used in forensic science with specifically attention on those used for blood and fingermark detection.

Master Thesis: Improving the Stability of Stored Fingermarks on Plastic Bags by Axis Inversion Development

http://hdl.handle.net/10027/18771 May 2014

Abstract

Low Density Polyethylene (LDPE) bags are used to package a variety of legal and illegal products including illicit drugs such as cocaine and methamphetamine. In addition to scientific confirmation of the materials in the LDPE bags, it is often desirable or necessary to determine who has handled them. A primary way that this is achieved is by developing latent fingerprints on the bag. This can be accomplished effectively with a variety of techniques, most commonly: Black Powder Dusting or Cyanoacrylate (CA) Fuming.

A challenge arises from the fact that a single kilogram of illicit drugs can wind up packaged into hundreds or even thousands of LDPE bags. As a result, when law enforcement personnel arrest persons for sale and distribution of these and other drugs or other contraband substances, they can be faced with an enormous number of samples to process.

This study evaluated Axis Inversion (AXI) Dyeing to develop latent fingerprints on LDPE plastic bags by comparing the durability of latent fingermarks developed by this method with those developed by the common Black Powder Dusting and CA Fuming methods. Under test conditions, fingermarks developed with AXI Dyeing proved more durable than those produced by Black Powder Dusting or CA Fuming.

Axis Inversion Dyeing to Evolve Fingerprints in Plastic Bags

2014 University of Illinois College of Pharmacy Research day

Abstract

Fingerprint development on Low Density Polyethylene (LDPE) bags can be accomplished effectively with a variety of techniques. However the processing the large number of samples that can result from an arrest can be a daunting challenge to the Forensic Scientist. A single kilogram of an illicit drug like cocaine or methamphetamine can be packaged into hundreds or even thousands of LDPE bags; making efficiency a major concern. This study evaluated using Axis Inversion Red (AI RED) to develop latent fingerprints on plastic bags by comparing the durability of latent fingerprints developed with AI RED vs. with those developed by the common Black Powder Dusting and Cyanoacrylate Fuming methods. Under test conditions fingerprints developed with AI Red proved more durable than those produced by Black Powder Dusting or Cyanoacrylate Fuming.

Forced Condensation of Cyanoacrylate with Temperature Control of the Evidence Surface to Modify Polymer Formation and Improve Fingermark Detection/Visualization

Journal of Forensic Identification, July/August 2012, Vol. 62, No. 4

Abstract

Tests involving temperature control of both the cyanoacrylate fuming environment and the evidence surface temperature performed at Mountain State University Forensics Program, Beckley West Virginia, have identified conditions to improve visualization of fingermarks. Proper temperature controls resulted in increased cyanoacrylate deposition, modification of the pseudo-crystalline structure and increased contrast. This research program has identified a controlled micro-crystalline structure modification of the polymer formation specific to latent fingermarks. The cyanoacrylate polymer structure can be controlled to yield a much more visible form due to the crystalline structure under these temperature controlled environments. This research also empirically suggests that the forced condensation of the cyanoacrylate deposition follows a specific heat capacity linear curve based on the evidence material type. In other words glass absorbs heat at a different rate than copper; copper absorbs heat at a different rate than steel, etc. Different material types have demonstrated this phenomenon in controlled temperature tests and we forecast that the polymer deposition could be forced to behave in certain ways based on type of evidence material with temperature control of the evidence surface.

The use of these forced condensation techniques via temperature control should add visual detection sensitivity to evidence processing protocols.

Synergistic Value of Complimentary Techniques in Fingermark Processing

2012 NIJ Technical Conference, Washington DC June 2012

Abstract

Fingermarks can be processed with a variety of techniques the selection of which, is usually left to the individual examiner's experience and training. Our research has shown that by combining multiple techniques significantly greater resolution can be achieved revealing finger marks which would otherwise be missed and allowing easier collection of normally feint marks.

Specific Heat Capacity Thermal Function of the Cyanoacrylate Fingermark Development Process

2011 NIJ 2009-DN-BX-K196

Abstract

Multiple methods were explored to increase the resolution of fingermarks obtained through cyanoacrylate (CA) fuming, or improve the ease of resolving fingermarks.

The first method explored was the development of sublimation based co-polymerized coloring. This research stream is an expansion of the work which produced CN-Yellow with an attempt to stretch the excitation range of the fluorescent effect to 530 nm so that it can be used with existing lasers. Many different colorants were evaluated for appropriate fluorescent responsiveness. Once appropriate colorants were identified, they were co-fumed with CN-Yellow in a closed chamber and evaluated with an ALS for detection at 530nm. Colored CA Fingermarks, detectable with a 530nm laser, were successfully produced.

The second method explored was the modification of evidence temperature. Samples of multiple materials were cooled 6°F-20°F below ambient and were CA fumed side by side with fingermarks which had not been cooled. The resulting fingermarks were weighed, tested for opacity and color uptake via dye staining. Our research as shown improvements in visibility: due to increase in opacity and color uptake, of CA fingermarks when the evidence is cooled 6°F-20°F.

The third method explored was the use infrared detection. Fingermark samples were prepared on Plexiglas and aged for two weeks to allow them to fade. The samples were then examined with infrared cameras at ambient temperature and cooled to force condensation and improve infrared visibility. While methods did yield fingermarks, no prints were resolved which would not have been detectable by more economical visible light means.

The fourth aspect of the research was to find a way to disperse nano-particles onto CA prints. Nano-particles can be applied in a variety of ways ranging from spraying liquid dispersions to creating dust clouds. However, when the particles are produced on the fingermark itself, it is possible to lock the color into the CA matrix with subsequent fuming. Carbon black nano-particles were therefore produced by burning oil and directing the vapor stream onto the print.

The final aspect of the research was to develop a commercially viable temperature and humidity controlled chamber to chill the evidence and allow for standard fuming. A unit was developed and can be purchased through Sirchie Corporation.

Polymer Coloration in Fingermarking Applications

2010 SPE RETEC, Nashville TN

Abstract

Unlike many consumer products, in forensic applications like fingermarking, polymer color is more than just an aesthetic feature. It is a functional property that allows for the identification and use of physical evidence. Therefore, methods of coloring subliming cyanoacrylates, the resins commonly used in fingermarking, are critically important. Traditional methods of polymer coloration have been employed for years. However, this study introduces improvements over the existing technology including methods for co-subliming color and the development of a pre-colored cyanoacrylate which maintains the sublimation properties of the base polymer.

Nonmigratory Colorants for Polylactic Acid

2009 SPE RETEC, Savannah GA

Abstract

Millions of disposable plastic items, like drinking bottles are filling waste disposal areas. Compostable resins like Polylactic Acid (PLA) can be used to make these items and save the ever diminishing space in landfill. However, like many applications, available color is a significant factor in determining the potential use of resins. A full color pallet is needed and colorants used for food and beverage packaging must be tested and confirmed as non-migratory according to relevant sections in 21 C.F.R. Therefore, a pallet of dyes has been injection molded into PLA and subjected to migration testing for indirect food contact meeting or exceeding the FDA guidance.

Specific Heat Capacity Thermal Function of the Cyanoacrylate Fingermark Development Process

2009 NIJ 2007-DN-BX-K242

Abstract

The use of cyanoacrylate, or superglue, fuming to develop latent fingermarks on non-porous evidence has been utilized by forensic investigators since the early 1980's when Ed German, a U.S. Army investigator, discovered his Japanese counterparts using the technique. Since then the application methodologies have expanded from vacuum chambers, torches with sublimation tips and rapid dispersion devices of the cyanoacrylate vapor, all moving us forward with the focus of increased of sensitivity of fingermark development. In an attempt to comprehend and improve the polymerization process of cyanoacrylate fuming, we embarked on an avenue of research that focused on temperature and humidity variations of both the environment in which the fuming occurs and also temperature variations were used on the actual evidence itself in an attempt to understand and optimize the development of latent fingermarks utilizing cyanoacrylate.

Our premise was that the temperature of the substrate material during the fuming event, combined with the relative humidity is crucial in obtaining the best possible fingermark development, and that the specific heat capacity and thermal conductivity of the evidence

substrate material would guide the temperature parameters of the polymerization process involved with cyanoacrylate fuming. The numerous tests that we have performed on various non-porous materials commonly found at crime scenes utilizing diverse temperature and relative humidity parameters have proven this assertion correct.

On identical materials with deposited latent fingermarks developed simultaneously but at different substrate temperatures, we have been able to show that there is a substantial increase in polymerization which is easily observed visually and supported by measurable weight increases when the evidence is cooled to a temperature relative to the substrate's specific heat capacity. The weight variations as shown in the data files serve as support to the visualization properties which is the main concern of latent fingermark examiners. We have shown that we can increase the polymerization on the fingermark ridge site by cooling the temperature of the substrate in a correlative manner to its known specific heat capacity.

Compostable Colorants for Bio-Plastics

2008 SPE RETEC, Detroit MI

Abstract

Efforts made by industry to move toward recyclable and compostable materials require biodegradable colorants. To meet this need, a variety of dyes and pigments were subjected to a standard composting protocol in both their raw form and in Polylactic Acid. From these results a range of compostable colorants is determined.

Use of Dyes in Nylon for Industrial Applications

2008 SPE RETEC, Detroit MI

Abstract

Polyamide resins are frequently used in consumer and industrial applications. They are chosen for these applications for a variety of reasons including their durability, chemical resistance and its ability to perform under high-heat working conditions. Therefore the dyes used in these applications must hold up under these extreme conditions. A full pallet of nylon stable dyes was subjected to migration, heat and moisture fastness testing under a variety of conditions for three different Polyamide resin systems. The resulting data is used to determine the suitability of dyes for various applications.

Enhancing Contrast of Fingermarks on Plastic Tape

Journal of Forensic Science, November 2003, Vol. 48, No. 6

Abstract:

Many of the currently available fingermarking methods have limited ability to visualize fingermarks on plastic tape without expensive equipment or significant handling of the sample. This is especially true for visualizing fingermarks on black electrical tape. This study sought a hands-off method to produce easy visualization of fingermarks on different types of plastic tape, including black electrical tape, without the need for expensive equipment. The methods selected were to sublime disperse dyes into the tape, both with and without the fuming of cyanoacrylate, everywhere except for where the fingermark was applied. The resulting color contrasts provided enough differentiation to visualize fingermarks on plastic

tape under ambient light. Sequential fuming with cyanoacrylate followed by disperse dyes provided the best visualizations on all tapes, and cyanoacrylate followed by disperse yellow 211 clearly visualized fingermarks on black electrical tape.

Locational Variations as an Obstacle to Single Point Reference Light Fade Studies
AATCC Review April 2003

Abstract:

This study evaluates the validity of light-fastness predictions based on standardized reference models that rely on a single testing environment. Light-fastness of identical sample sets were evaluated for the same duration of exposure to sunlight in five different locations around the North American Continent.

This study shows that identical samples in different locations fade to differing degrees even when exposed to a consistent duration of irradiance. Furthermore the relative fade rate was inconsistent from one sample type to another. Therefore, an accurate color fastness prediction for a specific colorant must be determined by testing that colorant, under the actual conditions of use, in the intended environment of use.

Relative Light-Fastness of the Colors Formed From Oxidation Dye Intermediates
Presented 2002 SCC Technical Showcase, New York, USA

Abstract:

As part of an ongoing study, combinations of oxidation dye intermediates were categorized according to the light-fastness of the color they produced on human hair.

Five sets of virgin blond human hair tresses were dyed with one of six commonly employed primary intermediates in combination with either a secondary or primary intermediate, on a 1:1 M.W. basis. One set of these dyed tresses was retained as a control, with the remaining sets being treated as required to emulate various environmental conditions/states and then subjected to UV light (employing an Atlas SunChex) in order to accelerate their potential for light instability. The environmental states evaluated included the following: dry hair; wet hair; hair wet with perspiration; hair wet with "swimming pool" water.

After UV exposure, each tress was evaluated both for the direction of the color shift and the decrease in overall color intensity according to the AATCC gray scale. Based on these data, the dye intermediate combinations were grouped according to their potential for light instability.

An Evaluation of Security Marking And Tagging Systems For Polymers and Polymer Products

Presented 2002 SPE RETEC, Toronto, Canada

Abstract:

Product Identity Fraud (PIF) is a general term encompassing **Alteration, Counterfeiting** and **Diversion** of raw materials and finished goods. PIF has always existed but in recent years improvements in production technology have caused the magnitude of these crimes to exceed two hundred billion dollars annually. In addition, these crimes have an incalculable impact on long-term brand equity and pose a genuine health and safety risk to people around the world.

One of the ways corporations are trying to secure their products against PIF is to include **Security Marking** and **Security Tagging** systems into manufactured goods and raw materials. Often these security systems are incorporated directly into the polymers that comprise the finished product. However, not all approaches are equally beneficial. Inappropriate systems can be expensive and still not provide the desired level of security. Poorly designed or implemented systems can actually increase vulnerability to PIF.

This paper therefore explains differences between marking and tagging systems, establishes the requirements for Durability, Readability and Uniqueness for valid systems and evaluates several systems for their use in securing polymers and polymer systems.

Testing of Hair Dye Products:

Presented 2000 James Robinson Agents Conference, Brampton, UK

Abstract:

The testing of hair dye products is intertwined with the formulating process. Before formulating can even be initiated, preliminary testing must be performed to insure that the materials used are of consistent and sufficient quality. Then during to the formulating process itself, a variety of testing is done to determine the formulation's compliance with predetermined goals. Finally after a formulation is arrived at it has to be validated and tested for efficacy and stability.

Keystone Quality Hair Dyes Technical Guide and Formulary

Summary:

Written as both an educational manual and a laboratory bench reference, the Keystone Quality Hair Dyes Technical Guide and Formulary presents an overview of the chemistry of hair dye products, technical information on the colorants used, and formulations for dozens of typical and novel products.

Section 6: Current Research and Pending Publications

Improving the Quality of Forensic Evidence by Improving the Jury's Understanding of Scientific Evidence in DUI Cases

In Progress

Abstract

This study focuses on the scientific evidence presented in DUI cases. It is a fundamental need in the United States court system that the average juror be able to understand the evidence presented to them. Unfortunately, there is a reason to believe that the average juror does not understand the relevant scientific evidence. Scientific literacy of the general population decreases while the level of sophistication of the forensic techniques employed increases.

A preliminary study led by researchers from the Forensic Science department at the University of Illinois at Chicago corroborates the theory that the average juror does not have the knowledge to properly understand the scientific evidence presented to them in DUI Cases. This preliminary study showed that only 14.8% of potential jurors surveyed understood the relevant forensic evidence. The remaining jurors based their verdict on elements of the case other than the forensic evidence or on elements not related to the case and reach a correct verdict only 66.7% of the time.

These data are not surprising since average potential juror has not had a significant scientific education beyond the expectations of high school. But current education models suggest that the average person can be taught the necessary science to allow them to evaluate the credibility and correctness of the scientific testimony they will encounter when serving on a DUI case. The deliverables for this study are an evaluation of the baseline understanding of potential jurors in DUI cases, training materials that can be administered prior to trial to prepare the juror to hear the scientific evidence and interim and final reports.

Analyzing Methods of Fingermarks Development on Plastic Bags

Submission intended 2020

Abstract

Evidence in an illicit drug arrest can include hundreds or even thousands of Low Density Polyethylene (LDPE) bags which are used for distribution. In addition to determining the contents inside the bag, the outside of the bags are also a possible source of evidence. For example, methods such as Carbon Black Powder Dusting, Cyanoacrylate (CA) Fuming or Axis Inversion (AXI) Dyeing can be used on the outside of the bags to locate the latent fingerprints of the persons who have handled the bags. Each of the three methods can be used to develop good quality fingermarks, so data from a stability study conducted at the University of Illinois at Chicago was used select which method produced the best and most durable development.

Methods were evaluated according to their ability satisfy: visualizing the latent fingerprint, the quality of the print produced and the durability of print in various environmental conditions. From these data it was possible to rank the methods and the environmental storage conditions. Carbon Black Powder and AXI dyeing equally provided the best quality print evaluated on the Bandey Scale. Carbon Black Powder however provided the best visualization to initially find the latent fingerprint.

Over-all fingerprints produced with Carbon Black Dusting and AXI Dyeing demonstrated no significant degradation caused by stability environment. Fingermarks developed with cyanoacrylate fuming demonstrated significant degradation in all environments except room temperature storage.

The data from abrasion testing shows that fingermarks developed with AXI dyeing are significantly for durable to incidental contact.

Oil Blue A as a Replacement for Oil Red O for Fingerprint Detection on Porous Materials

Submission intended 2020

Abstract

Methods using Oil Red O can be used to develop light pink to red fingerprints on porous materials like paper. However, the use of red shades on materials in the red to red-brown color space like manila envelopes and colored paper limits the resolution capability of the method to minor shade differences and variances in color intensity. This study adds Oil Blue A and Oil Yellow 202 to extend the pallet of available colors for the Oil Red O dyeing methods.

Expanding the Beers-Lambert Law

In Progress

Abstract

The Beers and Lambert Law, A = ElC, provides the basis for convenient and well-validated spectrophotometric methods for determining chemical concentration. Unfortunately, the A and E generated on one spectrophotometer will in most cases not match those generated on another and the Beers and Lambert Law does not provide a relationship between data generated on two or more different machines. The lack of this relationship is a detriment to the chemical industry where customers and formulators often want to rely on Absorption (A) and Extinction Coefficient (E) data from vendors or other laboratories and as a result often obtain erroneous results. To assist in these cases, this study determined that by expanding the equation to A = SXlC + b, where S is the efficiency of the spectrophotometer, X is the absorptivity of the sample and b is a constant, information may be communicated between different spectrophotometers.

Section 7a: Articles

Integration of Virtual reality technology into a CSI learning Environment, *Evidence Technology Magazine Vol 16, Number 4, Winter 2018*

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Understanding the Scientific Literacy of Jurors

© 2015Thomson Reuters

https://trexpertwitness.com/litigation-news/scientific-literacy-jurors/

Section 7b: Technical Bulletins & White Papers

From 2000 to 2008, I headed up the production of Keystone Aniline Corporation's technical data; serving as editor for more than 245 publications. In addition I have authored or coauthored the publications listed below for industrial applications ranging from decorative dyeing to security tagging.

Acid Dyes For Feathers

© 2000 Keystone Aniline Corporation

Products and dyeing methodologies

Color Control in Paper Making

© 2000 Keystone Aniline Corporation

Overview of color control process

Color Formed from Oxidation Dye Intermediates

© 2000 Keystone Aniline Corporation

Listing of reaction products from combinations of hair dye intermediates

Dyes for Antifreeze

© 2000 Keystone Aniline Corporation

Lists of dyes suitable for antifreeze formulations

Dyes for Xerographic Photo Copy Toners

© 2000 Keystone Aniline Corporation

Listing of products and physical properties

Keyacid Rhodamine WT Liquid

© 2000 Keystone Aniline Corporation

Water tracing method

Keyphos Phosphorescent Colorants

© 2000 Keystone Aniline Corporation

Catalogue of physical properties

Ochre for Paper

© 2000 Keystone Aniline Corporation

Technical data

Optical Brighteners for Textiles

© 2000 Keystone Aniline Corporation

Methods for overcoming yellowing of textiles

Strength vs. Purity

© 2000 Keystone Aniline Corporation

Descriptive essay on terminology

Tags, Taggants and Markers

© 2000 Keystone Aniline Corporation

Overview of types and requirements of tagging and marking systems

Certified Colorants D&C and FD&C

© 2001 Keystone Aniline Corporation

Technical and applications data of certified colorants

Color Enhancing Hair Care Products

© 2001 Keystone Aniline Corporation

Formulation methods for cationic hair dyes

DataTrax. Application Report

© 2001 Keystone Aniline Corporation

Results of stability testing of particulate taggants in a variety of substrates

DataTrax. Encoded Microparticles

© 2001 Keystone Aniline Corporation

Product technical data

Dyeing Methods for Acid Dyes

© 2001 Keystone Aniline Corporation

Dyeing methods for textiles, fibers and resinous materials

Dyes for Aqueous Inks & Coatings

© 2001 Keystone Aniline Corporation

Listing of acid dyes for water based applications

Dyes for Carpet "Touch-Up"

© 2001 Keystone Aniline Corporation

Dyes and application methodology

Dyes for Heat Transfer Printing

© 2001 Keystone Aniline Corporation

Overview of heat transfer printing process

Dyes for the Seed Treatment Industry

© 2001 Keystone Aniline Corporation

Listing of available and allowable products

Dyes for Water Tracing

© 2001 Keystone Aniline Corporation

Description of methodologies and available dyes

Flaw and Strain Detection

© 2001 Keystone Aniline Corporation

Use of solvent yellow 43 for non-destructive testing

pH Indicators for Water-Based Applications

© 2001 Keystone Aniline Corporation

Listing of dyes useable as non-standard pH indicators

pH Stable Dyes for Water-Based Applications

© 2001 Keystone Aniline Corporation

Catalogue of chemically stable dyes

Keystone Nerosol Dyes

© 2002 Keystone Aniline Corporation

Technical data and applications for wood stains and coatings

Oil Dyes for Candles

© 2002 Keystone Aniline Corporation

Product list and formulation methods

Keystone Fluorescent Dyes

© 2003 Keystone Aniline Corporation

Catalogue of dyes and physical properties

Section 8: Patents

Leak Detection Materials and Methods, 7,943,380
United States Patent no. 7,943,380

Abstract

material into a fluid system such as a climate control system, an engine oil system, or a fuel system is described. The leak detection material can be a dye delivery composition including a mixture of leak detection dye and a semi-solid carrier.

Method for preparing a co-sublimation pigment
Applied for

Abstract

A co-subliming pigment containing a subliming colorant and subliming resin that will resinate and color fingermarks is manufactured and ground alone and in situ in a dispersion.

Kit for Detecting the Presence of Oil in Water
Applied for

Abstract

A water permeable material is impregnated with a water insoluble fluorescent indicator which will dissolve in oil and placed in partially clear containers into which water is added. When the water is added the container is illuminated with a suitable light source and examined visually for fluorescent glow indicating the presence of oil in the water down to a detection limit of less than one part per billion.

Section 9: Notable Products

I have developed or help to develop more than one thousand consumer products. Most have been for clients and for reasons of practicality and in some cases confidentially will not be enumerated here. Instead, below are some of the products of which I am most proud.

Axis Inversion Dyes

Subliming colors which dye the background around latent fingerprints providing a durable negative image of the fingerprint.

ChicagoCare All Season Skin Treatment

Oil free skin lotion

CN-Yellow

Subliming resin for the one step development of colored and fluorescent fingermarks.

Fuming Orange

Subliming resin for the one step development of colored and fluorescent fingermarks with multi wavelength excitability from 380 nm to 550 mn.

Keysone Nerosol Wood Stains

Liquid color concentrates for wood stain manufacturing.

Massage Water

A water based/oil free massage lubricant.

Mr.Lloyds Hydrating Bath Treats

Oil free skin moisturizers for use in place of bath oil.

Oil Blue A Fingerprinting Solution

Lipid specific colorant for the developing of fingermarks on porous materials.

Semi-Solid Automotive leak Tracer

Pre-dissolved semi-solid fluorescent colorant that can be added to automotive air-conditioning systems during manufacturing to facilitate leak testing.

Wayfinder Trail Markers

Biodegradable colored and fluorescent trail marker for hikers and hunters.

Section 10: Copyrights

In addition to my professional, academic and scientific activities I am a short story and songwriter. In 2013 I briefly achieved the position of the 5th ranked singer songwriter in the Chicago market on the Reverbnation charts. Below are my published stories and music collections.

A Forensic Scientists Guide to Color *Color Theory for the Crime Lab* **ISBN:** 978-1505728675
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Slices of Life, ISBN 9781505480337
© 2014 Charles A. Steele

Sketches from My Audio Notebook, PAU003048045
© 2006 Charles A. Steele PAU003048045

The Collection Includes: *A Million Miles; Enchantress, The; Bowing Out; Good Life, The; Tuesday in Neuman; Windmills*

From my Music Room: More Songs by Charles A. Steele, SRu1-018-923
© 2011 Charles A. Steele SRu1-018-923

The Collection Includes: *Actress, The; Beneath Blue Skies; Daydream Star; Drunken Sailor; Enchantress, The; Everyday Darkness; Face of Clay; Faces in the Bombsite; Fingers of Time; For Jimmy Heart Song; Hell and Heaven's Gate; History of Our Age, The; Hunter's Moon; If you Want Someone Who'll Love you; Last Call; Leader of the People, The Pathfinder; Patriot; Pilgrim Waiting; Purgatory; Snapshot; Waiting for something to Begin; Way of the Warrior, The; Windy City Gladiator*

Section 11: Professional Associations

I am a publishing member of the following professional societies.

The Society of Cosmetic Chemists (SCC)
The Society of Plastics Engineers (SPE)
International Association for Identification (IAI)
American Association of Textile Chemists and Colorists (AATCC)
Broadcast Music, Inc. (BMI)