B112 The Impact of Antioxidant Beverages on the Chemiluminescent Detection of Bloodstains at Crime Scenes

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The goal of this presentation is to inform attendees of the recent findings related to the antioxidant inhibition of the chemiluminescent detection of bloodstains.

This presentation will impact the forensic science community by improving insight into the inhibition of the reaction between chemiluminescent reagents, specifically luminol and Bluestar Forensic®, and blood found at crime scenes. The possibility of this inhibition has been suggested in several published articles but has yet to be studied.

The identification of blood deposited at a crime scene is crucial to the reconstruction of events leading to and following a crime, as well as corroborating or rejecting statements and alibis. Many biochemical reagents are at the crime scene investigators disposal to both screen for, and confirm, the presence of visible and non-visible bloodstains. One such reagent for the detection of non-visible, or latent, bloodstains is a chemiluminescent reagent known as luminol, which comes in multiple formulations, the most widely utilized being Bluestar Forensic®. It was recently reported, but not further studied, that the presence of antioxidants in contact with a blood stain may hinder the reaction of such chemiluminescent reagents, giving way to a false negative reaction.[1,2] Conceivably, blood is the most commonly encountered bodily fluid at crime scenes. Therefore, further investigation of the possibility of antioxidants within the environment potentially masking bloodstains is necessary to address the opportunity for hindered investigations.

This study investigated the potentially negative effects of seven different antioxidant sources on the reaction between chemiluminescent reagents and blood. Methods involved staining both absorbent and non-absorbent surfaces, carpet and tile, respectively, with 2mL of four dilutions of blood: neat, 1:10, 1:100, and 1:1000. Each bloodstain, after a 24-hour drying period, was then treated with 5mL of one of seven antioxidant sources: orange juice (100%, not from concentrate); green tea (one processed Pure Leaf® cold green tea beverage and one unprocessed organic hot green tea leaf beverage); a supplement drink (Bai® Antioxidant Infusion); red wine (Pinot Noir); coffee (premium roast); or black English breakfast tea. Bloodstains were also treated with Coca-Cola®, which contains no antioxidants, acting as a control. Following a 24-hour drying period, each sample was then treated with one of two chemiluminescent reagents, luminol or Bluestar Forensic®, and documented for chemiluminescent intensity. A Canon® EOS Rebel T3i digital SLR camera was used to document each reaction to later compare to control samples and better approximate the chemiluminescent intensity.

The results of this study revealed red wine and coffee to negatively impact the chemiluminescent reaction of both luminol and Bluestar®, creating false negatives on both surfaces, with all dilutions. Samples tested with Coca-Cola® all produced moderate-strong positive chemiluminescence, showing the application of beverages to not act as a barrier for the reaction, rather potentially the antioxidants present in red wine and coffee inhibiting the reaction. The other five antioxidant drinks produced positive chemiluminescent reactions; however, these reactions were impacted and could lead to misinterpretation. Orange juice, both green teas, the supplemental drink, and black tea produced weak-moderate reactions on both surfaces, with Bluestar® fading very quickly compared to typical reactions, which could be misinterpreted as a false positive.

This research has highlighted the importance of the choice of method and considerations to be taken when screening evidence items/crime scenes for blood and of the possibility of antioxidants in the environment having a negative impact. The results of this study provide a valuable and novel contribution to the forensic science field as the impact of antioxidants has largely been unexplored, yet warrants investigation.

Reference(s):

1. Bancirova, M. Black and green tea – luminol false-negative bloodstains detection. *Sci Justice.* 2012. 52(2): p. 102-5.
2. Barni, F. et al. Forensic application of the luminol reaction as a presumptive test for latent blood detection. *Talanta.* 2007. 72(3): p. 896-913.

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