B16 A Glow in the Dark: Luminol Reaction Enhancement With "Fit" From Former Eastern Germany

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After attending this presentation, attendees will learn systematic vari- ation and double blind testing even of standard procedures – here, a widely used modification of the Luminol test — are helpful to avoid implementing unnecessary laboratory procedures.

This presentation will impact the forensic community and/or humanity by demonstrating wishful thinking can trick even experienced crime scene workers, as shown here. Double blind tests are the best way to avoid this.

Luminol fluorescence often dies down before it can be properly doc- umented on camera. On vertical tiles and other smooth surfaces, the danger of speedy blurring is also prevalent. For years, the criminal police of the former Eastern German city of Rostock reported to have found a way to prolong the duration of the glowing reaction by adding 3 drops of the detergent "Fit" to 1 litre of the final, standard alkaline Luminol reaction mix. "Fit" was one of the major dishwashing liquids available in former Eastern Germany, and is no longer produced. Very few samples survived. A new formula (under the same brand name) was reported to have no effect if used for bloodstain detection with Luminol.

In systematic, double-blinded experiments (against a control and against the new formula), researchers tried to determine which ingredient of the old formula was responsible for the reported effect. Initially, researchers focused on concentration changes of sodium potassium hexa-metaphosphate/sodium polyphosphate $(NaPO_3)_n$ which is the only ingre- dient that was used in Eastern German "Fit" but not in the new formula. Since these experiments did not show sufficient results, the systematic vari- ation was expanded to the blood itself (erythrocyte concentrate, fresh human blood, animal blood, both dried and/or diluted up to 1:100, blood wiped off, blood washed off with water, blood washed off with detergent, blood drop, and blood layers; n >350), and to different surfaces (plastic, paper, glass).

The experiments showed that the reported effect was only observed under non-blinded conditions. It is on the border of an illusion, caused by the uncontrolled conditions on real crime scenes. This is especially due to minute fluctuations both of the initial fluorescence intensity as well as of the duration of light emission caused by the Luminol/blood reaction. Polyphosphate alters the course of the reaction, too, but it is unclear if this is just because pH is becoming more neutral (normal reaction: pH 12, with polyphosphate: pH 8).

In the experiments, intensity was slightly increased when "Fit" mix- tures were used in glass vials (higher intensity with "Fit": 54.6% vs. higher intensity without "Fit": 18.2% , same intensity: 27.3%, undecided: 0%; n=21) but not in thin layers on plastic foil (higher intensity with "Fit": 0% vs. higher intensity without "Fit": 56.5% , same intensity: 34.8%, unde- cided: 8.7%; n=10). Under very specific conditions, the originally reported effect was sometimes present, *e.g.* in dry glass vials with erythrocyte con- centrate (1:100; higher intensity with "Fit": 100%; n=20). However, the ini- tially higher brightness was followed by a now much shorter duration of light emission (90%; n=20). This contradicted the statement of the police unit who said that the duration - not the initial light emission - should be increased. In diluted fresh blood (1:10), this effect was either reversed, or could be produced with the new formula as well. This means that the reaction intensity does change but cannot neither be predicted for a given crime scene nor for any realistic environment.

In general, the effects were so weak that the observers could hardly determine the possible differences of glowing intensities/durations. For example, no matter if the initial intensity was judged to be equal or dif- ferent, the duration of the glow was perceived to be increased in 62.5% of all cases (n=24) - *i.e.*, in completely identical samples as well as in actually different solutions. The absence of actual differences seems to be the main cause for misinterpretations.

Our experiments show that external influences play a major role in the Luminol reaction. Also, due to the perception difficulties, 7% — 68.8% of all observations were reported to be different even if the ingredients were identical (*i.e.*, all solutions completely identical and used at the same time). It is, therefore, believed that a highly trained, very experienced Crime Scene Unit was tricked by a psychological effect and wishful thinking. The CSU may have assumed that adding an extra ingredient must have some effect, and may therefore have been biased in their

perceptions at the crime scene.

The technically simple, yet very labour-intensive, systematic double blind may have helped to avoid further implementation of a standard pro- cedure that is based on anecdotal crime scene observation only.

It is of course possible that the old “Fit” may have contained an unstable component that did enhance either the initial intensity, or the duration of the fluorescent Luminol reaction. Due to now several years of storage of the remaining old “Fit”, and due to a complete lack of production records from the Eastern German production facility, this can not be tested any more. In the light of these experiments, it seems more likely that “Fit” has no predictable effect at all.

Detection of Blood, Luminol Test, Crime Scene Procedures

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