

# The Effect Of Furniture Polish On Luminol Reaction

Posted on October 16, 2018

## Introduction

This paper presents a comprehensive and qualitative analysis of the effect of furniture polish and sprays on the luminol reaction. Luminol is very commonly used in crime scenes as it is a very sensitive blood reagent. It is usually used to detect latent bloodstain evidence usually associated with a cleanup after the bloodletting argumentative event. Luminol works even if the blood stain has been cleaned or removed for many years. There is no magic behind it. Instead, it all works on the basis of biochemistry. But research is still going on to find out what exactly happens during the luminol reaction. Studies claim that there is a complicated mechanism behind the reaction comprising the formation of intermediate complexes and radicals. Ojima and Nonoyama proposed the development of a complex comprising of the 3-amino phthalate anion, a ligand, and an ion of Copper. All of them then combine and react with hydrogen peroxide which results in an excited state producing the glow. Some other researchers have an opposing view on the complexes that are responsible for the production of chemiluminescence. The study of luminol reaction is still underway. Though luminol has been extensively used for blood detection, there are several other substances or substrates that produce a similar glow to that of the blood. The behavior of certain substances has been studied for quite a long time since they can interfere with the process of blood detection during an interpersonal violent crime scene. One of those substances is wooden furniture sprays and multi-surface polishes which also pose interference by producing intense chemiluminescence almost compared to the one produced by blood. The current paper will deal with the effect of furniture polish on the luminol reaction, describing how it can interfere with the reaction and what possible effects it can have on it.

## Luminol

Luminol is a compound that seems to work like magic when it comes to detecting bloodstains. It works on the basis of biochemistry. The chemical composition of Luminol is shown in Figures 1 & 2.

It is frequently used by crime investigators to detect the presence of blood in an area regardless of the fact that it might have been removed because luminol is powerful enough to still detect it. The blood contains hemoglobin which contains iron and carries oxygen as well. Luminol is able to react with the iron in hemoglobin. Luminol is a very sensitive compound that can detect blood about one part per million. The luminol will produce fluorescence even if a container contains one drop of blood and 999,999 drops of water. Crime investigators do not use the luminol directly over the target area.

Luminol chemical is made up of carbon, hydrogen, oxygen, and nitrogen in the form of powder, which is then mixed with hydrogen peroxide to form a spray, which is used by crime investigators. When that solution is sprayed over a closed area in full darkness, luminol results in a natural glow, which is its inherent property. The glow is called chemiluminescence. But luminol is not always a handy tool. There are several different factors that affect the potential luminol to detect the blood. There are several substrates that can cause chemiluminescence and trick the investigators into the presence of blood.

Luminol was first discovered by Walter Sprech in the year 1937, as mentioned by J. I. Creamer and T. I. Quickenden (2003, p. 193), and since then, its forensic use has been widely employed. Due to its immense sensitivity, Luminol is used all around the world to detect traces of blood at a crime scene. Blood is considered to be a very important factor in the cases of violent crime scenes, so its detection was also very meaningful to the investigators. The trace of blood can then be further analyzed to find the answers to some questions using forensic serological techniques. The questions can be whether the blood is real or not, whether it is human blood, the sex of the blood (identity) and also the possible scenarios about how the blood reached that place. All these questions can be answered through further analysis.

As already mentioned, Luminol is sensitive enough to detect blood stains that are several years old. The fresh blood has a red color due to the presence of erythrocytes, as mentioned by J. I. Creamer and T. I. Quickenden (2003, p. 193). As time passes, the blood gets old and its color also changes from red to brownish. The detection of blood stains can help crime investigators anticipate the event based on its appearance, the shape of the stain, and the place where the blood was present. In the 20<sup>th</sup> century, there emerged a branch of forensic sciences called Blood Pattern Analysis. In order to extract meaningful conclusions from the blood stains, several physical and biochemical characteristics of blood are used to model it mathematically through which the activities during the scene can be well anticipated. Even a tiny droplet of blood, when detected, is of so much use due to the emergence of DNA Analysis. In this paper, the chemistry behind the luminol reaction is highlighted, and the interference effect of furniture polish with the luminol reaction is also elaborated.

## Luminol Reaction

Before starting the interference substrates of the luminol reaction, let's study the chemical composition of luminol and the substance that triggers the reaction and produces the fluorescence. There is certain chemistry behind the CL produced by the luminol. The chemical reaction that results in the appearance of the glow, called chemiluminescence, is very complex, and the exact process has not been found yet. If we talk about the blood, the presence of heme groups found in the hemoglobin results triggers the reaction that forms a very intensive CL. So, basically, hemoglobin acts as a catalyst. The exact process in detail is still unknown. For the test, luminol is used in the presence of an alkaline solution and an oxidant. The alkaline condition and the presence of catalytic behavior of hemoglobin results in the oxidation of luminol. The reaction undergoes several intermediate steps till

it reaches an intense stage that radiates the light called chemiluminescence.

## Interference

There are basically two types of interference that can lead to errors in luminol reaction. The first one is the false positive behavior of luminol, i.e., there are some substrates that mimic the behavior of the blood. Even in the absence of any blood stain, there are some compounds that exhibit the property of behaving like blood when exposed to luminol reaction. Examples of such substrates are hypochlorite (present in the bleach), enamel paint, copper metal, interior fabrics present in the auto-vehicles, some spray paints, and furniture polish. The main study of this paper girdles around the interference posed by the furniture polish to luminol reaction, giving false positive outputs. Such substances give very strong chemiluminescence even in the absence of blood or any hemoglobin-containing substances. There are some variations in the wavelength or intensities displayed by them, but the difference is not significant. So basically CL can be triggered by other elements as well instead of hemoglobin.

The most commonly discussed example is that of hypochlorite present in the bleach. Most of the time, the blood stains produced as the outcome of a crime scene are washed away using solutions like bleach etc. Sometimes just water is also used to serve the purpose. In the case of water, repeated washing of the stain resulted in diminished CL, but when washed with bleach, the CL decreased to a certain limit and then started to increase till it reached a stable value. The point to mention here is that there are many substances and substrates that can lead to false positive behavior of luminol reaction just because that substance mimics the behavior of the blood and, as a result, produces CL.

## Interfering Substances

The biggest drawback of the luminol reaction test is the interfering material that can result in false positive or false negative outcomes. The blood stain can either be washed or removed by such materials that give a very light CL when exposed to luminol reaction. On the other hand, there is material that gives very intensive CL which is almost comparable to blood even in the absence of no hemoglobin. Such substances can be some fruits, vegetables, peels, surface cleaning chemicals, insecticides etc. In such cases, if the luminescence is apparently comparable to that of blood, the analysis is done at a very deep level to study the wavelength shift of the fluorescence produced to distinguish the substrate as blood or others. So, very thorough care should be taken in crime scenes, especially when it is contaminated by vegetables like turnips, horseradish, furniture polish, or enamel paints etc. This paper will mostly deal with the interference exhibited by furniture polish.

# Furniture Polish

Furniture polishes are a type of paste, cream, or lotion that is used to shine wooden furniture. They are prepared from natural waxed mixed with oil extracted from petroleum ingredients. These modern formulations of furniture polishes have replaced the old method of repeated polished in layers. There is no single ingredient that provides the desired properties of furniture polish. Therefore, it is always made by mixing different ratios of waxes and oil to produce the best products. These are aerosol products, so they are always kept under scrutiny due to some regulations in legislation. Experiments were carried out on different materials, and various polishes were used to see how the effect is produced on the luminol reaction.

## Experiments Conducted On Ceramic Tile

### Experiment 1

In the first experiment, the substrate used was white tile made up of ceramic, as shown in Figure 3.



Figure 3. Ceramic Tile

The furniture polish used to create interference was Pledge furniture polish for multi-surface cleaning action. The target was to see what happens when a luminol reaction is executed on an area (tile, in our case) that is sprayed with furniture polish. Half of the tile was sprayed with the Pledge furniture polish and the remaining was left in the original state to see the differences. Now, the luminol reaction was conducted. As mentioned earlier, luminol is not used as it is. It is combined with a couple of other elements to produce a spray. The standard luminol solution generally contains the following elements: 0.01g of luminol, 0.13 g of  $\text{NaBO}_3 \cdot 4\text{H}_2\text{O}$ , and 10-12 mL of distilled water. The solution was used as a luminol spray to test the catalytic effect of furniture polish on the reaction and to check

whether the glow or CL produced by furniture polish is comparable to that produced by blood or not. It can then lead us to classify furniture polish as an interfering substrate in the process of blood detection during a crime scene or not.

## Results

The above image in Figure 4 shows that the upper half of the tile, which was sprayed by furniture polish, produced luminescence. The lower half is unaffected due to no interference substrate. The experiments conducted by other university groups have shown that the luminescence produced by the furniture polish has a wavelength shift of 11nm with a tolerance of 23. If we discuss the interference that can be posed by the furniture polish, we would need to understand that it can produce false positive results if the target is to detect the blood. There is a deviation of 11nm in the wavelength as compared to the hemoglobin, due to which there is a certain chance that it can mimic the behavior of blood. Other than the crime scenes, Pledge multi-surface furniture polish has the capacity to produce luminescence when exposed to the luminol reaction.

## Experiment 2

In the next experiment, the same steps were followed except for the furniture polish. This time, the furniture polish used was TESCO Multi-surface polish. Again, the tile used was white tile made of ceramic. The upper half of the tile was sprayed with the furniture polish. Then, the luminol mixture was sprayed on it, and the results were observed. The main point to be observed was whether, this time, the luminescence produced was intense or diminished as compared to the one produced by the previous polish. The solution used for the preparation of the luminol spray was the same as mentioned earlier. The results are mentioned below.

## Results

The furniture polish affected the luminol reaction and produced luminescence, as in the previous case. The results can be seen in Figure 5. But if the intensity is compared, the luminescence was much diminished as compared to the previous result. The luminescence was not brighter. The lower half was kept as original; to see the effect, it had no luminescence because it had to interfere with the substrate on it, like furniture polish.

## Experiment 3

The next experiment was conducted using TESCO Wooden Furniture polish. Wooden furniture polish is the one specifically formulated to clean and shine the furniture made of wood. They give a glaze on them and cannot be used on multi-surfaces as the case was with the previous two furniture polishes.

Wooden furniture polish contains hydrocarbons, which can be poisonous when inhaled or sprayed. The same ceramic tile was used for experimentation purposes, and wooden furniture polish (Tesco) was sprayed on the upper half of the tile. The lower half was left untouched for the comparison purposes. The same luminol spray was used to see the reaction of it on the wooden furniture polish and the luminescence produced by it.

## Results

The results show a very prominent and intense luminescence produced by the TESCO wooden furniture polish. The lower half was not glowing due to no furniture polish. Since the luminescence produced was quite intense and clear, the substrate can be a very obvious interfering material for the luminol reaction. If the target is to detect the blood, the wooden furniture polish can also give false positive results by mimicking the behavior of blood.

## Experiment 4:

The next experiment was conducted using Mr. SHEEN's multi-surface polish. The same steps were repeated by spraying the upper portion of the tile and leaving the lower half untouched. The solution used for the luminol spray is the same as mentioned earlier. The spray was done on the upper half of the tile and the luminescence was observed. The luminescence was produced. The results are mentioned below.

## Results

The results in Figure 7 show that the luminescence is still produced, but the glow is a bit less as compared to the previous wooden polish. There can be a probable difference in the composition of the polish, which resulted in the different glow. The glow is not too much intense. The lower half of the tile didn't produce any glow because it was not sprayed by the wooden polish.

The above experiments also show that ceramic tile itself cannot produce any glow unless it is sprayed with some interfering materials. The experiment was conducted to study the effect of multi-surface and wooden polish on the tile.

## Conclusions for Ceramic Tile Experiment

The above set of experiments was conducted using a different type of wooden furniture and multi-surface sprays and polishes on the ceramic tile. The reaction was analyzed in the presence of a luminol reaction. In all the cases, the glow is always there. When studied in depth, the wavelength can vary slightly, but the overall results show that the chemiluminescence is produced in the presence of the luminol reaction. This result is quite dangerous since some of the experiments

conducted by other research groups found out that the wavelength difference between the luminescence produced by the furniture sprays and by the blood is very small, and hence, a lot of interference can be caused by the furniture sprays. The crime investigators can be tricked into thinking of the presence of blood while there was nothing more than the furniture sprayed on the tiles. Care needs to be taken by the investigators in the presence of tiles or furniture sprays in the crime scenes since false positive results can likely be produced.

The next experiment was conducted to study the effect of multi-surface and wooden polishes on luminol reaction when sprayed on the "Wood."

## Experiments Conducted On The Wood

The surface used to spray the furniture and wood polish on is

This is a natural oak. The details of the experiment are mentioned below:

### Experiment 1

The spray used was PLEDGE multi-surface cleaner. The wood was sprayed with it on the upper half while the lower half was kept untouched so that the comparison could be performed. The luminol solution was the standard one comprising 0.01g of luminol, 0.13 g of  $\text{NaBO}_3 \cdot 4\text{H}_2\text{O}$ , and 10-12 mL of distilled water. The resulting luminol spray was used to test the presence or absence of chemiluminescence. If it was present, the intensity was observed to see if it was an interfering substrate during blood detection or not.

### Results

The results showed a very clear luminescence produced as a result of the luminol reaction. The possible reason behind this was the reaction of surface polish composition with that of luminol spray resulting in the glow. The glow was very intense, and a little of it was also observed in the lower part of the wood where there was no spray. The reason behind this can be the wood which might have reacted with luminol to some extent. But the upper half glow was much more intense and prominent. The resulting image is attached.

### Experiment 2

The second experiment was conducted using TESCO multi-surface polish. The type of wood used was the same as before. The upper half of it was sprayed with the multi-surface polish, while the lower half was left as it was. The luminol solution used was the same as in the previous experimentation. The results obtained are mentioned below.

## Results

The result showed somewhat similar results as in the previous case which can be seen in figure 10. Since both the polishes (in the current and previous experiment) were for multi-surface, the composition must be similar to much extent. The results showed that the glow was again produced as a result of the luminol reaction, and the chemiluminescence was quite intense. The lower half of the tile didn't show any glow, just a slight change due to some of the interference of spray that could've landed in the lower part.

## Experiment 3

In the third experiment, TESCO wooden furniture polish was used to spray the upper half of the wood. The luminol solution used was the same as in the previous experiments. The lower half of the wood was left as it is for comparison purposes. The luminol was sprayed over the wood, and the results were observed.

## Results

The wood showed chemiluminescence in the areas where the droplets of wooden furniture spray had landed, as seen in Figure 11. The areas where there were no droplets had no glow. The results showed that even the wooden furniture polish reacted with the luminol and produced a glow. If there been a crime scene in the area and the investigators wanted to figure out the places where the blood must have been present, the wooden furniture polish could easily trick the investigators by mimicking the behavior of the blood since it produces the intense glow like the blood would have been produced.

## Experiment 4

This time, the spray used was called Mr. Sheen's multi-surface polish. Again, the upper half of the wood was sprayed with the polish and the lower half was kept untouched for comparing purposes. The luminol spray used was the same as used for the previous experiments. The results produced were analyzed and are described below.

## Results

A very obvious glow or chemiluminescence was observed on the upper half of the wood, as shown in Figure 12, where the droplets of the spray had landed and the wood had been polished. There was no glow in the absence of the droplets, as can be seen in the lower half of the wood. The results clearly show that the wood itself does not respond to the luminol reaction. The multi-surface spray has a certain composition that interferes with the luminol spray composition to produce a glow. In the case

of any crime scene, the presence of wood can also introduce doubts since the multi-surface spray droplets landed on the wood can produce luminescence as well.

## Conclusion for Wood Experiment:

After the experiments were performed for four different furniture sprays on the wood, it was observed that there was a very prominent and obvious luminescence, which is too much compared to the glow produced by the reaction of luminol with the iron in hemoglobin. It is a very clear output that furniture polish on the wood can clearly lead to false positive results if the investigators are trying to detect blood. So special care is needed to be taken when the investigation is being carried out at the crime scene in the presence of a wooden object and furniture sprays.

## Experiments Conducted On Laminate

The next set of experiments was performed on the piece of laminate. Before moving on, let's have a look at the laminate and its properties.

### Laminate

Laminate is usually used for flooring. Laminations are produced by manufacturing a material in multiple layers so that the resulting material has enhanced strength, appearance, stability, and insulation of sound. A single laminate is an object that is produced through intense heat, welding, pressure, or adhesives. This is usually used for flooring for décor purposes. The experiment was performed on a piece of laminate.

The furniture and multi-surface polished were sprayed on this laminate and the results were then analyzed.

### Experiment 1

The PLEDGE multi-surface spray was performed on the upper half of the laminate while the lower half was left as it is, for comparison purposes. For the luminol reaction, the luminol composition used was the same as for the previous experiments. The luminol reaction is usually used to detect the blood, but there are some interfering substances that lead to the production of chemiluminescence. The sprays used are one of those substances, in addition to some vegetables and a couple of other chemicals. The results were analyzed.

## Results

The luminol reaction produced a very intense glow in the areas where the multi-surface spray had landed. The results can be seen in Figure 14. The chemical composition of the spray triggered the luminol to glow and create chemiluminescence. The glow was quite intense and almost comparable to the one produced by the glow.

## Experiment 2

The next experiment was performed using TESCO multi-surface polish. The polish was sprayed on the upper half of the laminate while the lower half was kept as it was so that comparison could be performed. The same luminol solution was used as in the previous experiments. Standard luminol solution was used as a spray with the same composition. The results were analyzed for the chemiluminescence, which was produced as an outcome.

### Results:

The outcome of the experiment was similar to the previous stage of this experiment performed using TESCO multi-surface polish as can be seen in Figure 15. The glow was produced quite intensely. Once again, it can be very easily used to foil the blood at the crime scene since this multi-surface polish replicates the behavior of the blood.

## Experiment 3

The next experiment was performed using TESCO wooden furniture polish. The substance used was laminate. The upper half of the laminate was sprayed with the TESCO wooden furniture polish, while the lower half was left as it was. The luminol solution used was the same as described in the previous experiment. The experiment was set up to analyze the effect of furniture sprays on the luminol reaction. The chemiluminescence was analyzed to see if such sprays could be used to produce false positive results.

### Results

The luminescence was produced as a result of a luminol reaction, as can be seen in Figure 16. This shows that there are some catalysts in the droplets of the spray, which, when landed on the laminate, started to glow when they came in contact with the luminol composition

## Experiment 4

The last step of the experiment with laminate was performed using Mr. SHEEN multi-surface polish. Again, the upper half of the laminate was sprayed with the mentioned multi-surface polish and the lower half was not sprayed so that the comparison can be done to analyze the results. The same luminol composition was used as a spray to see whether the spray glows and produces the chemiluminescence or not. Following are the obtained results.

## Results

The result was a prominent luminance, which was produced as a result of the luminol reaction with the Mr. Sheen multi-surface spray due to a probable reaction. Only those parts of the laminate glowed where the surface polish had been sprayed. The rest was completely dark. So, even if the laminate is used, false-positive results can still be produced. If there is some lamination on the crime scene, the multi-surface polish can still cause the luminance, tricking the investigators and giving false outcomes.

## Conclusion for Laminate Experiments

The above set of experiments shows that the multi-surface polishes and wooden furniture sprays produce luminescence, called chemiluminescence, even if the laminate is used for spraying. The luminol reaction causes the droplets of the spray to land on the laminate to shine. Again, considering the scenario of the crime scene, if there is some lamination present in the scene and it is sprayed using any of the above-mentioned or furniture sprays, the laminate is very likely to glow as a result of the luminol reaction. This can easily trick the investigators into the presence of blood when there can be no blood. The other tricks can also be used to confuse the investigators which will be discussed later on. So, conclusively, the effect of furniture sprays on the luminol reaction is very similar in the case of wood, laminate, or tile.

Now, the same experiment was performed on another type of wood to check if that wood produced luminescence in the presence of a luminol reaction when sprayed with any type of furniture or multi-surface sprays.

## Experiments Conducted On Hickory Wood

The same experiment was repeated by using another type of wood.

This time, the type of wood used was Hickory. Before moving on, let's see what Hickory Wood is.

# Hickory

Hickory trees lie in the category of deciduous trees and their leaves are pinnately compound. The hickory wood is obtained from a hickory tree. The same hickory wood was used for experimentation purposes.

## Experiment 1

Pledge multi-surface spray was used for this experiment. The upper portion of the hickory wood was sprayed with the multi-surface spray, while the lower half was kept unsprayed, just like in the rest of the experiments. For the luminol reaction, the composition used was the standard one, as mentioned before, i.e., 0.01g of luminol, 0.13 g of  $\text{NaBO}_3 \cdot 4\text{H}_2\text{O}$ , and 10-12 mL of distilled water. The solution was used as a spray to test and analyze the catalytic behavior of surface polishes and furniture sprays on the luminol reaction. The luminol reaction was performed on the hickory wooden piece, and the results were evaluated.

## Results

Even the hickory wooden piece showed the luminescence when sprayed with the multi-surface polish. Hence, the spray acted as a catalyst to trigger the luminol reaction to produce the chemiluminescence. Luminol is generally used for the detection of the presence of blood in the crime scene area. If there is hickory wood in the area, then the glow can be the result of some spray done on that instead of blood. Care needs to be taken by the investigators since the lamination or fluorescence can always give false positive results. An immediate appearance of chemiluminescence is not a clear indication of the blood's presence.

## Experiment 2

In the second set of the experiment, the spray used was TESCO multi-surface polish. The upper half of the hickory wood was sprayed with the multi-surface polish, leaving the lower half for comparison purposes. The luminol composition was exactly the same as in the above-mentioned experiments and was used as a spray. The luminol reaction was performed to see how the spray catalyzes the reaction and produces the luminescence.

## Results

The results showed that the hickory wood glowed at the places where the multi-surface polish spray had landed. The results were quite similar to those in the previous case. There was no chemiluminescence in the parts where there was no spray. Hence, this spray can also give false

positive results to the investigators, tricking them into the presence of blood at the crime scenes.

## Experiment 3

The third kind of spray used for the testing of luminol reaction was TESCOL wooden furniture spray. The spray was done on the upper half of the hickory wood, while the lower half was kept unsprayed for comparison purposes. For the luminol reaction, the same standard luminol composition was used as a spray. The effects of TESOL wooden furniture spray on the luminol reaction were then analyzed. The results are mentioned below.

## Results

The glow was again produced just like all the previous cases. The luminol reaction was catalyzed by the wooden furniture spray on the hickory wood, and thus, the lamination was produced. If there is a crime scene, the investigators can easily be tricked for the detection of furniture sprays instead of the blood. So care needs to be taken if there is any hickory wood or any such sprays in the crime areas as it can lead to false investigations.

## Experiment 4

The last experiment was performed by using Mr. Sheen's multi-surface polish on the hickory wood. The target was the same, i.e., to study the effect of furniture sprays on the luminol reaction. For the luminol reaction, the same standard solution was used. The catalytic behavior of the furniture spray was observed in the luminol reaction. The chemiluminescence produced was observed and analyzed.

## Results

The chemiluminescence was produced quite prominently by Mr. Sheen's multi-surface polish on the hickory wood. The wood glowed in the areas where the spray was done, while no glow was present in the unsprayed areas. The experiment again proved that the particles of spray triggered the fluorescent nature of the luminol reaction, and as a result, quite intensive chemiluminescence was produced. So, the above-mentioned type of furniture spray can also be used to trick the investigators. Care needs to be taken in the crime areas where there is the presence of any such type of furniture sprays or hickory wood since it can mimic the behavior of blood, and false positive results can be produced.

## Discussion

The luminol test is commonly performed to detect very small traces of blood that are completely invisible to the naked eye. The luminol reaction produces a very bright luminescence, which is called chemiluminescence, as a result of the catalytic reaction of hemoglobin. The main reason for the above-mentioned study and experimentation was that hemoglobin is not the only substance that produces a glow when interacting with a luminol reaction. There are several other components and chemicals that catalyze the luminol reaction and produce chemiluminescence. Such compounds or elements are said to be “interfering” and mimic the behavior. One of the very common substances that interfere with the luminol reactions is copper metal, which produces a very bright glow of almost equal intensity as produced by the hemoglobin in the blood. Therefore, the investigators or the personnel of law enforcement have to be very careful while doing luminol reactions for blood detection in the presence of copper metal piping etc. In a similar manner, the enamel and the spray (wooden furniture and multi-surface polishes) also act as catalysts to produce chemiluminescence of considerable intensity. The glow is bright enough to misguide or trick the investigators. When it comes to household or industrial situations, the furniture spray paints done on the furniture or on several other surfaces like tiles, wood, or laminate can mimic the behavior of the blood spatter. Other than this, bleach is also a very common agent that interferes with the blood detection process using luminol reaction. Bleach is also used to clean the surface contaminated with blood, but the reaction of bleach and luminol itself also produces chemiluminescence if the evaporation has not yet happened. On the other hand, furniture sprays may not be used to clean the blood or the areas that have been contaminated by blood, but they can interfere with the normal luminol reaction.

Particularly talking about crime scenes, the criminal may want to misguide the investigator and use the furniture spray on several areas like tiles, wood, or laminate so that the glow is produced on luminol reaction. The investigators can think the reason for the glow to be the possible traces of blood but in fact, it will be due to the furniture and multi-surface sprays.

## Conclusion

The experimentations were performed using four different kinds of sprays namely Pledge Multi-Surface Polish, TESCO Multi-Surface Polish, TESCO wooden furniture polish, and Mr. Sheen Multi-surface polish. All of these sprays have experimented on four different types of surfaces, i.e., ceramic tiles, normal wood, laminate, and Hickory wood. All of these substances were sprayed with any of the mentioned furniture sprays or polishes. The luminol reaction produced its chemiluminescence, on interacting with all the areas where the spray was performed. So basically, the furniture sprays and multi-surface polishes have the catalyst in their composition, which behaves in a similar way the hemoglobin does when exposed to the luminol reaction.

Since luminol is used most of the time at crime scenes, there is a very bright chance that polished

wood or any kind of furniture, tiles, or lamination is present in the crime areas. The furniture polishes and sprays do affect the luminol reaction and produce the glow. So, in the presence of such substances in the crime area, special care needs to be taken.

There is another challenge of distinguishing the glow produced by polished wood or furniture sprays from the one produced by hemoglobin in the blood. Studies and research have been carried out by many groups to identify the difference in wavelength of the light or luminance produced as a result of luminol reaction. They found out that on a very slight level, there is a difference in the wavelength, and that can help identify whether the chemiluminescence is being produced by blood or some other interfering reagent like furniture polishes (Laux, D.L., 1991). Some substances do not produce intense luminance, so they can be easily ruled out for misguidance. But some substances like furniture sprays, as studied and experimented with in this paper, produce a luminance almost equivalent in intensity to the blood, and hence, such substances are very likely to be mistaken for blood. Severe care needs to be taken while performing a luminol reaction test in an area that contains any of those interfering substance materials. If the materials cannot be avoided, the wavelengths of the glow can then be measured to clarify whether it is blood or something else being mistaken for blood.

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