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# Using Ultraviolet A to Check Inanimate Objects for Thorough Cleanliness during COVID-19 Pandemic

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### **Author's contribution**

*The sole author designed, analyzed, interpreted and prepared the manuscript.*

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## **ABSTRACT**

Introduction: Clean surroundings present lesser chances of catching Novel Coronavirus. Ultraviolet A (UVA, black light) flashlights can reveal things which the eye may miss but hardly anything is documented on the internet about UV and Covid-19 Pandemic when it comes to hygiene of inanimate objects. This report explores how one can detect uncleanliness using a UV flashlight. The formulated hypothesis questions several scenarios when this gadget could prove useful. Examples include: schools, workplace, childcare centres, bars, restaurants, hotels, public restrooms, hospitals, elderly homes, public transport and items like gloves and stretchers. Materials and methods: A clean ceramic bathroom tile was selected and photographed. UVA was emitted on the same tile using a UV flashlight and at the same time a small part was cleaned with a single stroke of a wet wipe and photographed again. External light was undimmed. Results: On comparison, the tile revealed that it was not clean enough because fluorescent green streaks were visible. A cleaner stripe was made after just one stroke with a wet wipe. Another observation showed that tile spacing can be problematic when cleaning. Conclusion: Despite some limitations, a UV flashlight may be useful for the visual monitoring of cleaning completion on high touch surfaces.

**Keywords:** *Cleanliness; coronavirus; Covid-19; flashlight; hygiene; pandemic; ultraviolet A.*

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## 1. INTRODUCTION

The cleaner the things we touch are, the lesser the chances of catching Novel Coronavirus responsible for Covid-19 which can remain for several hours to a couple of days on different inanimate objects [1]. Ultraviolet (UV) flashlights can help visualise things which the human eye may miss such as dried pet urine and hidden evidence for example, wiped off blood stains in forensic crime scenes [2]. Hence, in view of the Covid-19 Pandemic it was decided to check whether a UV flashlight (it is basically a small torch which emits UVA or black light) can be used to find out how diligently cleaning operators perform duties to keep high touch surfaces clean.

A Google and Google Scholar search was carried out using the following keywords, as inclusion criteria: UV; ultraviolet; black light; pathogens; virus; bacteria; microbes; coronavirus; Covid; clean; dirt; stain; hygiene. Except for some internet posts [3], it yielded no literature in the English language to sustain the effectiveness of UV in detecting clean surroundings.

Only one document mentioned the use of UV for cleaning practices against coronavirus. It involved the use of fluorescent gel applied onto the surface prior to cleaning thus making UV fluorescent marking unsuitable due to the high risk of spreading contamination [4]. On the other hand, studies are underway to explore how UV can be used as germicidal to disinfect objects in the fight against Covid-19 [5].

The hypothesis on the gadget's effectiveness in detecting uncleanness (the presence of biological matter) presents a wide range of questions on practical situations. For example, could a UV flashlight be used to make sure that school and office furniture are absolutely clean and safe for students and workers and in childcare centres where floor hygiene is key? How about using this thing as a tool by health inspectors when checking bars and restaurants, hotel rooms and public restrooms (toilets) for complete cleanliness? Perhaps, it can also contribute to the sanitization of public transport: buses, trains, airliners and cruise ships. Hospitals, especially intensive care units and homes for the elderly would also benefit from this gadget. It is also vital for certain medical items to be thoroughly clean; is it time latex gloves are

removed and new pairs are put on? Are those stretchers cleaned well?

## 2. MATERIALS AND METHODS

A ceramic bathroom tile was selected. It looked clean and was photographed. Then, UVA was emitted onto the same tile using a 'Pocketman' UV flashlight with 51 LEDs (costs around \$15) and at the same time a small part was cleaned with a single stroke of a wet wipe and photographed. The external light was not dimmed. According to the promotional literature of this flashlight, it has a wavelength of 395nm and an irradiation range of 9m.

## 3. RESULTS

Here is a before-after comparison of the same bathroom tiles.

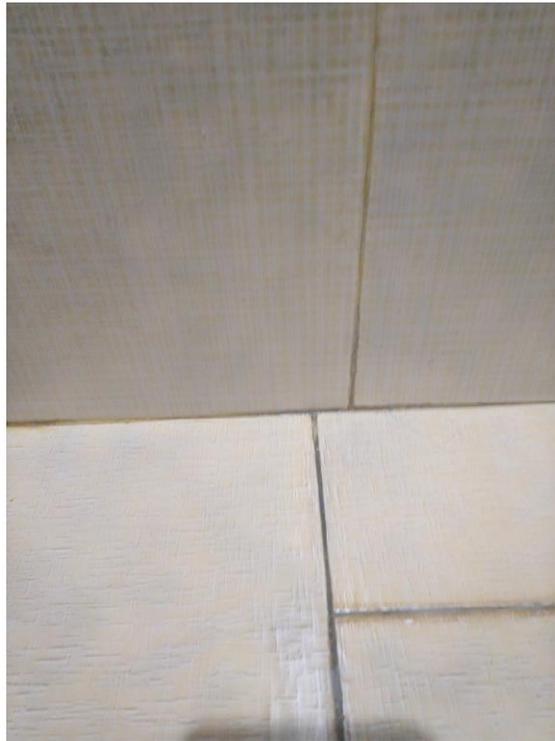
Fig. 1. Shows a seemingly clean bathroom wall tile. In Fig. 2, as UVA was emitted from a 51-LED flashlight onto the same tile, it revealed that it was not clean enough because fluorescent green streaks were visible. A cleaner stripe was made after just one stroke with a wet wipe. Note the tile spacing; this being relatively unsmooth is harder to clean (and is assumed to hold more microbes) than the glossy tile itself

Other observations were also promising. Using the same flashlight, non-permanent spots or markings were identified on: limestone carvings, marble floor, plastic items (from handles to keyboards and printers), metal (from aluminium doors and windows to kitchen utensils [both stainless and Teflon]) and acrylic wall paint.

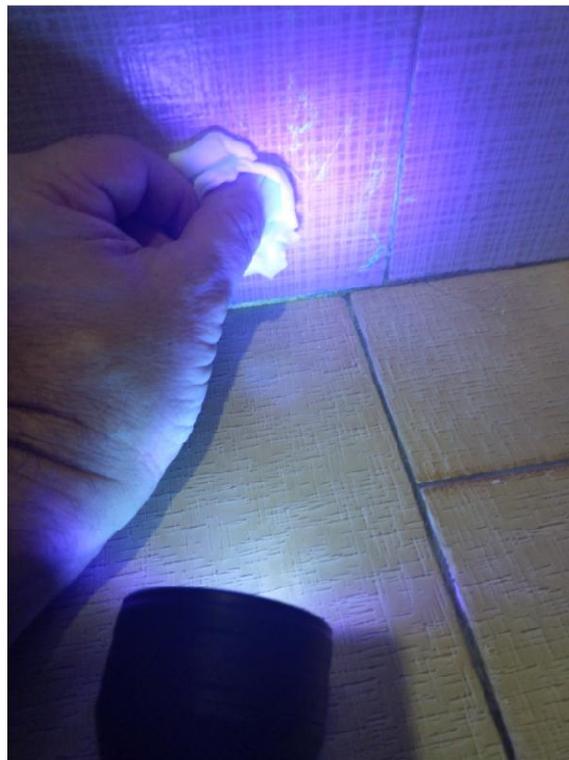
Not so conspicuous but still appreciable results were obtained on towels, carpets, leather shoes and food items like egg shells. No discolouration was noticed on tin preserves and labels. It could be that the ones that came across were clean. Dark furniture also unreacted with UVA.

## 4. DISCUSSION

The results of this simple demonstration are encouraging. A common UV flashlight can check if tile surfaces are clean or not. When a small part was cleaned with a single stroke of a wet wipe, it proved how effective cleaning could be. The use of a moist wipe was preferred to regular household products that are known to effectively



**Fig. 1. A seemingly clean bathroom tile**



**Fig. 2. Under UVA uncleaned parts showed as fluorescent green streaks**

eliminate the virus (such as a solution of 0.01% sodium hypochlorite [bleach] and 70% ethanol) because this report emphasises on basic cleanliness detection (when surfaces are not visibly dirty) and not on disinfection. Although the methodology used is somewhat crude, this preliminary study is hoped to stimulate a battery of experiments where paired images of each inanimate object under examination would be registered and compared with a specific software tool.

There are however, a couple of limitations when using UV light. The most basic one is visibility. The dimmer the surrounding light is, the more the non-cleaned areas become visible.

There is also a problem with soap (liquid or bar soap – does not make any significant difference) which fluoresce especially if used undiluted. However, one should always thoroughly *rinse* the *cleaned* area to remove any soap or detergent residues. In other words, the gadget still remains a valid tool to check whether cleaning protocols are adhered to especially in areas that could potentially be contaminated with germs.

Another drawback is attributed to safety. Sunlight consists of two types of harmful rays: long wave UVA and short wave UVB. UVA rays are less intense than UVB but long term exposure can still cause cancer and eye damage. UVB can kill some germs but is ineffective against SARS-CoV-2 [6]. The third type, UVC, is the most harmful. It can kill airborne flu viruses and recent studies have also found it effective against SARS-CoV-2 [5]. As UV flashlights usually emit wavelengths between 365nm and 395nm that is, within the UVA range, they can be considered as being less harmful than the other wavelengths. However, although hand hygiene has long been regarded as an important element of infection control activity [7], the author would not recommend these flashlights for checking the quality of hand rubbing. Although a You-Tube video, some literature and a couple of photos have been uploaded on the internet about hand hygiene assessment using UVA [8-10], if used irresponsibly this radiation can cause tissue damage, especially on repeated use [11].

Furthermore, it is recommended that a wide range of UV flashlights found on the market are tried and tested. Some may not be up to the

standard required for detecting thorough cleanliness. Others may require dimmed light to show results. More studies are therefore required.

## 5. CONCLUSION

It is understood that that cleaners, housekeepers and chambermaids may not be happy with the application of this gadget in revealing whether they truly did a good job or not. Conversely, supervisors, heads of schools and public health officers would find this gadget very useful because what the naked eye cannot see, this thing will immediately uncover, of course keeping its restrictions in mind.

Whilst scientists continue to focus on the killing properties (disinfection and sterilisation) of UV radiation at microbiological level through genetic modification of DNA or RNA [6], we should not forget the most basic control of the pandemic spread; the checking of object surfaces to see whether they are clean or not. Therefore, as hygiene is paramount for Covid-19 mitigation, a UV flashlight used responsibly can form an integral part of the arsenal for the visual monitoring of cleaning completion on high touch surfaces to curb the Coronavirus Pandemic by slowing the spread of this infectious disease.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

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## COMPETING INTERESTS

Author has declared that no competing interests exist.

## REFERENCES

1. WebMD. Surface Cleaning and COVID-19: What You Should Know. 2021.

- Accessed 31 May 2021.  
Available:<https://www.webmd.com/lung/how-long-covid-19-lives-on-surfaces>
2. Richards A, Leintz R. Forensic Reflected Ultraviolet Imaging. *J Forensic Identif* 2013; 63(1):46-69.
  3. [www.Thekingofrandom.com](http://www.Thekingofrandom.com). What's hiding in your hotel room? 2016. Accessed 31 May 2021. Available:<https://www.youtube.com/watch?v=EcTuhKz5Cgo>
  4. Victoria State Government. Coronavirus (COVID-19) cleaning guidelines for workplaces: Information for business owners, managers and cleaners. 2020. Accessed 31 May 2021. Available:<https://www.dhhs.vic.gov.au/coronavirus-cleaning-guidelines-for-workplaces-doc>
  5. Sarada BV, Vijay R, Johnson R, Rao TN, Padmanabham G. Fight against COVID-19: ARCI's technologies for disinfection. *Trans Indian Natl Acad Eng*. 2020;5(2): 349-54.
  6. Live Science. Does UV light kill the new coronavirus? 2020. Accessed 31 May 2021. Available:<https://www.livescience.com/uv-light-kill-coronavirus.html>
  7. Mathur P. Hand hygiene: back to the basics of infection control. *Indian J Med Res*. 2011;134(5):611–20.
  8. Eyewitness News. Coronavirus prevention: Are your hands clean? A black light experiment. 2020. Accessed 31 May 2021. Available:<https://www.youtube.com/watch?v=h5P9Psof5kk>
  9. Independent. Coronavirus: Black light photos show importance of washing hands amid outbreak. 2020. Accessed 31 May 2021. Available:<https://www.independent.co.uk/life-style/coronavirus-wash-hands-correctly-photos-black-light-germs-a9384321.html>
  10. Lehotsky Á, Szilágyi L, Bánsághi S, Szerémy P, Wéber G, Haidegger T. Towards objective hand hygiene technique assessment: validation of the ultraviolet-dye-based hand-rubbing quality assessment procedure. *J Hosp Infect*. 2017;97(1):26-9.
  11. Wischermann K, Popp S, Moshir S, Scharfetter-Kochanek K, Wlaschek M, De Grujil F, et al. UVA radiation causes DNA strand breaks, chromosomal aberrations and tumorigenic transformation in HaCaT skin keratinocytes. *Oncogene*. 2008; 27(31):4269-80.

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