DESIGN AND PRODUCTION OF TiO_2 NANOPARTICLE-BASED PHOTOCATALYTIC CLEANSING REUSABLE BOWL TO REDUCE THE RISK OF INTRAORAL FUNGAL AND BACTERIAL INFECTION IN PEOPLE WHO USE DENTAL PROSTHESIS

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1. Introduction

Candida albicans is one of the most widely observed fungal species that cause systemic inflammation when appropriate conditions are humid. C. albican fungal are found in the mouths whose people who use dental prothesis. Cleansing tablets produced in order to solve this problem are not enough. Therefore, some infections are occur. In recent years, TiO_2 nanoparticles used as antimicrobial and antifungal under the ultraviolet light (UV) (Sayılkan, 2016). Starting from these studies, we aimed to design a denture cleaning bowl that would allow the removal of the C. albican fungi on the dental prosthesis to the minimum by taking advantage of the photocatalytic properties of TiO_2 nanoparticles under UV light. In our project, we believe that, prosthesis users can use our TiO_2 thin film coated prosthesis cleaning cabinet, which is formed with UV light mechanism, without spending extra time for prosthesis cleaning since it is reusable and low cost. Since it offers much easier, economical, reusable and effective cleaning than the other prosthesis cleaning options available in the market, it is a first in the literature which adds originality to the work we do.

2. Method

To produce antifungal glass bowl, firstly the bowl was cleaned with acetone in ultrasonic cleaner for 10 minutes, and was dried with nitrogen gun. Then TiO_2 paste form was solved in the ethanol (1:3) and stirred to obtain homogeneous solution. Prepared solution was covered by spraying inside of bowl and the bowl was heated in the oven at a temperature of 450 ^{0}C for 40 minutes. The lower part of the designed denture bowl was designed in a three-dimensional (3D) design program and implemented with a 3D printer (Figure 1).

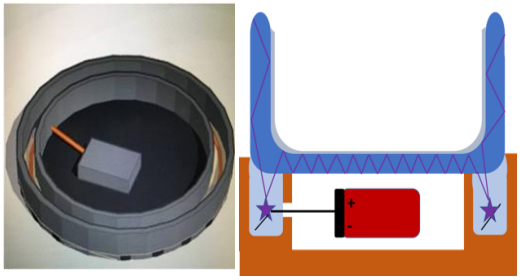

Figure 1. Design of denture bowl

The circuit components that will change the brightness of the light and supply for the UV light placed into the base printed via 3D printer. Polydimethylsiloxane (PDMS) mixture was prepared and applied between the two materials in order to fit the bottom designed with TiO_2 coated glass. Finally printed lower part, UV LEDs and TiO_2 coated glass bowl were assembled (Figure 2).

Figure 2. Antifungal glass bowl for dentures

3. Results

After the UV light system was installed in the prepared cleaning system a methylene blue deterioration test was carried out for the experimental confirmation of the known result of photocatalytic effect on the C. albicans fungus. It was observed that the designed system showed a photocatalytic reaction in a time interval as short as 2 hours, by lightening the colour of the methylene blue aqueous solution (Figure 3).

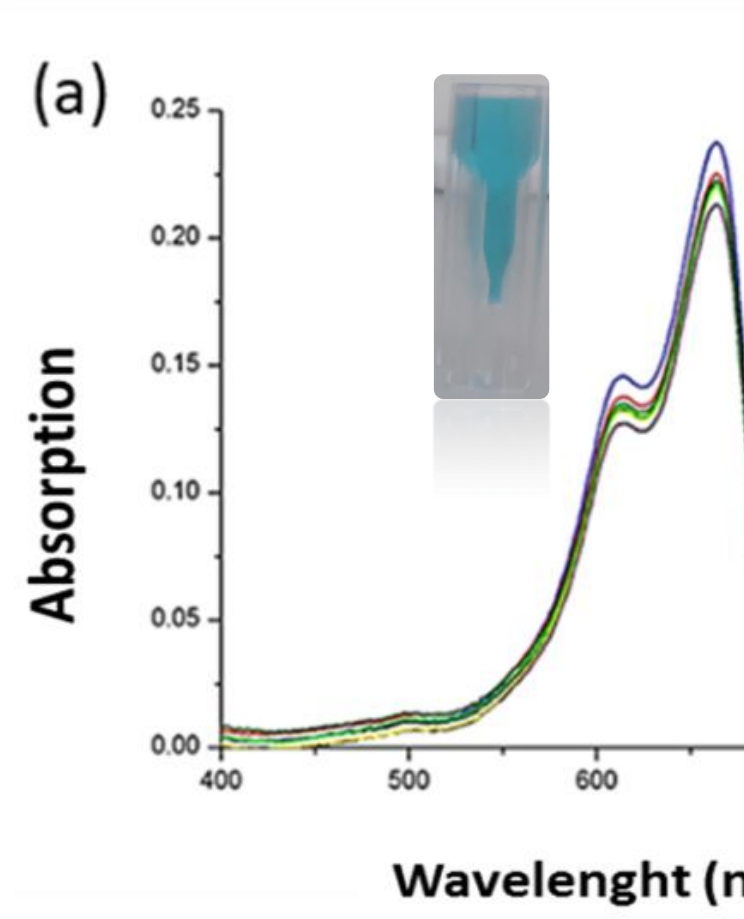

Figure 3. a) The control group (b) The absorption measurement of the TiO2-coated glass bowl with the spectrophotometer

4. Conclusion

Designed as an alternative to the fungicidal effects of tablets and solutions for denture cleaning, this glass bowl has several superior features such as easy to use, low cost and non toxic. For these reasons, the added value of the product we designed is high and it is beneficial to the society.

5. References

1. Sayılkan, F., Emre F.B., (2016). Characterization and Photocatalytic Properties of TiO_2 /chitosan Nanocomposites Synthesized by Hydrothermal Process, *Turk J Chem*, 40, 28-37

2. Francis, C., Breen, C., Sokmen, I., Buruk, M., Kurtulus, C. and Bacaksız, E. (2011). Degradation of Candida albicans on TiO2 and Ag-TiO2 thin films prepared by sol–gel and nanosuspensions. *Jounal of Sol-gel Science and Technology*, 60, (1), 23-32.