



**Innovation of High-Performance Nano Titanium Dioxide-Coated Wallpaper
with Light-Diffusing Properties for Enhanced Brightness
and Bacterial Reduction in Dental Room**

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Abstract

Dental clinics require a clean environment with adequate illumination to support dental procedures and reduce the risk of bacterial contamination in both the air and on wall surfaces. This study aimed to develop high-performance titanium dioxide (TiO₂) nanoparticle-coated wallpaper capable of enhancing light diffusion and reducing bacterial accumulation in dental clinics. TiO₂ nanoparticles were synthesised using the sol-gel method and mixed with acrylic resin before being coated onto wallpaper by the doctor blade coating technique. Four TiO₂ concentrations (0, 1, 3, and 5 wt%) were investigated. The coated wallpaper was evaluated in three aspects (1) photocatalytic activity using methylene blue as an indicator of organic degradation, (2) antibacterial performance by determining the number of airborne bacterial colonies cultured on agar plates inside a simulated chamber, and (3) light diffusion performance by measuring the increase in illumination using a lux meter. The results showed that the wallpaper coated with 3 wt% TiO₂ exhibited the highest photocatalytic activity, achieving the greatest degradation of organic compounds, and significantly reduced the number of bacterial colonies. In addition, it improved light diffusion and increased the illumination level inside the simulated chamber compared with uncoated wallpaper without requiring additional electrical energy. Furthermore, this project supports several United Nations Sustainable Development Goals (SDGs), including SDG 3, SDG 9, SDG 11, SDG 12, and SDG 13. Therefore, TiO₂ nanoparticle-coated wallpaper has strong potential as an interior wall material for dental clinics to promote hygiene, improve lighting efficiency, and support the sustainable use of resources.

Keywords: TiO₂ nanoparticle-coated wallpaper; photocatalysis; light diffusion; antibacterial activity; dental clinic