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# Synergistic effect of UV light photocatalytic on ytterbium doped titanium dioxide nanoparticles against Gram strain bacteria's

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A novel Up-conversion ytterbium material was doped with titanium dioxide (YbT) nanoparticles (NPs) for to analyze the effect on antibacterial activities in two conditions (without UV-irradiated and with UV-irradiated) against two Gram strain bacteria's (*Staphylococcus aureus and Escherichia coli*). For the synthesis of YbT NPs, we have employed a bottom-up approach in that the green route was adopted. In the green route, there are a number of bioreductants were used due to their potentiality. In our synthetic route, a novel Piper Betel leaf extract was chosen due to their rich constituents (Phytochemicals). In order to confirm their optical, functional, surface morphological, structural and thermal stability observations, YbT NPs was subjected to various characterization techniques. The obtained results were signified that they having an absorption maximum around at 373 nm, the presence of N-H, C-H, C=O and C-O on YbT FT-IR spectrum indicates that the possible presence of bioreductants which are responsible for the reduction and stabilizing the YbT NPs. The size of the particles was in nano nature and they consist size of about 7 nm. They are having a tetragonal crystal structure, later compared the crystalline size from Scherrer's and Williamson-Hall (W-H) methods, this may signify that estimated crystalline size from the W-H method is more appropriate for the TEM image as compared to the Scherrer's method. The YbT NPs are thermally stable. After the satisfactory results, we have further studies their antibacterial activities. The obtained results may indicate that YbT NPs have shown more potent antibacterial activities against *Staphylococcus aureus and Escherichia coli* bacteria in both the conditions. But we have got more zone of inhibition for with UV-irradiated YBT NPs. So this may indicate that YbT NPs can be used for various biological activities. Furthermore, this synthesis route can be utilized for the mass productions of NPs; it may help for the industrial uses.

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