The antimicrobial properties of nanotitania extract and its role in inhibiting the growth of klebsiella pneumonia and haemophilus influenza

ABSTRACT

Titanium dioxide (TiO2) is an antimicrobial agent which is considered of potential value in inhibiting the growth of multiple bacteria. Klebsiella pneumonia and Haemophilus influenza are two of the most common respiratory infection pathogens, and are the most. Klebsiella pneumonia causes fatal meningitis, while Haemophilus influenza causes mortality even in younger patients. Both are associated with bacteremia and mortality. The purpose of this study was to test a new antibacterial material, namely nanotitania extract combined with 0.03% silver that was developed at Universiti Malaysia Sabah (UMS) and tested against K. pneumonia and H. influenza. The nanoparticles were synthesized through a modified hydrothermal process, combined with molten salt and proven to have excellent crystallinity, with the band-gap energy falling in the visible light spectrum. The nanoparticle extract was tested using a macro-dilutional method, which involved combining it with 0.03% silver solution during the process of nanoparticle synthesis and then introducing it to the bacteria. A positive control containing the bacteria minus the nanoparticles extract was also prepared. 25 mg/mL, 12.5 mg/mL, and 6.25 mg/mL concentrations of the samples were produced using the macro dilution method. After adding the bacteria to multiple concentrations of nanoparticle extract, the suspensions were incubated for 24 h at a temperature of 37 °C. The suspensions were then spread on Mueller-Hinton agar (K. pneumonia) and chocolate blood agar (H. influenza), where the growth of bacteria was observed after 24 h. Nanoparticle extract in combination with silver at 0.03% was proven to have potential as an antimicrobial agent as it was able to inhibit H. influenza at all concentrations. Furthermore, it was also shown to be capable of inhibiting K. pneumonia at concentrations of 25 mg/mL and 50 mg/mL. In conclusion, the nanoparticle extract, when tested using a macro-dilutional method, displayed antimicrobial properties which were proven effective against the growth of both K. pneumonia and H. influenza.