

ABSTRACT

*The problem of antibiotic resistance in bacteria is studied to develop new agents that can inhibit bacterial activity. Recent studies have reported the potential application of nanoparticles as antibacterials. However, there is still a lack of research conducted in obtaining stable nanoparticles. Researchers also explored the effects of utilizing eco-friendly liquid media to maintain small sizes. In this study, zirconium dioxide (ZrO₂) nanoparticle colloids have been successfully synthesized using pulse laser ablation in liquid. The laser used was Nd:YAG with a wavelength of 1064 nm. The laser ablated the surface of the zirconium metal plate in different liquid media, namely deionized water, ethylene diamine, and chitosan solution. The formation of ZrO₂ nanoparticle colloids is characterized by a color change from transparent to cloudy white. The liquid media used affects the characteristics of the ZrO₂ nanoparticles formed and their ability as antibacterials. Scanning electron microscope images of ZrO₂ nanoparticle colloids in deionized water, ethylene diamine, and chitosan solutions showed spheres with diameters of about 24.33 nm, 19.76 nm, and 15.05 nm. The antibacterial effect of ZrO₂ nanoparticle colloids on *E. coli* bacteria was assessed by measuring the diameter of the inhibition zone of 6.40 mm for deionized water, 7.15 mm for ethylene diamine, and 8.10 mm for chitosan solution. ZrO₂ nanoparticle colloids in chitosan solution had a smaller size and a greater antibacterial effect than in other media. Based on these results, the smaller size of nanoparticles has a greater ability to inhibit the activity of *E. coli* bacteria.*

Keywords: *ZrO₂ nanoparticle colloids, pulse laser ablation in liquid, antibacterial, *E. coli**