Physicochemical properties, cytotoxicity, and antimicrobial activity of sulphated zirconia nanoparticles

ABSTRACT

Nanoparticle sulphated zirconia with Brønsted acidic sites were prepared here by an impregnation reaction followed by calcination at 600°C for 3 hours. The characterization was completed using X-ray diffraction, thermal gravimetric analysis, Fourier transform infrared spectroscopy, Brunner-Emmett-Teller surface area measurements, scanning electron microscopy with energy dispersive X-ray spectroscopy, and transmission electron microscopy. Moreover, the anticancer and antimicrobial effects were investigated for the first time. This study showed for the first time that the exposure of cancer cells to sulphated zirconia nanoparticles (3.9–1,000 μg/mL for 24 hours) resulted in a dose-dependent inhibition of cell growth, as determined by (4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide assays. Similar promising results were observed for reducing bacteria functions. In this manner, this study demonstrated that sulphated zirconia nanoparticles with Brønsted acidic sites should be further studied for a wide range of anticancer and antibacterial applications.

Keyword: Sulphated zirconia; Nanoparticles; Antimicrobial; Anticancer