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Research Article

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The Activity of Medical Plant Extracts with Al_2O_3 Nanoparticles on the Vitality of Bacteria and their Genomes

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ABSTRACT

This study was conducted to investigate the activity of crude plants extracts and alumina nanoparticles against Escherichia coli and Staphylococcus aureus by using two methods: agar well diffusion and DNA binding. FT-IR was used to compare the different peaks of the organic group in plant extracts and the plant extracts with an alumina nanoparticles (mix). The results showed that the extracts from three plants had antimicrobial effects against Escherichia coli and Staphylococcus aureus isolates. The mixture of the crude plant extract plus the alumina NP suspension revealed a different effect that ranged between a synergistic and an antagonistic effect. The gel electrophoreses results showed that most of the plant extracts and the mix cleaved DNA with the exception of the alumina nanoparticles alone, which did not have any clear effect.

Key words: bacteria, nanoparticles, Al_2O_3, plant extract, DNA Binding

INTRODUCTION

Nanoparticles (NPs) are generally defined as particles that have a diameter of less than 100 nm [1]. Many studies have demonstrated potential problems if nanomaterials are released into the environment, especially considering their toxicity to microorganisms, plants, and animals [2]. The antimicrobial activities of aluminum oxide, silver nanoparticles, gold nanoparticles and iron oxide nanoparticles have been previously reported [3- 5]. Nanomaterials have proved toxic to human tissue and cell cultures, resulting in increased oxidative stress, inflammatory cytokine production and cell death [6]. Studies demonstrate the potential for nanomaterials to cause DNA mutations [7]. Aluminum oxide (Al_2O_3) NPs have a wide range of applications in industrial as well as personal care products [8]. Aluminum oxide NPs are important applications in the ceramics industry [9] and can be used as an abrasive material, in heterogeneous catalysis, as an absorbent, as a bio-material, and as reinforcements of metal-matrix composites [10, 11]. Previous researchers have investigated the cytotoxic effects of metal oxide particles, such as, aluminum oxide (Al_2O_3), titanium dioxide (TiO_2), and zirconium oxide (ZrO2), on murine fibroblasts and murine monocyte macrophages [12]. Other studies revealed the toxicity range of metal oxide NPs, including Al_2O_3, which is 500-3000 nm in diameter, in human fibroblast cells [13]. Generally, the toxic effects of the Al_2O_3 nanoparticles are time dependent [14].

For centuries, plants have been used as remedies and to treat diseases [15]. Medicinal plants contain some organic compounds that provide a definite physiological action on the human body, and these bioactive substances include tannins, alkaloids, carbohydrates, terpenoids, steroids and flavonoids [16, 17]. *Matricaria chamomile* flowers mostly contain phenolic compounds and glycosides [18]. Aqueous and alcoholic extracts of *Chamomilla* flower powder are used in therapeutics to treat skin infections caused by pathogenic bacteria, as a therapy for mouth injuries, and in therapeutics to treat respiratory system infections and digestive disorders [19]. *Olea europaea* leaves contain