Секция «Микробиология»

Evaluation of antibacterial properties of grapefruit peel extracts and its green-synthetized silver nanoparticles

Научный руководитель – Podoprigora Irina Viktorovna

Mbarga Manga Joseph Arsene
Postgraduate
Российский университет дружбы народов, Медицинский факультет, Moscow, Russia
E-mail: josepharsenembarga@yahoo.fr

The gradual loss of efficacy of conventional antibiotics is a worldwide issue. Plant materials extracts and green-synthesized nanoparticles are among the most promising options to address this problem. The aim of the present study was to valorize a by-product of food consumption, grapefruit peels, by studying the antibacterial properties of its extracts and of its green-synthesized silver nanoparticles (AgNPs). The aqueous and hydroalcoholic extracts (80% v/v) were made and the volume and mass yields were determined. The synthesis of the nanoparticles (AgNPs) was done with an eco-friendly method using AgNO3 as a precursor. The nanoparticles were characterized by UV-vis spectrometry and by photon cross correlation spectroscopy (PCCS). The antibacterial activity of the extracts was tested on 3 Gram-positives bacteria (*S. aureus* ATCC 6538, clinical *E. faecalis* and *S. aureus*) and 2 Gram-negatives (2 clinical *E. coli*) with different concentrations of extracts (100, 50, 25, 12, 5 mg/ml and 5% DMSO as negative control) and MIC (minimal inhibitory concentration) and MBC (minimal bactericidal concentration) were determined by the microdilution method. The modulation of cefazoline and ampicillin on resistant *E. coli* and *S. aureus* strains was combined to the mixture design response surface methodology (MDRSM) with extreme vertices design, with the diameters of inhibition and the fractional inhibitory concentration index (FIC index) as responses and as factors: the antibiotic, the ethanolic extract and water varying respectively from 0.1MIC to 0.9MIC for the first two and from 0 to 0.8 in proportion for the third. Validating the models was obtained by calculating the absolute average deviation (AAD), the bias factor (Bf), and the accuracy factor (Af). The volume yield of the ethanolic (EE) and aqueous (AE) extracts were 96.2% and 93.8% (v/v) respectively, while the mass yields were 7.84% and 9.41% (m/m). The synthesized AgNPs were very uniform and homogeneous and their size depended on the concentration of AgNO3. The antibacterial activity of the two extracts was dose-dependent and the largest inhibition diameter was observed on gram-positive bacteria (*S. Aureus* ATCC 6538; AE, 12; EE, 16) whereas AgNPs had a greater effect on the Gram-negative bacteria. The MICs (in mg/ml) of the aqueous extracts varied from 3.125 (*S. Aureus* ATCC 6538) to 12.5 (*E. coli 1* and *E. coli* 2) while the MICs of the ethanolic extracts varied from 1.5625 (*S. Aureus* 1, *S. Aureus* ATCC 6538 and *E. Faecalis*) to 6.25 (*E. coli* 1). There was a significant difference between the MICs of aqueous extracts and ethanolic extracts (P = 0.014). The MBCs (in mg/ml) of the aqueous extracts varied from 12.5 (*S. Aureus* ATCC 6538) to 50 (*S. Aureus* 1) while those of the ethanolic extracts varied from 6.25 (*S. Aureus* 1) to 25 (*E. coli* 1 and *E. Faecalis*). Ethanolic grapefruit extracts demonstrated an ability to modulate cefazolin on *E. coli* and *S. aureus* but were completely indifferent to Ampicillin on *E. coli.* The grapefruit peel extracts and their AgNPs have antibacterial properties that can be exploited in the synthesis of new antimicrobials and their ethanolic extract can be use in synergy with cefazolin.

Key words : Antimicrobials, plants extract, grapefruit peel, green synthesis, silver nanoparticles.