Faculty of Science

Improvement of the Antimicrobial Properties of Nanoparticles and Application in Water Purification

Thesis Submitted for Ph.D. degree in Microbiology

By

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Declaration

This thesis has not previously submitted for any other universities.

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ABSTRACT

This studying is refering to identified of an easy and eco-friendly way for biosynthesis of nanoparticles, nanocomposite. Using isolates to metal ions leads to nanoparticles formation and using sonic vibro cell for synthesis nanocomposite. Nanoparticles were in the range at about 5-130 nm dimension. Nanoparticles and nanocomposite were examined utilizing Ultra Vilot-Visible spectroscopy, Transmission Electron Microscopy "TEM", X-ray Diffraction "XRD", and Fourier Transform Infrared Spectroscopy "FTIR" analysis, protein fractions and Maldi-TOF Analysis to identify their effectiveness in antimicrobial activities. For production of nanoparticles and nanocopmosite different human pathogenic bacterial strains were used. All the microbes were inhibited at low concentrations of the tested nanoparticles. The inhibition caused by nanoparticles was gradually increased with *E. coli* and *Pseudomonas aeruginosa* (Gram negative) compared with *Staph. aureus* and MRSA (Gram positive). The antitumor activity of HCT-116 (colon carcinoma cell) cancer cells. Where the results indicate high cytotoxic effect for synthesized silver nanoparticles 500µl- Zinc oxide nanoparticles 500 µl with the half maximal inhibitory concentration IC_{50}=73.7 µl, nanocomposite against cancer HCT-116 colon carcinoma cell line. For water purification from heavy metals and also antibacterial, the results indicate that the maximum adsorption of heavy metals with almost all adsorbents were obtained with an adsorbent dosage was considered the optimum time at about 15 minute. Nanocomposites showed higher growth inhibitory effect on *Shigella*, compared to *Salmonella*. *Salmonella* and *Shigella* growth was inhibited by 100 % inhibation when exposed to 2.17 mg/mL of silver, zinc oxide and titanium dioxide nanoparticles.

ABBREVIATIONS

(w/v)	Weight per volume
Abs.	Absorption
AG	El Gharbia El Agezia El-Mahalla
Ag^{+}	Silver ion
$AgNO_3$	Silver nitrate
Asp.	*Aspergillus*
ca.	calibration
Cd	Cadmium
cfu	colony forming unit
Conc.	Concentration
Cr	Chromium
Cu	Copper
d.	Day/Days
DNA	Deoxyribonucleic acid
E.coli	*Escherichia coli*
EDX	Energy Dispersive X - ray Spectroscopy

F.	Fusarium
Fe	Iron
FTIR	Fourier Transform Infrared Spectroscopy Analysis
g.	Gram
hrs.	Hour/hours
IC_{50}	The half maximal inhibitory concentration
K.	Klebsiella
kDa	Kilo Dalton
kV	Kilovolts
LA	Luria Agar
LB	Luria Bertani
M	El-Mahalla
ML	molar (mol / litre)
m/z	Mass to charge ratio
MALDI-TOF	matrix-assisted laser desorption/ionization/ time-of-flight mass spectrometer)
min.	minute

mm.	Millimeter
mM	millimolar
Mn	Manganese
MRSA	methicillin-resistant Staphylococcus aureus
NADH	Nicotinamide Adenine Dinucleotide
NADPH	Nicotinamide Adenine Dinucleotide Phosphate
Ni	Nickel
nm.	Nanometer
No.	number
NPs	nanoparticles
O.D	Optical Density
P.aeruginosa	*Pseudomonas aeruginosa*
PAGE	Electrophoresis of native protein
Pb	Lead
PDA	Potato Dextrose Agar
PDB	Potato Dextrose Broth

PNSE	Plan of National Sant Environment
ppm.	parts per million
PVC Tube	Plastic Vinyl Corp Tube
RNA	ribonucleic acid
rpm.	rotations per minute
S. aureus	*Staphylococcus aureus*
SCM	Similarity Coefficients Matrix
SD±	standard deviation
SDS	Sodium Dodecyl Sulfate
Sec.	seconds
SEM	Scanning Electron Microscope
SH	El GharbiaShobrababel
SLs	similarity levels
Son	El GharbiaSonbat
spp.	species
SPR	surface plasmon resonance
T	Tanta

TEM	Transmission Electron Microscope
TG	El Gharbia Tanta
TiO_2	Titanium dioxide
UV-Vis	Ultraviolet Visible Spectroscopy
XRD	X-Ray Diffraction Analysis
Zef	El Gharbia Zefta
Zn	Zinc
ZnO	Zinc Oxide
θ	Theta

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