Cairo University
Faculty of Science

Chemical Studies on Molecular Detection and Nanobiocidal Control of Some *Enterobacteriaceae* Foodborne Bacteria

Thesis
Submitted for the Partial Fulfillment of the PhD Degree in Biochemistry

BY
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ABSTRACT

Student Name: Heba Allah Mohamed Mohamed Nour EL-Din
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Introduction:

Foodborne diseases are caused by consumption of food spoiled by pathogens or their toxins. Sampling beef meat and chicken samples from local markets which is additionally affecting foodborne disease outbreaks, making food safety a universal issue. Food safety nowadays, remains focused on prevention and monitoring of potentially harmful effects growingly correlated with a number of different microbial subtypes and sub strains that may produce toxic products not easily detectable by standard methods Targeted molecular profiling of Enterobactericea in randomly collected samples is traced with their health risk impact on human. Biochemical classical microbiological, real time PCR, MALDI TOF as well as sequencing confirmation techniques were performed for speciation of possible foodborne pathogens may present in meat and tissue samples. Salmonella, E-coli are confirmed, 6 samples were selected for further confirmation by sequencing.

A study on nanobiocidal control investigations were tried on some *Enenterobactericea* species using newly prepared nanoparticles. Curcumin chitosan nanocomposite and selenium nanoparticles were synthesized by ionotropic gelation and green methods respectively. The biosynthesized nanoparticles were characterized by using Fourier transform spectroscopy (FT-IR), Dynamic Light Scattering (DLS), Zeta Potential (ZP) and Transmission Electron Microscopy (TEM). Antibacterial activities of Curcumin Chitosan nanocomposites with size of 160nm and surface charge of +24mv and selenium nanoparticles of 30-50nm and -22mv were tested against *Escherichia coli O157:H7* and *Salmonella species* by broth macrodilution method and Minimum inhibitory concentration (MIC) of bacterial growth was determined. Curcumin Chitosan nanocomposite inhibit bacterial growth at lower concentration compared to selenium nanoparticles which may referred to high solubility of chitosan with curcumin rather than bare selenium nanoparticles . Results indicate that Curcumin Chitosan nanocomposite distort and damage bacterial cell membrane, resulting in a leakage of intracellular contents and eventually the death of bacterial cells as detected by TEM on broth media 24hrs post incubation with standard strains of *E coli O157:H7* and *Salmonella specie.* Minimum inhibitory concentration (MIC) of bacterial growth was determined. Selenium NPs have no effect for *Salmonella Enteritidis* (*S.E*) and

S.typhymurium (*S.T*) but MIC of selenium for *E.coli O157* was at 12.5 µg/ml, while Chitosan curcumin NPs have effect for *S.T* and *S.E* with MIC 50 µg/ml, on the other hands *E.coli O157* was 25 µg/ml.

Aim of the Study:

1. Compromise study between molecular profiling of different detection techniques for boodborne speciation of randomly collected from local markets.
2. Nanobiocidal control of bacterial growth with newly prepared nanoparticles; selenium NPs and chitosan curcumin nanocomposite on *E.coli O157* and some *Salmonella* species.

Key Words:

Enenterobactericea, MALDI-TOF, sequencing, foodborne pathogen, molecular speciation, nanobiocidal control, Curcumin Chitosan nanocomposite, selenium nanoparticles, MIC, *Escherichia coli O157:H7, Salmonella species*