

The Academic Year: 2022-2023

Author: Ehsan Semsari

Title of thesis: Carbon dots of lemon peel: Synthesis and application in improving shelf life of beef

Abstract

In this study, carbon quantum dots (CQD) were synthesized from Omani lemon peel using the hydrothermal synthesis method, and their effects on beef fillet were investigated. The average particle size of the synthesized CQD was determined to be 7.55 nm using particle size analysis, and transmission electron microscopy images confirmed their spherical shape. FTIR analysis showed that the CQD contained carboxyl, hydroxyl, and amine groups. Additionally, visible-UV spectroscopy revealed a sharp peak at 284 nanometers, attributed to the $\pi-\pi^*$ transition in the functional groups of C=C and C=N double bonds. Moreover, a peak observed in the range of 315-340 nanometers could be related to the $\pi-n^*$ transition in the C=O and NH₂ groups. The DPPH assay indicated that the CQD had a DPPH scavenging capacity of 50% at a concentration of 0.66 mg/mL (IC₅₀=0.66 mg/mL). Toxicity tests against L929 mouse fibroblast cells revealed that, at concentrations lower than 5.0 mg/mL, 95% of the tested cells remained viable. The CQD at two concentrations (100 and 200 mg/mL) was added to beef fillet using the aerosol method, and quality indicators in the meat (e.g., pH, TVB-N, TBA, psychrophilic and mesophilic bacterial counts, color changes, and sensory evaluation) were measured during a 15-day storage period in the refrigerator. Based on the results obtained, it was evident that there was a significant difference ($P < 0.05$) in the control group compared to the treatment groups on different days, and the use of CQD synthesized from Omani lemon peel could extend the meat's shelf life. Therefore, using CQD through aerosolization can reduce the CQD amount and extend the quality of beef fillet during storage.

Keywords: Carbon Dot, Meat Preservation, Spray, Antimicrobial Properties, Antioxidant