

BIOACTIVE CMC-BASED FILMS ENRICHED WITH GREEN COFFEE OIL AND ITS RESIDUES

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Active food packaging films based on biopolymers represents a promising alternative for replacing synthetic plastic films due to the biodegradability, non-toxicity and ability to carry bioactive compounds. The aim of this study was to develop and characterize bioactive films based on carboxymethylcellulose (CMC) incorporated with green coffee oil (GCO) and extracts from residues after GCO screw pressing. Cake (CE) and sediments (SE) extracts were obtained with 70% ethanol. A controlled amount of CE and SE were added to obtain 2:0.5 or 2:1 CMC:extract ratios, then glycerol (0.5%), lecithin (0.08%) and GCO (0.2%) were added to elaborate six film-forming solutions. GCO and extracts were characterized according to oil content, yield and by direct-infusion electrospray ionization-mass spectrometry (DESI-MS). Films were characterized by moisture, thickness, FTIR analysis, scanning electronic microscopy, colorimetric properties, light transmission, mechanical properties, water vapor permeability (WVP) and antioxidant activity (Folin-Ciocalteu and DPPH methods). Eight fatty acids, hexose and 4 major phenolic compounds were identified in the extracts and GCO by DESI-MS. FTIR analysis indicates that exists interactions between CMC and phenols and fatty acids. Films enriched with extracts presented rough and heterogeneous surfaces, indicating the presence of fibres. The color was influenced by both concentration and type of extract ($p < 0.05$) producing yellow-green films. Films incorporated with 1% of CE showed a good light barrier in the UV-region. The tensile strength and Young's modulus of the films decreased progressively (48.4 to 2.6 MPa and 5.2 to 0.3 MPa, respectively) with the extracts concentration, while elongation significantly increased (39.7 to 155.8%) ($p < 0.05$). WVP (average 3.6×10^{-8} g.mm/cm².h.Pa) was not affected by the incorporation of extracts and GCO ($p > 0.05$). Finally, CMC-based films presented a high antioxidant activity (0.41 and 0.67 mM Trolox eq./g films; 18.53 and 51.28 mg GAE/g films, respectively for SE0.1 and CE0.1) showing great potential for food active packaging.

Keywords: Green coffee oil, CMC films, antioxidant residue extracts.