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Development and bioactive potential of films from plant residue enriched with eucalyptus extract and oregano essential oil

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Introduction: Traditional plastic food packaging is typically non-renewable and non-biodegradable, creating a need for new eco-friendly and sustainable alternatives, such as plant-based films. Plant agro-industrial wastes have been explored as sources of polymeric matrices in film development. Additionally, natural compounds from plants, like plant extracts (PEs) and essential oils (EOs) can provide these films with antimicrobial and antioxidant activities. So, this work aimed to produce polymeric films with licorice-based polymers incorporated with eucalyptus extract and oregano EO. **Methodology:** Licorice residue was characterized using high-performance liquid chromatography (HPLC) and used to develop films with alginate and glycerol. Films were produced with oregano EO (2%), eucalyptus extract (1%), and a combination of both (1% each). The antimicrobial activity was tested against *Escherichia coli* (*E. coli*) and *Staphylococcus aureus* (*S. aureus*) using the viable cell method. Antioxidant activity was assessed by 2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) and 2,2-difenil-1-picrilhidrazil (DPPH) scavenging assays. **Results:** The results showed that the residue consisted mostly of insoluble fibers from approximately 74%, with lignin being the main constituent from approximately 33%. The residue was, then, used to produce films incorporated with eucalyptus extract and oregano EO as bioactive agents. The antimicrobial activity test showed that the films with licorice residue incorporated with eucalyptus extract and oregano oil was able to completely inhibit *E. coli* after 2 h of exposure; Besides that, the film incorporated with eucalyptus extract was able to completely inhibit *S. aureus* after 4 h of exposure and the film incorporated with eucalyptus extract and oregano oil inhibited this bacterium after 2 h. Regarding the antioxidant potential of the films, the film with licorice residue (no extract nor oil) was the one with the least antioxidant activity (ABST: 226,7428 Trolox equivalents (µM)/mg film; DPPH: 162,2766 Trolox equivalents (µM)/mg film). The incorporation of eucalyptus extract and oregano EO to the films significantly increased its antioxidant activity. **Conclusion**: Polymeric films made from licorice residues and incorporated with EOs and PEs, due to their antimicrobial and antioxidant activities, can constitute an alternative to conventional food packaging.

Keywords: plant residue; plant extract; essential oil; polymeric film; bioactive potential.