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Polyvinyl Alcohol Incorporated with Hibiscus Extract Microcapsules as Combined Active and Intelligent Composite Film for Meat Preservation

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Abstract : Numerous attempts are being performed in order to formulate suitable packaging materials for meat products. However, to the best of our knowledge, the incorporation of free hibiscus extract or its microcapsules in the pure polyvinyl alcohol (PVA) matrix as packaging materials for meats is seldom reported. Therefore, this study aims at protection of the aqueous crude extract of hibiscus flowers utilizing spry drying encapsulation technique. Fourier transform infrared (FTIR), scanning electron microscope (SEM), and zetasizer results confirmed the successful formation of assembled capsules via strong interactions, spherical rough microparticles, and ~ 235 nm of particle size, respectively. Also, the obtained microcapsules enjoy high thermal stability, unlike the free extract. Then, the obtained spray-dried particles were incorporated into the casting solution of the pure PVA film with a concentration 10 wt. %. The segregated free-standing composite films were investigated, compared to the neat matrix, with several characterization techniques such as FTIR, SEM, thermal gravimetric analysis (TGA), mechanical tester, contact angle, water vapor permeability, and oxygen transmission. The results demonstrated variations in the physicochemical properties of the PVA film after the inclusion of the free and the extract microcapsules. Moreover, biological studies emphasized the biocidal potential of the hybrid films against microorganisms contaminating the meat. Specifically, the microcapsules imparted not only antimicrobial but also antioxidant activities to PVA. Application of the prepared films on the real meat samples displayed low bacterial growth with a slight increase in the pH over the storage time up to 10 days at 4 oC which further proved the meat safety. Moreover, the colors of the films did not significantly changed except after 21 days indicating the spoilage of the meat samples. No doubt, the dual-functional of prepared composite films pave the way towards combined active/smart food packaging applications. This would play a vital role in the food hygiene, including also quality control and assurance.

Keywords : PVA, hibiscus, extraction, encapsulation, active packaging, smart and intelligent packaging, meat spoilage
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