Development of Aloe vera-green banana Saba-curcumin composite film for colorimetric detection of Ferrum (II)

ABSTRACT

This study was performed to develop and characterize a bio-film composed of Aloe vera (Aloe barbadensis), green banana Saba (*Musa acuminata x balbisiana*), and curcumin for the detection of Fe^{2+} ions. Cross-linking interaction between banana starch-aloe vera gel and banana starch-curcumin enhanced l the sensing performance of the composite film towards divalent metal ions of Fe^{2+}. The morphological structure of the Aloe vera-banana starch-curcumin composite revealed a smooth and compact surface without cracks and some heterogeneity when observed under Scanning Electron Microscopy (SEM). The thickness, density, color property, opacity, biodegradation, moisture content, water-solubility, water absorption, swelling degree, and water vapor permeability of bio-films were measured. The incorporation of aloe vera gel and curcumin particles onto the banana starch film has successfully improved the film properties. The formation of the curcumin-ferrum (II) complex has triggered the film to transform color from yellow to greenish-brown after interaction with Fe^{2+} ions that exhibit an accuracy of 101.11% within a swift reaction time. Good linearity (R^2 = 0.9845) of response on colorimetric analysis was also obtained in Fe^{2+} ions concentration that ranges from 0 to 100 ppm, with a limit of detection and quantification found at 27.84 ppm and 92.81 ppm, respectively. In this context, the film was highly selective towards Fe^{2+} ions because no changes of color occur through naked eye observation when films interact with other metal ions, including Fe^{3+}, Pb^{2+}, Ni^{2+}, Cd^{2+}, and Cu^{2+}. Thus, these findings encourage curcumin-based starch films as sensing materials to detect Fe^{2+} ions in the field of food and agriculture.