Antioxidant and physiochemical properties of edible sodium alginate films incorporated with moringa leaves

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There is a growing interest in the development of biodegradable packaging materials from the emerging natural biopolymers such as protein and polysaccharides in the food industry due to their biodegradability and raising environmental concern related to plastic packaging (Farhan and Hani, 2017). Biodegradable packaging films with additional properties such as antioxidant and antimicrobial properties are set to replace the existing plastic packaging. Sodium alginate, a polysaccharide extracted from seaweeds, has been widely used to develop active packaging films and also as a coating material for protection of quality of food. Degradation of food are generally, triggered by the growth of aerobic microorganisms, lipid oxidation and enzymatic browning etc. Incorporation of antioxidants either directly into food matrices or into food packaging materials controls the negative oxidative effect caused by native oxygen (Bonilla et al., 2012). In this regard, natural antioxidant compounds are preferred over the deleterious chemical antioxidants. Moringa (*Moringa oleifera*; drumstick) is a tropical plant widely available in India and its antioxidant properties has been reported by several authors (Qwele et al., 2013; Vongsak et al., 2013). The Present study was conducted to evaluate the antioxidant properties of sodium alginate films incorporated with moringa leaf powder and moringa leaf extract for possible application as food grade applications.

Edible sodium alginate films incorporated with 0.25% (w/w) dried moringa leaf powder and 0.5% (v/w) moringa leaf extract (hot water extraction) were prepared according to the tray casting method (Fig. 1). Antioxidant activities, physicochemical properties such as water activity, pH, colour and heat-sealing property of the edible films were characterized. The sodium alginate films incorporated with moringa leaf powder and moringa leaf extract had pH 6.98 and 7.02 and lower aw 0.41 and 0.56, respectively. The sodium alginate films incorporated with moringa leaf extract had higher aw as compared to the film added with moringa leaf powderand were relatively sticky in nature and showed poor sealing characteristics as the films werevery thin and soft. However, sealing was possible for the moringa leaf powder incorporated sodium alginate film. Regarding the colorimetric parameters, there was significant difference ($p>0.05$) in lightness (L*) and redness (a*), between the edible films incorporated with moringa leaf powder and moringa leaf extract. Edible sodium alginate films with moringa leaf powder have lower L* (20.48) and a* (-2.51) values compared with the film incorporated with moringa leaf extract (L* 41.59 and a* -0.33). This is possibly explained by the presence of higher chlorophyll content in the moringa leaves which changed the colour of the edible sodium alginate films.

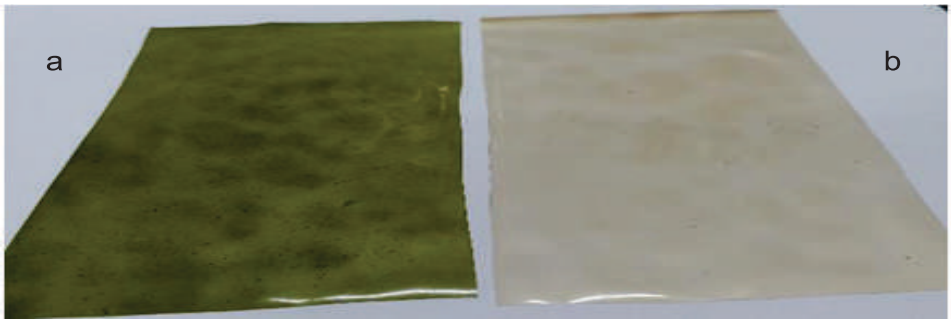

Fig. 1. *Edible sodium alginate films incorporated with a) 0.25% moringa leaves powder and b) 0.5% moringa leaves water extract*

DPPH radical scavenging activity of edible sodium alginate film incorporated with dried moringa leaf powder and moringa leafextract were 70.04±0.34% and 55.44±0.22%, respectively at 2.5% concentration. Accordingly, sodium alginate film incorporated with moringa leaf powder showed stronger ABTS scavenging activity and had significantly higher reducing power than the films incorporated with moringa leaf extract (Fig. 2). Contrary to present results, Rodríguez et al. (2020) reported lower antioxidant activity of papaya edible films incorporated with 6% moringa leaf powder. The differences in antioxidant activity of moringa leavescouldbe influenced by many factors such as location and season (Iqbal and Bhanger, 2006).

Finally, the incorporation of moringa increased the antioxidant properties of the sodium alginate films and moringa can be used as an antioxidant compound to develop active food packaging to prevent the lipid oxidation in food.

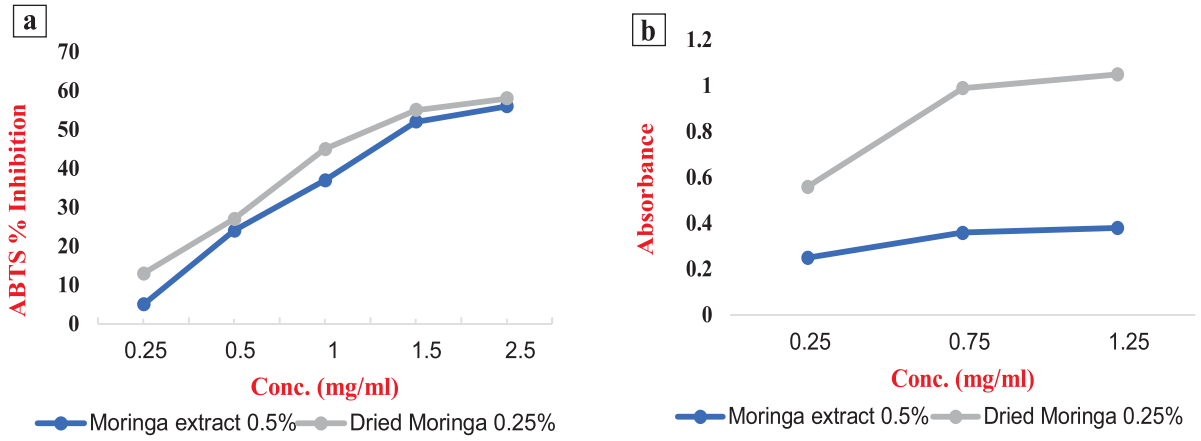

Fig. 2. *Antioxidant activity a) ABTS scavenging activity and b) reducing power of sodium alginate films incorporated with moringa leafpowder and moringa leaf extract.*

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