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Effect of Tween 20 concentrations on the properties of coriander essential oil incorporated cassava pomace-based films

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The global concern about environmental pollution caused by conventional packaging materials has driven governments to restrict certain polythene types. Interest in biodegradable packaging has arisen as a result of its potential to reduce the impacts of pollution. The present study developed packaging materials using cassava pomace, a major waste from cassava starch manufacturing. A major drawback of natural polymer-based packaging is the poor water barrier properties. Researchers incorporate oils to improve these properties, but since oil is not soluble in water-based mixtures, surfactants are needed to create stable emulsions. The objective of this study was to assess the impact of different concentrations of Tween 20 on the physical, mechanical, and microstructure properties of cassava pomace films that were incorporated with coriander essential oil. Three packaging materials were developed, with a different concentration of Tween 20 and a consistent concentration of coriander essential oil. A control film was developed, which contained the oil without Tween 20. The films were evaluated on their thickness, density, solubility, colour, opacity, moisture content, and mechanical qualities, with three replicates. The films' microstructure was assessed using a scanning electron microscope (SEM). The thickness exhibited a 24.24% increase when the concentration of Tween 20 was raised to 0.3%, compared to the control. The density correspondingly increased as the concentration of Tween 20 was increased. Surface colour was measured using L^* , a^* , and b^* parameters. As the Tween 20 concentration increased, L^* and a^* values decreased slightly. Coriander essential oil gave the packaging a yellow colour, indicating a higher b^* value as the Tween 20 concentration increased. The opacity value increased in comparison to the control film and further increased with the increment of Tween 20 concentration. The inclusion of Tween 20 at concentrations ranging from 0.1% to 0.3% resulted in an increase in the moisture content from $8.52 \pm 0.06\%$ to $9.77 \pm 0.36\%$, and an increase in solubility from 16.73 ± 0.44 to 21.99 ± 0.85 . Compared to the control, the addition of Tween 20 caused an increment in the tensile strength of all the films. Nevertheless, a noticeable decrease in the tensile strength (0.87 ± 0.21 to 0.52 ± 0.09 Mpa) was observed as the concentration of Tween 20 increased from 0.1% to 0.3%. The increment of Tween 20 in cassava pomace-based film increased elongation at break from $15.34 \pm 1.94\%$ to $20.09 \pm 1.11\%$. This may be due to the ability of surfactants to behave mechanically as plasticizers. The SEM images revealed a reduction in the size of coriander essential oil droplets detected on the surface of the images without surface defects, such as cracks or bubbles. In conclusion, higher concentrations of tween 20 surfactants negatively affect the important film properties such as tensile strength, water solubility, and moisture content of the coriander essential oil incorporated cassava pomace-based biodegradable films.

Keywords: Cassava Pomace, Tween 20, Coriander essential oil, Surfactants, Active packaging

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