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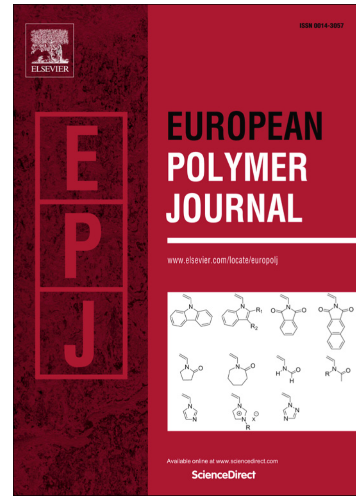

Quantitative and mechanistic analysis of impact of novel cassava-assisted improved processing on fluid transport phenomenon in humidity-temperature-stressed bio-derived films

K.S. Tumwesigye, J.C. Oliveira, M.J. Sousa-Gallagher

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Quantitative and mechanistic analysis of impact of novel cassava-assisted improved processing on fluid transport phenomenon in humidity-temperature-stressed bio-derived films

K.S. Tumwesigye[1, 2], J.C. Oliveira[1], M.J. Sousa-Gallagher[1*].
[1]Process and Chemical Engineering, School of Engineering, University College Cork, Cork, Ireland
[2]National Agricultural Research Laboratories, NARO, Kawanda, Uganda
*m.desousagallagher@ucc.ie

Abstract

Bio-derived films' realistic performance integrity is ascertained by their resilience in highly-stressful storage conditions, a function of its ability to respond timely and manages fluid barrier appropriately. Bio-derived films' moisture and temperature sensitivity often posed mass transport challenges, thus decreasing their lifespan. Quantifying bio-derived film mass transport behaviour has been limited to mass transfer representations, which can be imperfect to understand fully mass transport phenomenon. This study reported quantitative and mechanistic analysis of fluid-phase mass transport phenomenon in Simultaneous Release Recovery Cyanogenesis-produced intact bitter cassava (IBC) bio-derived films under stressful conditions. Films were tested for solvent solubility, swelling ratio, sorption and permeability to water vapour and oxygen at 10-40°C and 10-95% RH. Film's structural alterations were characterised by their thermal and chemical properties. Modified-BET, Peleg, Oswin models best described sorption data. Temperature-dependence of film water vapour permeability was simulated best by Arrhenius model, while oxygen permeability was influenced highly by crystallinity and RH. Non-organic and organic film-solvent diffusion followed case II and Fickian diffusional patterns respectively. Solvents induced structural changes in IBC films with concentration-dependent diffusion. Cassava bio-derived films' integrity will depend on the host environment, thus maximum care should be ensured to minimise environment impact during applications. Nonetheless, IBC films hold potential as biomaterials for broad range product use.

Key words: Mechanistic; Cassava film; Mass transport; Fickian diffusion; Temperature-RH-dependence