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Films based on quaternized hydroxyethylcellulose: Formation and characterization

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Despite the great availability of cellulose and its considerable characteristics and properties, its quaternized ethoxylated hydroxyethylcellulose (CELqeh) derivative has practically not been used in film production. The films in this study have been effectively produced using a significant proportion of renewable and water-soluble raw materials. Different concentrations of CELqeh were considered, as well as the use of glycerol as a plasticizer. Lignosulfonate (LS), also soluble in water, was used as an additive to evaluate the impact on the properties of the films. Zinc oxide nanoparticles with an average of 19.7±1.4 nm were synthed, and incorporated into films to confer them with antimicrobial properties. The films were characterized using various methods including dynamic mechanical analysis, thermogravimetry, tensile testing, scanning electron microscopy, contact angle measurements, electrochemical impedance spectroscopy, and water vapor barrier measurements. All films investigated exhibited hydrophilicity, transparency, and good homogeneity with the incorporation of the selected additives, besides thermal stability up to approximately 200 °C. Compared to the control (CELqeh), the electrical conductivity of the films increased with the presence of glycerol and decreased with the presence of ZnO and LS, indicating the interference of the additives in the transport of electrical charges. The CELqeh film presented tensile strength, Young's modulus, and elongation at break of approximately 13 MPa, 23 MPa, and 47%, respectively, varying to higher or lower values, depending on the additive and their concentration. Water vapor permeability was approximately 6.5 10-10gm-1s-1Pa-1 for CELqeh, and only decreased when LS, rich in hydrophobic aromatic rings, was present. The current findings are quite promising and the study is still in progress. Funding: Foundation Coordination for the Improvement of Higher Education Personnel, CAPES, Code 88887756608.