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Electrochemical Impedance Spectroscopy as a Novel Approach to Investigate the Influence of Metal Complexes on Electrical Properties of Poly(vinyl alcohol) (PVA) Composites

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Abstract

In the current study, black tea leaves extract solution (TES) as a new green technique is used to fabricate metal-polyphenols complexes (X-polyphenols complex; X= Cu+2, Ce+3, and Cd+2). The metal-complexes are integrated with poly (vinyl alcohol) (PVA) to prepare PVA composite films. The electrical properties of pure PVA and composites are characterized using the electrochemical impedance spectroscopy (EIS) method. The EIS data are fitted to the electrical equivalent circuit to evaluate the impedance parameters of pure PVA and composite films. The trend of DC conductivity is further verified by dielectric analysis. The electrical parameters are considerably improved upon incorporating with the metal-complexes. The effects of the metal-complexes on the modification of PVA are compared together. The PVA composite incorporated with the Cu+2-complex shows the highest DC conductivity and dielectric constant, which is important for application in electrochemical energy storage devices such as batteries and supercapacitors, in comparison with the Ce+3-and Cd+2-complexes. © 2021 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

Author Keywords

Cd(II)-complexes; Ce(III)-; Cu(II)-; EIS study; Extract tea solution; Polyphenols; PVA polymer

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