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Research Article

Synthesis and Characterization of Sustainable Curcumin-Based Bio-benzoxazines for Antimicrobial and Anticorrosion Applications

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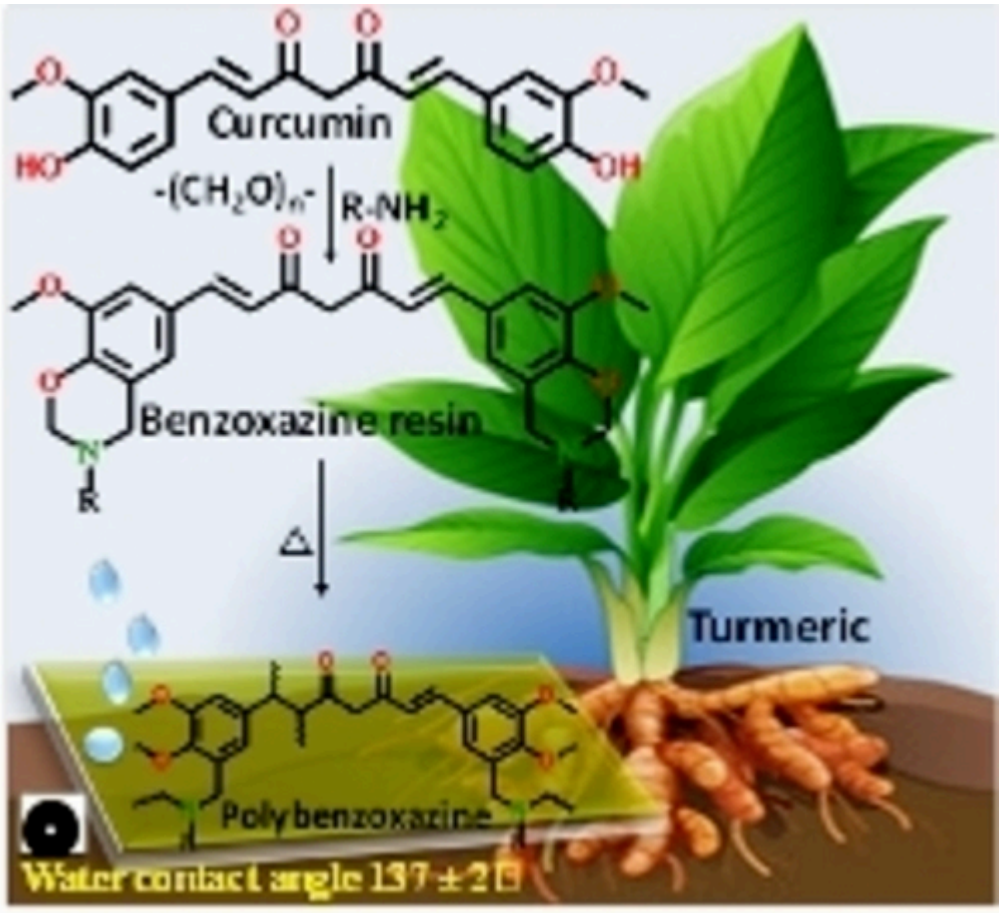
Graphical Abstract

Curcumin based bio-benzoxazines have been studies for hydrophobic, antimicrobial, anticorrosion properties.



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In the current study, three novel bio-based benzoxazines were produced from curcumin (CU), which reacts individually with three different primary amines such aniline (a), furfurylamine (ffa) and octadecylamine (oda) under suitable experimental conditions. FTIR and ^{1}H-NMR spectra were used to confirm the molecular structure of synthesized curcumin based benzoxazine monomers (CU-a, CU-ffa and CU-oda). It was found that the curing temperatures of the three benzoxazine monomers, CU-a, CU-ffa, and CU-oda are 207 °C, 193 °C, and 199 °C respectively. According to theromogravimetric analysis (TGA) analysis, cured poly(CU-a), poly(CU-ffa), and poly(CU-oda) have remaining char yields of 78, 77, and 55 %, respectively, and their corresponding limiting oxygen index (LOI) values are 49, 48, and 40, respectively, confirming that they have exceptional thermal stability and flame-retardant qualities that are ideal for applications. The value of water contact angle of poly(CU-a), poly(CU-ffa) and poly(CU-oda) are 131°, 135° and 137° respectively, which infer their excellent hydrophobicity. Results from corrosion and anti-microbial studies ascertain that these curcumin based benzoxazines can be considered as efficient coating materials to protect the surfaces of mild steel specimen under adverse environmental conditions. Using density-functional theory (DFT) band gap of the monomers has been calculated and found that CU-a possesses the lower value of band gap of 2.9212 eV than other benzoxazines.

Conflict of interest

The authors declare no conflict of interest.

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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