

ABSTRACT

Fungi are destructive organisms that can cause structural and aesthetic damage to various materials, thus requiring materials that inhibit fungal growth with high effectiveness and durability. Eugenol is known to have antifungal activity. This study aims to modify nitro-substituted eugenol-ethylene glycol dimethacrylate (PEEGDMA) copolymer to function as an antifungal agent. Eugenol was modified into a polymer through copolymerization with cross-linked ethylene glycol dimethacrylate (EGDMA) to increase structural density and thermal stability. Nitro groups were added to enhance antifungal activity. The research methodology involved the synthesis of poly-eugenol and eugenol-ethylene glycol dimethacrylate copolymer through cationic addition polymerization using $\text{BF}_3\text{O}(\text{C}_2\text{H}_5)_2$ as a catalyst, the synthesis of a nitro EEGDMA copolymer, and testing of antifungal activity against *Aspergillus niger* fungus. The result of polyeugenol synthesis was a brownish-orange powder with a yield of 71.62%, a melting point of 80-84 °C, and a molecular weight of 9432.44 Daltons. The EEGDMA copolymer yielded a light orange powder with a yield of 92.12%, a melting point of 90-95 °C, and a molecular weight of 40396.0843 daltons. Polieugenol and EEGDMA are soluble in chloroform, diethyl ether, ethyl acetate, methanol, ethanol, and DMSO, but are insoluble in distilled water. FTIR analysis showed the loss of the C=C alkene group and the presence of O-H and C=O ester groups in the polymer. The synthesis of nitro copolymer eugenol-ethylene glycol dimethacrylate resulted in a dark brown powder with a yield of 89%, a melting point of 202-206 °C, and a molecular weight of 86357.1496 daltons. NPEEGDMA is soluble in methanol, ethanol, diethyl ether, ethyl acetate, and DMSO. FTIR of NPEEGDMA successfully showed absorption in the 1326 and 1558 cm^{-1} regions, indicating the presence of N=O groups, and absorption at 1275 cm^{-1} , indicating the presence of C-N groups. TGA analysis results showed that NPEEGDMA degraded by 10% at a temperature of 160 °C. The antifungal activity of NPEEGDMA showed effective results in resistance and inhibiting the growth of *Aspergillus niger* fungus, and was better than eugenol, polyeugenol, and PEEGDMA.

Keywords: antifungal, eugenol, ethylene glycol dimethacrylate, nitration, copolymer