PREFACE

The development of high performing waterborne hyperbranched polyester (WHPE) under facile and eco-friendly condition leads to more attention to the materials scientist over solvent borne one owing to its low or zero volatile organic compounds (VOC), no ordor, non-toxic and non-flammability nature. However, such polymers are unable to address some modern applications due to their poor mechanical properties. In this milieu, the fabrication of polyester nanocomposites by incorporation of suitable nanomaterials may address the above drawbacks. The development of polyester nanocomposites with carbon-based nanomaterials especially graphene oxide (GO) and carbon dot (CD) is a promising area as they are fantastic materials with various unique and outstanding properties. Further, they not only improve the properties of pristine polyester but also offer some extraordinary properties in the resultant nanocomposites. However, literature remains silent on fabrication of CD and GO-based WHPE nanocomposites. Thus, it unlocks a new direction of research to develop WHPE nanocomposites with multi-functional attributes using GO, CD and CD-based nanohybrids.

Thus, the main objective of this thesis is to develop WHPE in absence of solvent, catalyst and neutralizing agent to address the drawbacks of solvent borne polyesters. Further, to improve the properties of this polyester and in order to introduce some exceptional properties; GO, CD and CD-based nanohybrids are incorporated into the polyester matrix. The nanocomposite based on functionalized GO showed good catalytic activity for Aza Michael addition reaction along with significant improvement in mechanical and thermal properties of the matrix. Incorporation of CD into WHPE matrix showed excellent transparency, photoluminescent properties and self-cleaning activity. The development of WHPE nanocomposite with clay@CD nanohybrid exhibited good adsorption capacity for Pb(II) ion along with good transparency and photoluminescence properties. Further, some special properties like anti-reflecting, anti-icing, anti-fogging, self-cleaning, antibacterial, anti-counterfeiting, etc. are introduced into WHPE nanocomposite by incorporating CD@TiO_2 nanohybrid. Thus, the studied WHPE nanocomposites have the potential to be used as high performing materials for multifaceted applications.

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