Dinoop Lal S. “Photodegradation of polystyrene by nano titanium dioxide and photosensitizers.” Thesis. Research & Postgraduate Department of Chemistry, St. Thomas’ College (Autonomous), Thrissur, University of Calicut, 2020.

of this composite undergo better degradation when thrown into the environment after their usage. TiO_2-GO, even though a better photocatalyst, cannot be considered as suitable filler for every application replacing other photocatalysts. The BDV values of PS-TiO_2-GO composites were lower compared to PS-TiO_2. This implies that the composite cannot be used for high voltage insulation applications. PS-TiO_2-PANI as well as PS-TiO_2-metal composites also showed lower BDV values even though they underwent appreciable extent of photodegradation. These composites also cannot withstand higher voltage similar to GO. Even though PS-TiO_2-metal can be used for food packing, PS-TiO_2-PANI and PS-ZnO-PANI are not suitable since the contact of PANI with edible materials is unhealthy. The PS-benzophenone derivative composites are transparent and mechanically stronger than pristine PS. The composites can substitute PS in applications where transparency is in demand. It should also be however noted that the compound 2-hydroxy-4-methoxybenzophenone does not sensitize PS for photodegradation as evident from the results obtained.

Practical significance of this work

- Photodegradation studies using an artificial UV lamp which has the power 30W and wavelength 253 nm have been conducted in this study. The photodegradation of PS was effective under this condition. It is estimated that UV radiation from sun striking the earth is around 32 W. This signifies that the efficiency of PS photodegradation, inside UV chamber, is certainly possible under natural sunlight too. Some of the composites of TiO_2 or ZnO with PANI or metals have the ability to be photocatalytically active even under visible light, as discussed in chapter 1. Exposure of PS under sunlight may increase the extent of photodegradation for such composites.
- Photodegradation might occur much easier and faster in our environment where the conditions are much harsher. Environmental weathering of the polymer may further assist its degradation process.
- Incorporation of optimum amount of photocatalysts also makes PS mechanically stronger and thermally more stable promising a wide range of applications.
- Photocatalysts can be loaded into PS during the moulding process and can be brought into commercial applications without much time consuming and complicated processes.

Eco friendliness in the photocatalysed degradation of PS and the relevance of this work

- Photodegradation occurs naturally under direct sunlight without any further requirements, making the process costless.
- No toxic gases are liberated during the process.
- The photocatalysts and sensitizers employed in this work, such as TiO_2, ZnO, GO, Fe, Cu and Ag are non-hazardous materials.
- Even though the photosensitizers like PANI, benzophenone derivatives and triphenylmethane dyes may be hazardous, their presence in PS doesn't matter much as they are loaded in very minute quantities.
- Photodegradation of PS composites would be effective in water bodies too. Interaction of water molecules with the catalysts or PS furnishes more OH• under sunlight that enhances photodegradation.

Way forward

UV-visible spectra of some of the PS composites especially composites consisting of PANI, GO, metals and dyes showed absorption in the UV as well as in the visible region. A thorough literature survey also supports the fact that these photosensitizers have the ability to extend the photocatalytic activity of TiO_2 and ZnO into the visible region. Replacing the UV light source with the visible light of sun can further extend the scope of PS photodegradation studies.

The electrical, mechanical and thermal properties of the PS-composites showed variations according to the type of photocatalysts used. A detailed study of various properties of these PS composites may explore the possible usages of these composites in several applications.