EXPLORING THE PHOTOCATALYTIC ACTIVITY OF DIAMINOMALEONITRILE-DERIVED C=N EXTENDED SYSTEMS: PHOTODEGRADATION OF LINDANE AS PROOF OF CONCEPT

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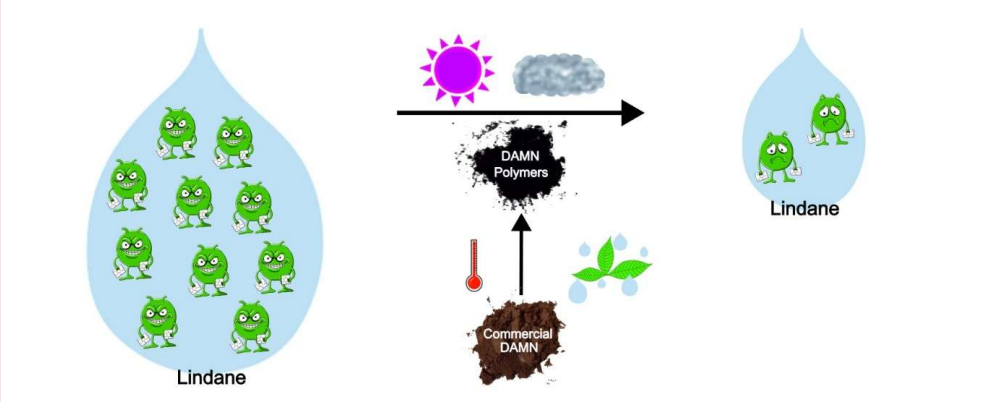

Semiconductive C=N materials derived from diaminomaleonitrile (DAMN) polymerisation were investigated as potential photocatalysts. DAMN-based polymers were synthesised using bulk thermal polymerisation or under wet conditions, via a hydrothermal process as well as using n-alcohols. Pentanol and hexanol proved to be excellent solvents for DAMN polymerisation, leading to extended macrostructures composed of N-heterocyclic moieties with nearly quantitative yields. A comparative study was conducted using FTIR and solid-state NMR spectroscopies, along with thermal analysis, to elucidate the structural changes occurring when transitioning from bulk polymerisation to solvothermal synthesis. Complementary characterisation techniques, such as EPR, XRD, and SEM, provided deeper insights into the solvent effects on the DAMN polymers under investigation. Their morphological and textural properties were also examined, revealing that the BET surface areas were considerably higher and particle sizes significantly smaller for samples polymerised in solution compared to those synthesised in bulk. Furthermore, the optoelectronic properties of these macromolecular systems were analysed through UV-vis spectroscopy and cyclic voltammetry, confirming their semiconductive nature. Finally, the photodegradation of lindane using these DAMN polymers indicated promising potential for the development of photocatalysts based on these polyheterocyclic systems as alternative materials to the well-known carbon nitrides.

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