Synthesis, characterization and investigation of photocatalytic activity of nano-titania from natural ilmenite with graphite for cigarette smoke degradation

ABSTRACT

Titanium dioxide (TiO2) nanoparticles and TiO2 with recycled graphite (TiO2/G) nanocomposite have been successfully synthesized by alkaline fusion method using synthetic rutile for measuring the degradation time of the cigarette smoke under the visible light irradiation. In this work, the synthetic rutile was derived from natural Malaysian Ilmenite's waste to produce a low cost of TiO2 nanoparticles via environmental friendly process. The prepared samples were then analyzed using X-ray diffraction (XRD), Fourier transform infrared (FTIR) spectroscopy and Energy Dispersive X-Ray Fluorescence (EDXRF) to study their structural phase composition, functional group, and elemental composition respectively. The surface morphology and the size of the particles were studied using Field Emission Scanning Electron Microscopy (FESEM) and Particle Size Analyzer (PSA), respectively. The functionality of the prepared nanoparticles in terms of photocatalyst activity was analyzed by degradation of cigarette smoke under the exposure to the visible light. The UV–Vis Spectroscopy (UV–VIS) results revealed that the energy band gap of modified TiO2/G nanocomposite decreases to 2.90 eV compared with the commercial TiO2, 3.06 eV. This is capable enough to TiO2/G nanocomposite degrade the smoke under the visible light irradiation for 2 min faster compared to others types of TiO2 nanoparticles. This indicated the material has the ability to purify the toxins in the air.

Keyword: Titanium dioxide; Photocatalytic activity; Graphite; Nanocomposite; Smoke