

Environmental Cleanup using TiO₂-assisted Photocatalysis

Research focusing on the use of titanium dioxide (TiO₂) assisted photocatalytic oxidation/reduction process for the treatment of industrial wastewaters is currently underway at the department of Civil Engineering, KFUPM. TiO₂ assisted photocatalytic oxidation/reduction process has been intensively studied and used for the decontamination of air and water streams containing dilute concentrations of toxic organic and inorganic pollutants. The process is based upon photo-induced interfacial charge transfer processes as illustrated in diagram below. When exposed to a UV light source with wave length <380 nm, an electron/hole pair (e⁻/h⁺) is produced within a TiO₂ particle. The hole scavenges an electron from the OH⁻ ions adsorbed onto the TiO₂ surface, producing ·OH radicals, which are powerful nonselective oxidants and mineralize the organic contaminants to end products such as CO₂, NO₃⁻, and NH₄⁺. Water streams contaminated with heavy metals can also be purified by accumulating the metal species onto the TiO₂ surface. Other advantages of this technology include 1) short reaction time, 2) catalyst being non-toxic, cheap, & reusable, 3) possible use of sunlight instead of lamps as a UV source because of its abundance in the Kingdom, 4) complete destruction of recalcitrant organic contaminants, and 5) harmless reaction end products like CO₂.

