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PHOTOACTIVE POLYMER-CEMENT COMPOSITES FOR TANNINS REMOVAL FROM WASTEWATERS

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HIGHLIGHTS

- Photoactive, MDF polymer-cement composites were produced by using three technologies
- TiO_2 nano powder embedding or MDF coating with TiO_2 by dip coating +/- chelating agent
- MDF water resistance increase: $TiO_{2\ embeded} \approx TiO_{2\ dip\text{-}chelator} > TiO_{2\ dip+chelator} > MDF$
- Photodegradation efficiency against tannins was 98% at irradiation with 254 nm for 6h
- Kinetic of tannins depletion is complex, only partially fitting on the pseudo-first kinetic model.

Abstract: The TiO_2 nanoparticles exhibit a remarkable photocatalytic activity against wastewater organic pollutants but their separation from the liquid media after the photocatalytic process is a very difficult task. The immobilization of TiO_2 on different supports could be a good solution to simplify the cleaning stage after photocatalysis. In this study, two types of photoactive polymer-cement composites named macro-defect free cements (MDF) were obtained both by embedding TiO_2 nanoparticles (Degussa P25) in the composite matrix and by photocatalyst deposition on the composites surface through the dip-coating method (in two types of recipe). The composites surface was characterized by SEM and XRD and photocatalytic efficiency was determined against wastewater tannins from woodworking industry. The tannin concentration was monitored by VIS-spectrophotometry, using the Folin-Ciocalteu method. All specimens evidenced photocatalytic activity. The process efficiency is dependent on the light wavelength and on the irradiation duration. The best results were obtained when the MDF containing embedded TiO_2 nanoparticles were exposed to 254 nm light (92% after 6 h). Under higher wavelength light irradiation (365 nm), the photocatalytic efficiency decreased to 48.2% for the MDF containing embedded TiO_2 and to 39.85% for the MDF coated with a TiO_2 film. The obtained results are promising both in terms of