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Synthesis of nanostructured titania/zirconia membrane for treatment of textile industries wastewater

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Abstract
Nanostructured TiO_2/ZrO_2 composite membranes with varying compositions were obtained by sol–gel technique. The influence of 0-30 mol% zirconia doping on microstructure, water permeability, photocatalytic and physical separation properties, removal of methyl violet of textile industries wastewater and thermal and mechanical stability of titania/zirconia composite membranes was described. Firstly, alumina supports were coated with TiO_2 intermediate layers using the colloidal sol–gel route. The TiO_2/ZrO_2 composite sols were prepared via a polymeric sol–gel method and dip-coated on TiO2 intermediate layer. The samples were characterized by DLS, TG-DTA, XRD, FTIR, BET-BJH, UV-visible, SEM, TEM and AFM. It was shown that zirconia retards the phase transformation of anatase to rutile until at least 700 oC. The minimum pore size and maximum surface area have been obtained 1.2 nm and 153 m2/g, respectively that attributed to the sample with 20 mol% zirconia. The mechanical strength of titania membranes was significantly improved by addition of zirconia. The most methyl violet removal efficiency, with and without UV-irradiation, has been obtained 80.8% and 72.6%, respectively that attributed to the sample with 20 mol% zirconia.

Keywords*:* Titania/zirconia membrane; Sol-gel method; Photocatalytic; Physical separation

1. Introduction
Recently the development of efficient and enviromentalist routs to removal contaminants from water has become of fundamental importance, since pollution is increasing drastically. Recent advances in nanotechnology suggest that many of the issues involving water quality could be resolved or mostly improved using nanoparticles, nanofiltration or other products resulting from the development of nanotechnology[1, 2]. Ceramic membranes are currently being considered due to their potential applications in chemical, petrochemical, pharmaceutical and food industries, where high pressure, high temperature and chemically harsh operation conditions are often faced. Recently, nanostructure titania membranes have received considerable attention because of their unique characteristics including semiconductance, high water flux, photocatalysis and chemical

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