

Cerium Oxide Nanoparticles Coated Ceramic Membranes

Evrin Celik Madenli^{a*}, Dilara Kesiktas^a, Halil Kandemir^b, Esra Sen^c, Havva Elif Lapa^c,
Murat Kaleli^c

^a Suleyman Demirel University, Department of Environmental Engineering, Isparta, Turkey

^b Suleyman Demirel University, Department of Chemical Engineering, Isparta, Turkey

^c Suleyman Demirel University, Innovative Technologies Application and Research Center, Isparta, Turkey

*Corresponding author: evrimcelik@sdu.edu.tr, +90 246 211 16 91

Abstract:

Membrane materials are divided into two main groups, i.e., inorganic and organic. The thermal and chemical stability of organic membranes is limited. Today, inorganic membranes with exceptional chemical and physical properties are gaining increasing interest due to their applicability to different processes and reusability. In recent years, promising studies in nanotechnology and materials development methods have featured the use of materials that improve membrane performance and increase membrane life. Cerium oxide nanoparticles, an effective biocide against many bacterial strains, have been used in many applications, such as catalysis, sensors, water treatment, and various industrial applications. Recent studies have shown that cerium oxide nanoparticles are used in membrane production due to their low cost, high surface area, and antioxidant properties. They have advantages in removing the hydrophobic contaminants increasing the fouling and biofouling resistance of the membranes. Cerium oxide nanoparticles were synthesized by hydrolysis of cerium nitrate in a basic medium. Then spray coating method was used for coating membranes with cerium oxide nanoparticles in this study. Several analytical methods were used to characterize membranes, such as scanning electron microscopy, a contact angle goniometer, a Fourier transform infrared spectroscopy, X-ray powder diffraction, and permeation tests. It was found that the nanoparticle amount is an important factor affecting the permeation properties of the membranes.

Keywords: ceramic membrane, cerium oxide nanoparticles, coating, spray coating

This research was supported by a grant (120Y135) from the Scientific and Technological Research Council of Turkey, through the Support Program for Scientific and Technological Research Projects.