

Effects of silver and zinc-oxide nanoparticles on gas and liquid permeability of heat-treated Paulownia wood

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Keywords: Gas and Liquid Permeability; Nanoparticle; Nano-Fluids; Porous Materials; Vacuum Pressure.

Abstract

Effects of aqueous dispersion of silver and zinc-oxide nano-particles on gas and liquid permeability of Paulownia wood is studied here. Longitudinal cylinder specimens of 17.5 mm in diameter and 30 mm in length were impregnated with a 400 ppm nano-silver (NS) and a 5000 ppm nano-zinc oxide (NZ) suspension, with size range of 10 to 80 nm, under 2.5 bars of pressure using empty-cell method (Rueping process) for 20 minutes. Control, NS, and NZ-impregnated specimens were divided into 3 groups of unheated, heat-treated at 100°C, and heat-treated at 150°C; totally, nine treatments. Gas permeability values were measured under 7 different vacuum pressures in a single run and correlation of each was analyzed with two liquid permeabilities as 1st drop time and 50-mm-lowering time; both liquid permeabilities were measured using Rilem test tube. Results showed that gas permeability was increased by 8.5 and 33% in nanosilver and nanozinc-oxide-impregnated specimens, respectively. Heat treatment had also an overall increasing effect on the specimens. Nanozinc-impregnated unheated specimens had the highest, and control heat-treated at 100°C specimens showed the lowest liquid permeability, respectively. Regression analysis showed high correlation between longitudinal gas and liquid permeability.

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