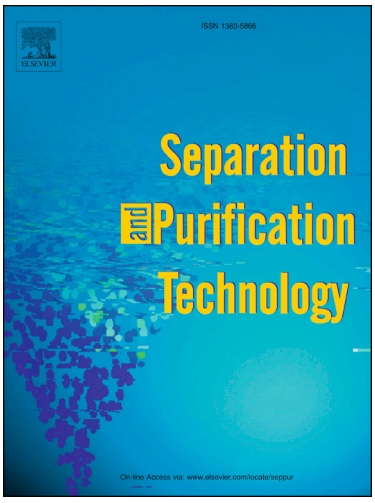


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# $CO_2$ absorption enhancement by water-based nanofluids of CNT and $SiO_2$ using hollow-fiber membrane contactor

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**Abstract**

In this study, $CO_2$ absorption enhancement using nanofluid in a gas-liquid hollow fiber membrane contactor (HFMC) was conducted through a 2D mathematical model. The model was developed by considering molecular diffusion in radial and axial directions as well as non-wetting condition. $CO_2$ absorption was conducted from a gas mixture, containing $CO_2$ and air, which flows in the shell. Also, absorbents which are containing CNT and $SiO_2$ nanoparticles flow in tube side counter-currently. The effect of nanoparticles was considered by taking two prominent mechanisms for mass transfer enhancement in nanofluids; i.e., Brownian motion and Grazing effect. Model predictions compared with experimental results and excellent agreement was found. The simulation results indicated that introducing 0.05 wt.% $SiO_2$ nanoparticles enhanced absorption rate up to 16%. CNT because of high adsorption capacity and hydrophobicity showed much better performance than the $SiO_2$ nanoparticles, so that introducing 0.05 wt.% CNT enhanced the absorption rate up to 34%. For better performance of nanoparticle in the absorbent, there is an optimal loading which is 0.03 and 0.04 wt.% for $SiO_2$ and CNT, respectively.

**Keywords**: CFD; Nanofluid; $CO_2$ absorption enhancement; Hollow fiber; Membrane contactor; Mass transfer