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Residence Time Distribution Study of Geothermal Vapor Flow in Pipe Using Axial Dispersion Modeling

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In the present study, the residence time distribution of geothermal vapor phase flow is studied using axial dispersion model. The experimen is carried out by injection of Krypton-85 (85Kr) gas isotope into 10 inch pipe diameter containing dry geothermal vapor. The pressure and the temperature of the vapor are 8 kg.cm-2 and 170oC respectively. Three collimated radiation detectors positioned respectively at 127, 177 and 277 m from the injection point are employed to capture gamma radiation from the injected 85Kr isotope. The data represents residence time distribution (RTD) of isotopes in the selected experimental section. During the experiment, the flow properties is assumed time invariant, therefore the flow properties is also assumed linear in character. Flow parameter calculated using first moment method shows that the flow rate of the vapor is 11 m.s-1. Model parameter, represented by the Peclet number (P_e), predicted from best fitting of the axial dispersion model to the experimental data is 223, whereas the coefficient of molecular diffusion (μ) calcualted from the Peclet number is 0.5 m2.s-1. The experiment concludes that the vapor flow is dominated by convection transport and the flow pattern tends to follow plug flow due to big value of the Peclet number.

Keywords: vapor phase, geothermal, residence time distribution (RTD), axial dispersion model, 85Kr, Peclet number.

Country/Organization invited to participate

Indonesia

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