Flow Characterization of Vapor Phase of Geothermal Fluid in Pipe Using Isotope 85Kr and Residence Time Distribution Modeling

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Abstrak

Measurement of vapor flow in geothermal pipe faces great challenges due to fast fluids flow in high-temperature and high-pressure environment. In present study the flow rate measurement has been performed to characterization the geothermal vapor flow in a pipe. The experiment was carried out in a pipe which is connected to a geothermal production well, KMJ-14. The pipe has a 10” outside diameter and contains dry vapor at a pressure of 8 kg/cm2 and a temperature of 170 oC. Krypton-85 gas isotope (85Kr) has been injected into the pipe. Three collimated radiation detectors positioned respectively at 127, 177 and 227m from injection point were used to obtain experimental data which represent radiotracer residence time distribution (RTD) in the pipe. The last detector at the position of 227 m did not respond, which might be due to problems in cable connections. Flow properties calculated using mean residence time (MRT) shows that the flow rate of the vapor in pipe is 10.98 m/s, much faster than fluid flow commonly found in various industrial process plants. Best fitting evaluated using dedicated software developed by IAEA expert obtained the Péclet number Pe as 223. This means that the flow of vapor of geothermal fluids in pipe is plug flow in character. The molecular diffusion coefficient is 0.45 m2/s, calculated from the axial dispersion model