

INTISARI

Energi *geothermal* merupakan salah satu bentuk energi alternatif yang dapat menghasilkan listrik dalam jumlah besar, ramah lingkungan, dapat diperbaharui, dan dapat menggantikan penggunaan bahan bakar fosil dalam pembangkit listrik. Namun dalam proses produksinya, terjadi permasalahan dalam pengoperasiannya. Permasalahan yang muncul disebabkan oleh tingginya kadar silika dalam perut bumi, yang terangkat bersama *brine* dan menyebabkan pengendapan. Pengendapan umumnya dapat dijumpai pada pipa antara daerah *wellhead* dengan separator, *flasher*, pipa *liquid* setelah separator dan sumur reinjeksi. Pengendapan tersebut terjadi akibat proses pendinginan *brine* di sepanjang pipa, sehingga silika yang terlarut berada dalam kondisi jenuhnya, dan mulai mengalami pengendapan.

Penelitian ini bertujuan untuk menghitung dan menganalisis perpindahan panas sistem pendinginan pada unit alat eksperimen *silica scaling* dengan alat penukar panas *shell and tube*, alat penukar panas *fin and tube*, radiator dan air bak pendinginan beserta es balok. Perhitungan menggunakan metode LMTD dan NTU.

Perhitungan unit instalasi eksperimen *silica scaling* dihasilkan temperatur air bak yang harus dijaga sebesar $30,41^{\circ}\text{C}$ dan massa es balok yang dibutuhkan $86,71\text{ kg}$ (ΔT air bak 5°C) dan $867,17\text{ kg}$ (ΔT air bak 50°C). Suhu akhir sampel produk overflow dan underflow berkisar $35,65^{\circ}\text{C} - 86,26^{\circ}\text{C}$ dan $43,35^{\circ}\text{C} - 90,03^{\circ}\text{C}$. LMTD *Circular finned tube* $27,51^{\circ}\text{C}$ (underflow) dan $82,53^{\circ}\text{C}$ (overflow), penurunan tekanan pada tube $0,00256\text{ kPa}$ (underflow) dan $0,0234\text{ kPa}$ (overflow) dan penurunan tekanan pada fin $25,13\text{ kPa}$, *number transfer unit* (NTU) sebesar $0,46$, efektivitas (ϵ) sebesar $0,36$. LMTD *Shell and tube* $16,55^{\circ}\text{C}$ (*shell and tube-1*) dan $10,51^{\circ}\text{C}$ (*shell and tube-2*), penurunan tekanan pada tube sebesar $0,52\text{ kPa}$ (*shell and tube-1*) dan $0,63\text{ kPa}$ (*shell and tube-2*) dan penurunan tekanan pada shell $0,36\text{ kPa}$ (*shell and tube-1*) dan $0,38\text{ kPa}$ (*shell and tube-2*), *number transfer unit* (NTU) sebesar $0,994$, efektivitas (ϵ) sebesar $0,60$.

Kata kunci : *PLTP, Pengendapan Silika, Alat Penukar Panas, LMTD, Penurunan Tekanan, Number Transfer Unit (NTU), Efektivitas (ϵ)*

ABSTRACT

Geothermal energy is a form of alternative energy that can generate large amounts of electricity, is environmentally friendly, can be renewed, and can replace the use of fossil fuels in power generation. However, in the production process, there were problems in its operation. The problems that arise are caused by high levels of silica in the bowels of the earth, which are lifted with the brine and cause precipitation. Deposition can generally be found in the pipe between the wellhead area with the separator, flasher, liquid pipe after the separator and reinjection well. This precipitation occurs as a result of the brine cooling process along the pipe, so that the dissolved silica is in a saturated state, and begins to experience deposition.

This study aims to calculate and analyze the heat transfer of the cooling system in the experimental unit of silica scaling with a shell and tube heat exchanger, a fin and tube heat exchanger, a radiator and salting bath water along with block ice. The calculation uses the LMTD and NTU methods.

The calculation of the experimental installation unit for silica scaling resulted in a tank water temperature that had to be maintained at 30.41°C and the mass of ice blocks required was 86.71 kg (ΔT pool water 5°C) and 867.17 kg (ΔT tank water 50°C). The final temperature of the overflow and underflow product samples ranged from 35.65°C - 86.26°C and 43.35°C - 90.03°C. LMTD Circular finned tube 27.51°C (underflow) and 82.53°C (overflow), the pressure drop in the tube is 0.00256 kPa (underflow) and 0.0234 kPa (overflow) and the pressure drop at the fin is 25.13 kPa, the number transfer unit (NTU) is 0.46, the effectiveness (ϵ) is 0.36. LMTD Shell and tube 16.55°C (shell and tube-1) and 10.51°C (shell and tube-2), the pressure drop in the tube is 0.52 kPa (shell and tube-1) and 0.63 kPa (shell and tube-2) and the pressure drop on the shell is 0.36 kPa (shell and tube-1) and 0.38 kPa (shell and tube-2), the number transfer unit (NTU) is 0.994, effectiveness (ϵ) by 0.60.

Keywords: PLTP, Silica Deposition, Heat Exchanger, LMTD, Pressure Drop, Number Transfer Unit (NTU), Effectiveness (ϵ)