

## **ABSTRACT**

*Final cooler heat exchanger is a device used to cool gas fluids with seawater in process industries. Ensuring the reliable performance of a heat exchanger involves reviewing the reliability of the tube material, as it can impact the heat transfer mechanism and other performance aspects such as stress resistance and corrosion. This study aims to analyze the use of CuNi 70/30 material under the operating conditions of a final cooler heat exchanger in a petrochemical company. The operating conditions include heat transfer performance based on heat exchanger effectiveness, minimum tube thickness based on pressure, service life based on corrosion rate, maximum outlet tube temperature according to PERMEN LHK No.8 of 2009 regulations, and a cost-effective analysis of the currently used material, Duplex 2507. The research method involves numerical analysis encompassing performance calculations of effectiveness, lifespan, and minimum thickness, reviewing outlet temperature through tube reduction variations of 5%, 10%, and 15%, and cost-effective material analysis. Based on the numerical analysis of CuNi 70/30 as a heat exchanger tube material, several results were obtained. The effectiveness performance of CuNi 70/30 was 0.913, the minimum tube thickness based on operating pressure was 0.008 mm, and the lifespan based on corrosion rate was 57 years. The optimal tube reduction variation for CuNi 70/30 was a 10% reduction, with an effectiveness value of 0.904 and an outlet temperature of 40.02 °C. CuNi 70/30 reduced the cost from Duplex 2507 under the same operating conditions, with a cost reduction of 65.04%.*

**Keywords:** CuNi 70/30, tube heat exchanger, cost-effective

## INTISARI

*Heat exchanger final cooler* merupakan alat penukar kalor yang berfungsi mendinginkan fluida gas dengan *seawater* dalam industri proses. Salah satu cara untuk memastikan performa *heat exchanger* dengan baik yaitu dengan meninjau keandalan material *tube*, pasalnya hal itu bisa berdampak pada mekanisme transfer panas maupun aspek performa lain seperti ketahanan terhadap *stress* maupun korosi. Penelitian ini bertujuan sebagai riset analisis penggunaan material CuNi 70/30 terhadap kondisi kerja *heat exchanger final cooler* milik perusahaan industri petrokimia. Kondisi kerja mencakup performa transfer panas berdasar efektivitas *heat exchanger*, ketebalan minimum *tube* berdasar tekanan, masa pakai berdasar laju korosi, temperatur maksimum *outlet tube* berdasarkan regulasi PERMEN LHK no.8 tahun 2009, serta analisis *cost-effective* terhadap material yang dipakai sekarang yaitu Duplex 2507. Metode penelitian berupa analisis numerik berupa perhitungan performa yang melingkupi efektivitas, *lifespan* dan ketebalan minimum, peninjauan temperatur *outlet* melalui variasi pengurangan jumlah *tube* sebesar 5%, 10%, dan 15%, serta perhitungan aspek *cost-effective* material. Berdasarkan analisis numerik CuNi 70/30 sebagai material *tube heat exchanger*, didapatkan beberapa hasil. Performa efektivitas CuNi 70/30 sebesar 0,913, ketebalan minimum *tube* berdasar *operating pressure* sebesar 0,008 mm dan *lifespan* berdasar laju korosi selama 57 tahun. Variasi pengurangan jumlah *tube* paling optimal pada CuNi 70/30 yaitu pengurangan 10% dengan nilai efektivitas 0,904 dan temperatur *outlet* 40,02 °C. CuNi 70/30 menurunkan biaya dari material Duplex 2507 pada kondisi operasi yang sama, dengan penurunan *cost* sebesar 65,04%.

Kata kunci: CuNi 70/30, *tube heat exchanger*, *cost-effective*