

ABSTRAK

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Analisa Pemilihan Material Pipa Pengendalian Debu Batubara dari *Carbon* menjadi SUS 304 PLTU Tanjung Jati B Unit 3-4
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Sistem pengendalian debu batubara pada area penanganan batubara di PLTU Tanjung Jati B Unit 3–4 berfungsi untuk mengendalikan penyebaran debu melalui penyemprotan air bertekanan. Dalam operasionalnya, pipa pengendalian debu batubara *eksisting* berbahan baja karbon ASTM A135 Grade A mengalami kebocoran akibat degradasi material yang dipicu oleh korosi pada lingkungan lembap dan area pesisir. Kondisi ini menurunkan keandalan sistem serta meningkatkan frekuensi perawatan. Penelitian ini bertujuan untuk menganalisis kelayakan penggantian material pipa dari baja karbon menjadi stainless steel ASTM A312 Grade 304 melalui pendekatan teknis dan kuantitatif. Metode penelitian yang digunakan adalah penelitian terapan dengan pendekatan deskriptif-analitis. Data diperoleh melalui observasi lapangan, dokumentasi teknis, pengujian komposisi kimia menggunakan spektrometer, serta studi literatur berdasarkan standar ASTM. Analisis dilakukan dengan membandingkan chemical composition dan mechanical properties material ASTM A135 Grade A, ASTM A312 Grade 304, dan ASTM A312 Grade 316. Selain itu, dilakukan simulasi pembobotan berdasarkan kondisi operasi aktual sistem, meliputi tekanan kerja ± 9 bar, paparan kelembapan tinggi, serta potensi beban mekanis di area *coal yard*. Hasil analisis menunjukkan bahwa baja karbon ASTM A135 Grade A tidak memiliki unsur kromium dan nikel sehingga rentan terhadap korosi. Sementara itu, ASTM A312 Grade 304 dan Grade 316 memiliki kandungan kromium dan nikel yang meningkatkan ketahanan korosi serta memiliki kekuatan tarik yang lebih tinggi dibandingkan baja karbon. Berdasarkan simulasi pembobotan teknis, ASTM A312 Grade 316 memperoleh nilai tertinggi, namun peningkatan performanya tidak signifikan dibandingkan Grade 304 untuk kondisi operasi sistem pengendalian debu batubara. Oleh karena itu, ASTM A312 Grade 304 dinilai sebagai material yang paling optimal dan rasional karena mampu meningkatkan ketahanan korosi, mempertahankan kekuatan mekanik, serta meningkatkan keandalan sistem secara keseluruhan.

Kata kunci: baja karbon, pengendalian debu batubara, korosi, pemilihan material, PLTU, stainless steel 304.

ABSTRACT

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Analisa Pemilihan Material Pipa Dust Suppression dari Carbon menjadi SUS 304

PLTU Tanjung Jati B Unit 3-4

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The dust suppression system in the coal handling area of PLTU Tanjung Jati B Units 3–4 functions to control coal dust dispersion through pressurized water spraying. In its operation, the existing dust suppression pipelines made of ASTM A135 Grade A carbon steel have experienced leakage due to material degradation caused primarily by corrosion in a humid and coastal environment. This condition reduces system reliability and increases maintenance frequency. This study aims to analyze the feasibility of replacing carbon steel pipelines with ASTM A312 Grade 304 stainless steel through a technical and quantitative approach. The research method employed is applied research with a descriptive-analytical approach. Data were obtained through field observations, technical documentation, chemical composition testing using a spectrometer, and literature studies based on ASTM standards. The analysis was conducted by comparing the chemical composition and mechanical properties of ASTM A135 Grade A, ASTM A312 Grade 304, and ASTM A312 Grade 316 materials. In addition, a weighted scoring simulation was performed based on the actual operating conditions of the system, including a working pressure of approximately ± 9 bar, high humidity exposure, and potential mechanical loads in the coal yard area. The results indicate that ASTM A135 Grade A carbon steel does not contain chromium and nickel elements, making it more susceptible to corrosion. In contrast, ASTM A312 Grade 304 and Grade 316 contain chromium and nickel, which significantly improve corrosion resistance while providing higher tensile strength compared to carbon steel. Based on the technical weighted scoring simulation, ASTM A312 Grade 316 achieved the highest score; however, its performance improvement was not significantly superior to Grade 304 under the operating conditions of the dust suppression system. Therefore, ASTM A312 Grade 304 is considered the most optimal and rational material, as it enhances corrosion resistance, maintains mechanical strength, and improves overall system reliability.

Key words: dust suppression, carbon steel, corrosion, material selection, stainless steel 304, steam power plant.