

Korosi atmosferik merupakan salah satu penyebab utama degradasi baja struktural pada lingkungan industri pesisir. Perbedaan karakteristik lingkungan menyebabkan perkembangan korosi berlangsung dengan laju yang berbeda. Penelitian terdahulu umumnya berfokus pada evaluasi eksperimental perilaku korosi atau pengembangan model prediksi *corrosion rate* secara terpisah. Integrasi analisis karakteristik korosi atmosferik, pemodelan *Artificial Neural Network* (ANN), dan model empiris berbasis *power law* untuk mengevaluasi *corrosion rate* serta memprediksi perkembangan *corrosion loss* jangka panjang masih terbatas.

Penelitian ini bertujuan mengkaji karakteristik perkembangan korosi atmosferik pada spesimen baja dengan dan tanpa pelapisan berdasarkan perubahan *mass loss*, *corrosion rate*, dan *corrosion loss*, menganalisis hubungan antara waktu paparan atmosferik dan parameter lingkungan terhadap perkembangan *corrosion rate*, mengevaluasi kemampuan pendekatan *Artificial Neural Network* (ANN) dalam memprediksi *corrosion rate* berdasarkan parameter lingkungan, waktu paparan, jenis pelapisan, dan lokasi paparan, serta mengkaji karakteristik perkembangan *corrosion loss* jangka panjang menggunakan model empiris berbasis *power law* dan membandingkan hasil prediksinya dengan model empiris ISO 9224:2012. Penelitian menggunakan data sekunder hasil pemaparan atmosferik selama 12 bulan pada spesimen baja tanpa pelapisan, baja berlapis organik, dan baja berlapis galvanis. Analisis dilakukan menggunakan regresi linear, regresi non-linier (*power law*), pemodelan ANN dengan algoritma Levenberg–Marquardt (*trainlm*), serta perbandingan dengan model empiris ISO 9224:2012.

Area Pantai menunjukkan nilai *mass loss*, *corrosion loss*, dan *corrosion rate* tertinggi dibandingkan Area ESP dan Green Zone. *Mass loss* dan *corrosion loss* meningkat seiring bertambahnya waktu paparan, sedangkan *corrosion rate* menunjukkan karakteristik yang berbeda pada setiap lokasi. Model ANN memberikan akurasi prediksi yang baik pada sistem *bare steel-coating* organik maupun *bare steel-coating* galvanis. Model *power law* memprediksi perkembangan *corrosion loss* terbesar selama 20 tahun terjadi di Area Pantai, diikuti Area ESP dan Green Zone. Penelitian ini menunjukkan bahwa integrasi data hasil pemaparan atmosferik, pemodelan ANN, dan model *power law* dapat digunakan untuk mengevaluasi perkembangan korosi atmosferik serta memprediksi *corrosion rate* dan *corrosion loss* sesuai dengan ruang lingkup penelitian.

Kata kunci: korosi atmosferik, *Artificial Neural Network*, *corrosion rate*, *corrosion loss*, Model *Power Law*, lingkungan industri pesisir

Atmospheric corrosion is one of the primary causes of structural steel degradation in coastal industrial environments. Variations in environmental conditions result in different corrosion behaviors, requiring evaluation based on actual atmospheric exposure data. Previous studies have mainly focused on experimental investigations of atmospheric corrosion or the development of corrosion rate prediction models as separate approaches. Integrating atmospheric exposure data, environmental parameters, Artificial Neural Network modeling, and an empirical power-law model into a unified framework for evaluating corrosion rate and predicting long-term corrosion loss has received limited attention.

This study aims to analyze the characteristics of atmospheric corrosion development based on mass loss, corrosion loss, corrosion rate, and environmental parameters, evaluate the relationships among mass loss, corrosion rate, and exposure time, develop ANN models for corrosion rate prediction, and predict long-term corrosion loss using an empirical power-law model. The study employed secondary data obtained from a 12-month atmospheric exposure program involving bare steel, organic-coated steel, and galvanized steel specimens. Data were analyzed using linear regression, non-linear power-law regression, ANN modeling with the Levenberg–Marquardt (trainlm) algorithm, and comparison with the empirical model specified in ISO 9224:2012.

The Coastal Area exhibited the highest mass loss, corrosion loss, and corrosion rate. Both mass loss and corrosion loss increased with exposure time, whereas corrosion rate showed different trends across the exposure locations. The developed ANN models achieved satisfactory predictive performance for both bare steel–organic coating and bare steel–galvanized coating systems. The empirical power-law model predicted the greatest long-term corrosion loss in the Coastal Area, followed by the ESP Area and the Green Zone over a 20-year period. Overall, integrating atmospheric exposure data, ANN modeling, and the empirical power-law model provides a reliable framework for evaluating atmospheric corrosion and predicting both corrosion rate and long-term corrosion loss within the scope of this study.

Keywords: *atmospheric corrosion, structural steel, artificial neural network, corrosion rate, corrosion loss, power-law model*