RINGKASAN
ANALISIS PENGARUH ASAM ORGANIK DARI CANGKANG KELAPA DENGAN METODE PIROLISIS TERHADAP PROSES PEREDUKSI SCALE DI INDUSTRI MINYAK

(Aninda Arik Tanza Putri; Halaman 62, 14 Tabel, 9 Gambar, 4 Lampiran)

Permasalahan *scale* dalam industri minyak telah menjadi tantangan serius karena dapat menyumbat sistem perpipaan dan menurunkan efisiensi operasional. Penelitian ini bertujuan untuk mengevaluasi efektivitas asam organik hasil pirolisis cangkang kelapa sebagai pereduksi *scale* ramah lingkungan serta membandingkannya dengan larutan HCl pada berbagai konsentrasi. Pirolisis dilakukan pada suhu 500 °C selama 30 menit untuk menghasilkan *bio-oil* yang kaya senyawa fenolik dan asam organik. Karakterisasi menggunakan GC-MS menunjukkan dominasi senyawa fenol, fenol 2-metoksi, dan fenol 2,6-dimetoksi yang berperan aktif dalam proses reduksi. Uji reduksi dilakukan terhadap scale berbasis Fe_2O_3, Fe_3O_4, dan $FeSO_4$ dengan variasi waktu 5-40 menit, dan HCl 5-30% sebagai pembanding. Hasil menunjukkan bahwa asam organik mampu mereduksi *scale* hingga 36,03% dalam 40 menit, setara dengan HCl 15% (37,85% pada 20 menit) dan HCl 25% (37,45% pada 10 menit). Efektivitas optimum pada asam organik terjadi di menit ke-25 sebesar 30,04%. Meskipun HCl menunjukkan kemampuan reduksi lebih tinggi, asam organik dinilai lebih aman terhadap lingkungan dan infrastruktur logam. Penelitian ini mengindikasikan bahwa *bio-oil* hasil pirolisis cangkang kelapa memiliki potensi sebagai alternatif pereduksi *scale* yang berkelanjutan.

Kata kunci: Pirolisis, Asam Organik, Cangkang Kelapa, *Scale*, Reduksi, Fenol.

ABSTRACT
ANALYSIS OF THE EFFECT OF ORGANIC ACID FROM COCONUT SHELL VIA PYROLYSIS METHOD ON SCALE REDUCTION PROCESS IN THE OIL INDUSTRY

(Aninda Arik Tanza Putri; *Page 62, 14 Tables, 9 Figures, 4 Appendices*)

The issue of scale in the oil industry has become a serious challenge due to its potential to clog pipeline systems and reduce operational efficiency. This study aims to evaluate the effectiveness of organic acid derived from coconut shell pyrolysis as an environmentally friendly scale reducer and to compare it with hydrochloric acid (HCl) at various concentrations. The pyrolysis was conducted at 500 °C for 30 minutes to produce bio-oil rich in phenolic and organic acid compounds. GC-MS characterization revealed that phenol, 2-methoxyphenol, and 2,6-dimethoxyphenol were the dominant compounds playing active roles in the reduction process. Scale reduction tests were carried out on Fe_2O_3, Fe_3O_4, and $FeSO_4$-based scales using reduction times of 5–40 minutes, with HCl concentrations ranging from 5% to 30% as a comparison. The results showed that the organic acid was capable of reducing scale by up to 36.03% within 40 minutes, which was equivalent to the performance of HCl 15% (37.85% at 20 minutes) and HCl 20% (38.60% at 15 minutes). The optimal effectiveness of the organic acid occurred at 25 minutes, reaching 30.04%. Although HCl demonstrated higher reduction capability, the organic acid was considered safer for both the environment and metal infrastructure. This study indicates that bio-oil derived from coconut shell pyrolysis has strong potential as a sustainable alternative for scale reduction in the oil industry.

Keywords: *Pyrolysis, Organic Acid, Coconut Shell, Scale, Reduction, Phenol.*