

# ADSORPTION EFFECTIVENESS OF COFFEE GROUNDS ACTIVATED CARBON IN REDUCING IRON (Fe) CONTROL IN WATER

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## ABSTRACT

High iron (Fe) content in water can pose a risk to human health. A viable approach to diminish iron levels involves the utilization of an adsorbent, specifically activated carbon produced from coffee grounds. This study aimed to evaluate the efficacy of activated carbon derived from coffee grounds and treated with Nitric Acid (HNO<sub>3</sub>) in lowering the concentration of Fe in water.

This study employs a true experimental design characterized by a pretest-posttest controlled group framework. The research population consisted of iron (Fe) solutions, comprising a total of 31 samples, each with a volume of 500 ml. Adsorption was conducted using the batch method with two adsorbent doses (0.5; 1.5; and 2.5 g) and five stirring times (30, 60, 120, 180, and 360 minutes). The stirring speed was 150 rpm and the adsorbent particle size was 80 mesh. The data collected were subjected to analysis through a Two Way ANOVA test.

The findings regarding water content (1.46%), ash content (8.58%), and iodine absorption (1038 mg/g) prove that coffee grounds activated carbon was successfully made. The highest iron (Fe) reduction occurred at a dose of 0.5 grams with a contact time of 120 minutes resulting in a final iron content of 0.014 mg/l. The collected data were subjected to analysis through the Two Way ANOVA test. The findings from the Two Way ANOVA indicated a p-value greater than 0.05, suggesting the absence of a significant difference. The adsorption capacity concerning iron content conformed to the Freundlich isotherm model, exhibiting an R<sup>2</sup> value of 0.9879, while the kinetics of adsorption adhered to a zero-order model, which presented an R<sup>2</sup> value of 0.2476.

The findings of this study indicate that coffee grounds may serve as an effective form of activated carbon for the reduction of iron concentrations in water. Further research is needed to reduce turbidity in water that has been given coffee grounds activated carbon adsorbent without reducing the efficiency of adsorption.

**Keywords** : Activated Carbon, Coffee Grounds, Iron (Fe)

**Bibliography** : 78 (72 Journal, 4 Book, 2 Regulations)

# EFEKTIVITAS ADSORPSI KARBON AKTIF AMPAS KOPI DALAM MENURUNKAN KANDUNGAN BESI (Fe) DALAM AIR

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## ABSTRAK

Kandungan zat besi (Fe) yang tinggi dalam air dapat membahayakan kesehatan manusia. Salah satu metode untuk menurunkan kadar besi adalah dengan menggunakan adsorben, seperti karbon aktif yang dihasilkan dari ampas kopi. Penelitian ini bertujuan mengevaluasi efektivitas karbon aktif dari ampas kopi yang diolah dengan Asam Nitrat ( $\text{HNO}_3$ ) dalam menurunkan konsentrasi Fe dalam air.

Penelitian ini merupakan *true experiment* dengan desain *pretest-posttest controlled group design*. Sampel terdiri dari 31 larutan besi (Fe), masing-masing berukuran 500 ml. Adsorpsi dilakukan menggunakan metode batch dengan variasi dosis adsorben (0,5; 1,5; dan 2,5 g) dan waktu pengadukan (30, 60, 120, 180, dan 360 menit). Kecepatan pengadukan adalah 150 rpm dan ukuran partikel adsorben 80 mesh. Data dianalisis menggunakan uji *Two Way ANOVA*.

Hasil penelitian menunjukkan kadar air (1,46%), kadar abu (8,58%), dan daya serap yodium (1038 mg/g), membuktikan bahwa karbon aktif ampas kopi berhasil dibuat. Penurunan kadar besi tertinggi tercapai pada dosis 0,5 gram dengan waktu kontak 120 menit, menghasilkan kadar besi akhir 0,014 mg/l. Analisis dengan *Two Way ANOVA* menunjukkan p-value > 0,05, menandakan tidak ada perbedaan signifikan. Kapasitas adsorpsi sesuai model isoterm Freundlich dengan nilai  $R^2$  0,9879, sementara kinetika adsorpsi mengikuti model orde nol dengan nilai  $R^2$  0,2476.

Penelitian ini menunjukkan bahwa karbon aktif dari ampas kopi efektif mengurangi kadar besi dalam air. Penelitian lanjutan diperlukan untuk mengurangi kekeruhan tanpa mengurangi efisiensi adsorpsi.

**Kata kunci** : Ampas kopi, besi (Fe), karbon aktif

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