

ABSTRAK

PENGARUH LAJU ALIR DAN TEKANAN UDARA PADA SISTEM *PRETREATMENT ZEOMANGAN COLUMN* TERHADAP PENINGKATAN KINERJA ULTRAFILTRASI AIR SUMUR MENJADI AIR MINUM

(Epan Riansyah, 2026, 48 Halaman, 40 Tabel, 14 Gambar, 5 Lampiran)

Kualitas air sumur yang digunakan sebagai sumber air baku sering kali belum memenuhi standar air minum karena mengandung besi (Fe), mangan (Mn), Total Dissolved Solids (TDS), kekeruhan, serta kontaminan mikrobiologi. Penelitian ini bertujuan untuk menghasilkan Air Minum Isi Ulang (AMIU) dari air sumur menggunakan sistem *pre-treatment* berupa kolom aerasi, kolom *zeomangan*, dan kolom karbon aktif yang dikombinasikan dengan membran ultrafiltrasi, serta menganalisis pengaruh variasi laju alir dan tekanan udara aerasi terhadap efektivitas penyerapan parameter pencemar. Penelitian dilakukan menggunakan variasi tekanan udara aerasi 4 dan 5 bar serta laju alir 6, 8, 10, 12, dan 14 L/menit. Air baku yang digunakan memiliki karakteristik awal pH 7,9; TDS 341 mg/L; Fe 0,60115 mg/L; Mn 0,42823 mg/L; kekeruhan 7,23 NTU; *E. coli* 121 CFU/100 mL; dan coliform 1 CFU/100 mL. Sistem pengolahan terdiri atas proses aerasi, filtrasi menggunakan *zeomangan* dan karbon aktif, dilanjutkan dengan ultrafiltrasi dan desinfeksi ultraviolet. Parameter yang dianalisis meliputi pH, TDS, Fe, Mn, kekeruhan, *E. coli*, dan coliform. Hasil penelitian menunjukkan bahwa peningkatan tekanan aerasi dan penyerapan laju alir meningkatkan efektivitas pengolahan air. Kondisi optimum diperoleh pada tekanan aerasi 5 bar dan laju alir 6 L/menit dengan kualitas air bersih hasil *pre-treatment* berupa TDS 139 mg/L, pH 6,8, Fe 0,0103 mg/L, Mn 0,0143 mg/L, dan kekeruhan 0,89 NTU. Efektivitas penyerapan TDS dan Fe masing-masing mencapai 55,5% dan 98,29%. Setelah proses ultrafiltrasi, kualitas air minum yang dihasilkan memiliki pH 6,8; TDS 142 mg/L; Fe 0,15 mg/L; Mn 0,06 mg/L; kekeruhan 0,9 NTU; *E. coli* 0 CFU/100 mL; dan coliform 0 CFU/100 mL sehingga telah memenuhi persyaratan kualitas air minum berdasarkan Peraturan Menteri Kesehatan Republik Indonesia Nomor 2 Tahun 2023.

Kata kunci: Aerasi, Air Minum, Karbon Aktif, Ultrafiltrasi, Zeomangan

ABSTRACT

THE EFFECT OF FLOW RATE AND AIR PRESSURE IN THE ZEOMANGAN COLUMN PRETREATMENT SYSTEM ON IMPROVING THE PERFORMANCE OF ULTRAFILTRATION OF WELL WATER INTO DRINKING WATER

(Epan Riansyah, 2026, 48 Pages, 40 Tables, 14 Figures, 5 Attachments)

The quality of well water used as a raw water source often does not meet drinking water standards due to its high iron (Fe), manganese (Mn), total dissolved solids (TDS), turbidity, and microbiological contaminants. This study aimed to produce refillable drinking water (AMIU) from well water using a Pretreatment system consisting of an aeration column, a zeomanganese column, and an activated carbon column combined with an ultrafiltration membrane. This study also analyzed the effect of varying aeration flow rates and air pressures on the effectiveness of pollutant reduction. The study was conducted using varying aeration pressures of 4 and 5 bar and flow rates of 6, 8, 10, 12, and 14 L/minute. The raw water used had initial characteristics of pH 7.9; TDS 341 mg/L; Fe 0.60115 mg/L; Mn 0.42823 mg/L; turbidity 7.23 NTU; and E. coli 121 CFU/100 mL and coliform 1 CFU/100 mL. The treatment system consisted of aeration, filtration using zeomanganese and activated carbon, followed by ultrafiltration and ultraviolet disinfection. Parameters analyzed included pH, TDS, Fe, Mn, turbidity, E. coli, and coliform. The results showed that increasing aeration pressure and decreasing flow rate increased the effectiveness of water treatment. Optimal conditions were achieved at an aeration pressure of 5 bar and a flow rate of 6 L/minute, with pre-treatment clean water quality of 139 mg/L TDS, 6.8 pH, 0.0103 mg/L Fe, 0.0143 mg/L Mn, and 0.89 NTU turbidity. The effectiveness of TDS and Fe reduction reached 55.5% and 98.29%, respectively. After the ultrafiltration process, the resulting drinking water quality was pH 6.8; 142 mg/L TDS; 0.15 mg/L Fe; 0.06 mg/L Mn; and turbidity 0.9 NTU; E. coli 0 CFU/100 mL; and coliform 0 CFU/100 mL so that it has met the drinking water quality requirements based on Regulation of the Minister of Health of the Republic of Indonesia Number 2 of 2023..

Keywords: Aeration, Activated Carbon, Drinking Water, Ultrafiltration, Zeomangan