

# **PENGARUH UNSUR KIMIA DAN LOGAM BERAT DARI REMBESAN SUNGAI BANYUPUTIH TERHADAP KESEHATAN MASYARAKAT DI DESA BANTAL, KECAMATAN ASEMBAGUS, KABUPATEN SITUBONDO, PROVINSI JAWA TIMUR**

**Oleh: Syalva Taskia Muhamad Yusuf  
114160071/TL**

## **INTISARI**

Air Kawah Gunung Ijen, Kabupaten Banyuwangi, Provinsi Jawa Timur merupakan sumber asam dan belerang dengan nilai pH (0-2). Kawah Gunung Ijen mengalami rembesan sehingga air mengalir hingga Sungai Banyuputih, Kabupaten Situbondo. Unsur kimia dan logam berat dari Sungai Banyuputih dapat mengkontaminasi air tanah dan tanaman. Sehingga masyarakat yang mengonsumsi, memiliki resiko kesehatan seperti fluorosis gigi. Tujuan penelitian ini mengetahui kualitas air Sungai Banyuputih dan air tanah, mengetahui unsur kimia dan logam berat dalam tanah dan tanaman yang dikonsumsi, mengetahui distribusi dan prevalensi kejadian kerusakan gigi, mengkaji keterkaitan kualitas air yang dikonsumsi terhadap kerusakan gigi dan mengetahui arahan pengolahan air tanah dan efektivitas dari pengolahan air sungai.

Metode yang digunakan dalam penelitian ini adalah metode pendekatan kuantitatif dengan survey dan pemetaan lapangan, metode pengambilan sampel yaitu *purposive sampling*, metode analisis data dengan uji laboratorium kualitas air, tanah dan tanaman, metode evaluasi yaitu studi *cross-sectional*, uji statistik regresi logistik dan deskriptif. Uji statistik regresi logistik untuk mengetahui keterkaitan kualitas air dan data wawancara masyarakat terhadap fluorosis gigi. Data laboratorium digunakan untuk evaluasi deskriptif dan peta sebaran kualitas air dan unsur kimia serta logam berat dalam tanah dan tanaman.

Hasil penelitian didapatkan air sungai di lokasi penelitian memiliki 1 parameter yang melebihi baku mutu yaitu nilai pH 4-5,5. Air tanah yang ada di lokasi penelitian memiliki 2 parameter yang melebihi baku mutu yaitu Fluor (F) sebesar 0,6171 mg/L dan 0,687 mg/L, Sulfat ( $\text{SO}_4$ ) berkisar antara 325-683 mg/L. Nilai pH tanah berkisar 3,2-5. Unsur yang paling banyak ditemukan pada tanah adalah Si 45,3% dan Fe 20,4% dan pada tanaman yaitu Kalium (K) pada tanaman cabai dan kacang tanah dengan nilai 50% dan 64,7%.

Angka prevalensi penderita fluorosis gigi di daerah penelitian sebesar 94,59% (zona merah). Distribusi jumlah penderita fluorosis gigi perempuan sebanyak 60 orang (57%), laki-laki 45 orang (43%), dewasa 44 orang (42%), lansia 33 orang (31%), anak-anak 14 orang (13%), balita dan remaja 7 orang (7%). Berdasarkan uji statistik, parameter kualitas air tanah yang mempengaruhi gejala fluorosis gigi adalah Fluor (F) dan Sulfat ( $\text{SO}_4$ ), sedangkan faktor masyarakat yang paling rentan terhadap fluorosis gigi adalah masyarakat dengan kategori umur dewasa dan tingkat pendidikan terakhir Sekolah Dasar (SD). Efektivitas penurunan nilai Sulfat ( $\text{SO}_4$ ) dan Fluor (F) pada air sungai dengan koagulasi-flokulasi adalah < 22,3%. Namun, efektif dalam penurunan Fe dan Mn yaitu > 90%. Pengolahan air tanah yang dapat dilakukan menggunakan pengolahan adsorpsi dengan karbon aktif dan *activated alumina* secara mandiri di rumah warga.

**Kata Kunci:** Kawah Ijen, Sungai Banyuputih, Geomedik, Kimia Air, Kesehatan Masyarakat

**THE EFFECT OF CHEMICAL AND HEAVY METAL ELEMENTS  
FROM THE BANYUPUTIH RIVER ON PUBLIC HEALTH IN BANTAL  
VILLAGE, ASEMBAGUS DISTRICT, SITUBONDO DISTRICT, EAST JAVA  
PROVINCE**

**Oleh: Syalva Taskia Muhamad Yusuf  
114160071/TL**

**ABSTRACT**

Volcanic crater lake of Ijen, Banyuwangi Regency, East Java Province is a source of acid and sulfur with a pH value (0-2). A fault near the crater of Mount Ijen causes seepage so that water flows up to the Banyuputih River in Situbondo Regency. Chemical elements and heavy metals from the Banyuputih River can contaminate groundwater and plants. So that people who consume, have health risks such as dental fluorosis. The purpose of this study was to determine the water quality of Banyuputih River and groundwater, to determine the chemical elements and heavy metals of soil and plants,, to determine the distribution and prevalence of dental fluorosis, to study the effect of water quality that has been consumed towards dental fluorosis and to know the right groundwater treatment and the effectiveness of river water treatment.

The method used in this research is a quantitative method with survey and field mapping, the sampling method is purposive sampling, data analysis methods are water quality laboratory tests, soil and plant laboratory tests, and evaluation methods are cross-sectional, logistic regression and descriptive. Cross-sectional study to determine the distribution and prevalence of dental fluorosis. Logistic regression is a statistical test to determine the relationship between water quality and community interview data on dental fluorosis. Laboratory data were used for descriptive evaluation and maps of the distribution of water quality and chemical elements as well as heavy metals for soil and plants.

The results showed that river water in the research location has 1 parameter that exceeds the quality standard of the 6 parameters tested, pH value of 4-5.5. Groundwater in the research location has 2 parameters that exceed the quality standard, Fluoride (F) 0.6171 mg / L and 0.687 mg / L, Sulfate (SO<sub>4</sub>) ranges from 325-683 mg / L. Soil pH values range from 3.2-5. Based on the results of testing chemical elements and heavy metals in the soil, it can be seen that the most abundant elemental content found is Si 45.3% and Fe 20.4%. Based on the results of testing chemical elements and heavy metals in plants, it can be seen that the element potassium (K) in chili and peanut plants has a high enough value, namely 50% and 64.7%.

The prevalence rate of dental fluorosis sufferers in the study area was 94.59% (red zone). The distribution of dental fluorosis sufferers based on gender and age was 60 women (57%), 45 men (43%), 44 adults (42%), 33 elderly people (31%), 14 children (13%), toddlers and teenagers 7 people (7%). Based on statistical tests, groundwater quality parameters that affect the symptoms of dental fluorosis are fluoride (F) and sulfate (SO<sub>4</sub>), while the community factors most susceptible to dental fluorosis are people with the category of adult age and the last elementary school education level (SD). The effectiveness of Sulfate (SO<sub>4</sub>) and Fluor (F) removal with coagulation-flocculation treatment is <22.3%. However, it is effective in reducing Fe and Mn (>90%). Groundwater treatment can be done using adsorption treatment with activated carbon and activated alumina in household scales.

**Keywords:** Ijen Crater, Banyuputih River, Geomedical, Water Chemistry, Public Health

# **PENGARUH UNSUR KIMIA DAN LOGAM BERAT DARI REMBESAN SUNGAI BANYUPUTIH TERHADAP KESEHATAN MASYARAKAT DI DESA BANTAL, KECAMATAN ASEMBAGUS, KABUPATEN SITUBONDO, PROVINSI JAWA TIMUR**

**Oleh: Syalva Taskia Muhamad Yusuf  
114160071/TL**

## **INTISARI**

Air Kawah Gunung Ijen, Kabupaten Banyuwangi, Provinsi Jawa Timur merupakan sumber asam dan belerang dengan nilai pH (0-2). Kawah Gunung Ijen mengalami rembesan sehingga air mengalir hingga Sungai Banyuputih, Kabupaten Situbondo. Unsur kimia dan logam berat dari Sungai Banyuputih dapat mengkontaminasi air tanah dan tanaman. Sehingga masyarakat yang mengonsumsi, memiliki resiko kesehatan seperti fluorosis gigi. Tujuan penelitian ini mengetahui kualitas air Sungai Banyuputih dan air tanah, mengetahui unsur kimia dan logam berat dalam tanah dan tanaman yang dikonsumsi, mengetahui distribusi dan prevalensi kejadian kerusakan gigi, mengkaji keterkaitan kualitas air yang dikonsumsi terhadap kerusakan gigi dan mengetahui arahan pengolahan air tanah dan efektivitas dari pengolahan air sungai.

Metode yang digunakan dalam penelitian ini adalah metode pendekatan kuantitatif dengan survey dan pemetaan lapangan, metode pengambilan sampel yaitu *purposive sampling*, metode analisis data dengan uji laboratorium kualitas air, tanah dan tanaman, metode evaluasi yaitu studi *cross-sectional*, uji statistik regresi logistik dan deskriptif. Uji statistik regresi logistik untuk mengetahui keterkaitan kualitas air dan data wawancara masyarakat terhadap fluorosis gigi. Data laboratorium digunakan untuk evaluasi deskriptif dan peta sebaran kualitas air dan unsur kimia serta logam berat dalam tanah dan tanaman.

Hasil penelitian didapatkan air sungai di lokasi penelitian memiliki 1 parameter yang melebihi baku mutu yaitu nilai pH 4-5,5. Air tanah yang ada di lokasi penelitian memiliki 2 parameter yang melebihi baku mutu yaitu Fluor (F) sebesar 0,6171 mg/L dan 0,687 mg/L, Sulfat ( $\text{SO}_4$ ) berkisar antara 325-683 mg/L. Nilai pH tanah berkisar 3,2-5. Unsur yang paling banyak ditemukan pada tanah adalah Si 45,3% dan Fe 20,4% dan pada tanaman yaitu Kalium (K) pada tanaman cabai dan kacang tanah dengan nilai 50% dan 64,7%.

Angka prevalensi penderita fluorosis gigi di daerah penelitian sebesar 94,59% (zona merah). Distribusi jumlah penderita fluorosis gigi perempuan sebanyak 60 orang (57%), laki-laki 45 orang (43%), dewasa 44 orang (42%), lansia 33 orang (31%), anak-anak 14 orang (13%), balita dan remaja 7 orang (7%). Berdasarkan uji statistik, parameter kualitas air tanah yang mempengaruhi gejala fluorosis gigi adalah Fluor (F) dan Sulfat ( $\text{SO}_4$ ), sedangkan faktor masyarakat yang paling rentan terhadap fluorosis gigi adalah masyarakat dengan kategori umur dewasa dan tingkat pendidikan terakhir Sekolah Dasar (SD). Efektivitas penurunan nilai Sulfat ( $\text{SO}_4$ ) dan Fluor (F) pada air sungai dengan koagulasi-flokulasi adalah < 22,3%. Namun, efektif dalam penurunan Fe dan Mn yaitu > 90%. Pengolahan air tanah yang dapat dilakukan menggunakan pengolahan adsorpsi dengan karbon aktif dan *activated alumina* secara mandiri di rumah warga.

**Kata Kunci:** Kawah Ijen, Sungai Banyuputih, Geomedik, Kimia Air, Kesehatan Masyarakat

**THE EFFECT OF CHEMICAL AND HEAVY METAL ELEMENTS  
FROM THE BANYUPUTIH RIVER ON PUBLIC HEALTH IN BANTAL  
VILLAGE, ASEMBAGUS DISTRICT, SITUBONDO DISTRICT, EAST JAVA  
PROVINCE**

**Oleh: Syalva Taskia Muhamad Yusuf  
114160071/TL**

**ABSTRACT**

Volcanic crater lake of Ijen, Banyuwangi Regency, East Java Province is a source of acid and sulfur with a pH value (0-2). A fault near the crater of Mount Ijen causes seepage so that water flows up to the Banyuputih River in Situbondo Regency. Chemical elements and heavy metals from the Banyuputih River can contaminate groundwater and plants. So that people who consume, have health risks such as dental fluorosis. The purpose of this study was to determine the water quality of Banyuputih River and groundwater, to determine the chemical elements and heavy metals of soil and plants,, to determine the distribution and prevalence of dental fluorosis, to study the effect of water quality that has been consumed towards dental fluorosis and to know the right groundwater treatment and the effectiveness of river water treatment.

The method used in this research is a quantitative method with survey and field mapping, the sampling method is purposive sampling, data analysis methods are water quality laboratory tests, soil and plant laboratory tests, and evaluation methods are cross-sectional, logistic regression and descriptive. Cross-sectional study to determine the distribution and prevalence of dental fluorosis. Logistic regression is a statistical test to determine the relationship between water quality and community interview data on dental fluorosis. Laboratory data were used for descriptive evaluation and maps of the distribution of water quality and chemical elements as well as heavy metals for soil and plants.

The results showed that river water in the research location has 1 parameter that exceeds the quality standard of the 6 parameters tested, pH value of 4-5.5. Groundwater in the research location has 2 parameters that exceed the quality standard, Fluoride (F) 0.6171 mg / L and 0.687 mg / L, Sulfate (SO<sub>4</sub>) ranges from 325-683 mg / L. Soil pH values range from 3.2-5. Based on the results of testing chemical elements and heavy metals in the soil, it can be seen that the most abundant elemental content found is Si 45.3% and Fe 20.4%. Based on the results of testing chemical elements and heavy metals in plants, it can be seen that the element potassium (K) in chili and peanut plants has a high enough value, namely 50% and 64.7%.

The prevalence rate of dental fluorosis sufferers in the study area was 94.59% (red zone). The distribution of dental fluorosis sufferers based on gender and age was 60 women (57%), 45 men (43%), 44 adults (42%), 33 elderly people (31%), 14 children (13%), toddlers and teenagers 7 people (7%). Based on statistical tests, groundwater quality parameters that affect the symptoms of dental fluorosis are fluoride (F) and sulfate (SO<sub>4</sub>), while the community factors most susceptible to dental fluorosis are people with the category of adult age and the last elementary school education level (SD). The effectiveness of Sulfate (SO<sub>4</sub>) and Fluor (F) removal with coagulation-flocculation treatment is <22.3%. However, it is effective in reducing Fe and Mn (>90%). Groundwater treatment can be done using adsorption treatment with activated carbon and activated alumina in household scales.

**Keywords:** Ijen Crater, Banyuputih River, Geomedical, Water Chemistry, Public Health

