Identifikasi dan analisis pola perubahan kualitas air Citarum

Mira Kurniasari, author

Abstrak

Perubahan kondisi lingkungan bersifat dinamis termasuk perubahan kuantitas dan kualitas lingkungan. Perubahan lingkungan terjadi akibat aktivitas alam maupun aktivitas manusia. Tidak sedikit aktivitas manusia yang menyebabkan pencemaran lingkungan dan kerusakan lingkungan. Alam memiliki kemampuan untuk memulihkan perubahan lingkungan yang terjadi, namun perubahan yang sangat besar memungkinkan alam kesulitan untuk melakukan pemulihan.
DAS Citarum adalah sumber air baku utama bagi masyarakat Jawa Barat maupun DKI Jakarta. Kualitas DAS Citarum akan menentukan kualitas sumber air baku tersebut. Penelitian ini dimaksudkan untuk menganalisis pola perubahan kualitas air Citarum yang difokuskan pada parameter BOD5, COD, dan DO serta analisis alokasi industri sebagai suatu altematif antisipasi perubahan kualitas air sungai. Hipotesis dalam penelitian ini adalah:
1. Perubahan kualitas air Citarum homogen menurut waktu pengukuran sepanjang tahun 1994 hingga tahun 2000.
2. Ada kecenderungan perubahan kualitas air Citarum menurut waktu sepanjang tahun 1994 hingga tahun 2000.
3. Perubahan kualitas air Citarum homogen menurut lokasi Citarum dari hulu hingga hilir sungai.
4. Ada kecenderungan perubahan kualitas air Citarum menurut lokasi Citarum dari hulu hingga hilir sungai.
5. Ada pengaruh keberadaan waduk kaskade Citarum terhadap perubahan kualitas air Citarum.
6. Ada pengaruh alokasi industri terhadap perubahan kualitas air Citarum.
Pengujian hipotesis tersebut dilakukan dengan menggunakan uji Friedman untuk mengetahui homogenitas perubahan kualitas air menurut perubahan waktu maupun lokasi. Uji Z untuk mengetahui kecenderungan perubahan kualitas air terhadap perubahan waktu maupun lokasi, perhitungan sen slope untuk mengetahui tingkat kecenderungan perubahan kualitas air, serta simulasi model terhadap variasi debit sungai, debit limbah, BOD5 limbah dan jarak dengan menggunakan program dari Perum Jasa Tirta II yaitu First Basic Streeter-Phelps Model.
Hasil penelitian menunjukkan bahwa:
1. Perubahan kualitas air Citarum tidak homogen menurut waktu pengukuran sepanjang tahun 1994 hingga tahun 2000.
2. Pada Citarum Hulu, kecenderungan perubahan BOD5 dan COD menurun dan perubahan DO menaik. Hal ini dimungkinkan kondisi lingkungan yang masih terpelihara dengan baik. Pada Citarum Hilir, kecenderungan perubahan BOD5 dan COD menaik dan perubahan DO menurun. Hal ini disebabkan adanya peningkatan kegiatan tambak ikan di kawasan waduk, kegiatan industri maupun peningkatan jumlah penduduk.
3. Pada Citarum Hulu, tingkat perubahan COD cenderung lebih besar dari pada BOD5. Hal ini menunjukkan bahwa penerapan peraturan pengendalian limbah industri cukup efektif menurunkan kadar COD. Pada Citarum Hilir terutama di lokasi bendung Curug, tingkat perubahan COD jauh lebih besar dengan tingkat

perubahan BOD5. Hal ini menunjukkan bahwa peningkatan kandungan organik yang tidak dapat terurai secara biologis tinggi yang diperkirakan bersumber dari kegiatan industri.
4. Perubahan kualitas air Citarum tidak homogen menurut lokasi Citarum mulai dari hulu hingga hilir sungai.
5. Sebelum waduk kaskade Citarum, kadar BODE dan COD menunjukkan kecenderungan menaik sehubungan peningkatan kegiatan industri. Sepanjang waduk kaskade Citarum, kadar BOD5 dan COD menunjukkan kecenderungan menurun sehubungan dengan proses sedimentasi dan aerasi pada waduk. Setelah waduk kaskade Citarum, kadar BOD5 dan COD menunjukkan kecenderungan menaik sehubungan peningkatan kegiatan industri.
6. Sebelum waduk kaskade Citarum, tingkat peningkatan COD hampir dua kali dari tingkat peningkatan BOD5. Hal ini menunjukkan bahwa kandungan organik yang sulit terurai yang umumnya bersumber dari kegiatan industri cukup tinggi. Sepanjang waduk kaskade Citarum, tingkat penurunan COD hampir dua kali dari tingkat penurunan BOD5. Hal ini menunjukkan bahwa kandungan organik yang sulit terurai menurun cukup efektif dengan adanya proses sedimentasi dan aerasi pada waduk. Setelah waduk kaskade Citarum, tingkat peningkatan COD hampir 4 kali dari tingkat peningkatan BOD5. Hal ini menunjukkan peningkatan kegiatan industri sangat tinggi dibandingkan dengan lokasi sebelum waduk kaskade Citarum.
7. Adanya perbedaan yang nyata terhadap kadar BOD5 dan DO pada variasi jarak industri.
Kesimpulan hasil penOlitian ini menunjukkan bahwa:
1. Pola perubahan kualitas air Citarum tidak homogen menurut waktu sepanjang tahun 1994-2000.
2. Kecenderungan perubahan kualitas air Citarum menurut waktu tergantung pada pola pertumbuhan penduduk dan ekonomi yang berpotensi mempengaruhi kualitas air.
3. Pola perubahan kualitas air Citarum tidak homogen menurut lokasi Citarum dari hulu hingga hilir sungai.
4. Kecenderungan perubahan kualitas air Citarum menurut lokasi tergantung pada kondisi lingkungan dan kegiatan yang berpotensi mencemari lingkungan.
5. Keberadaan waduk kaskade Citarum mempengaruhi perubahan kualitas air Citarum dengan adanya peningkatan kualitas air Citarum setelah waduk kaskade Citarum.
6. Alokasi kegiatan industri mempengaruhi perubahan kualitas air Citarum. Hal ini ditunjukkan dengan adanya perbedaan kadar BOD5 dan DO pada variasi jarak industri.
.....The Identification and Analysis on The Pattern of Water Quality Fluctuation at CitarumThe changes of environmental condition are dynamic, so are the changes of environmental quantity and quality. Environmental changes are resulted from natural as well as human activities. Many of human activities have caused pollution and environmental damages. Nature has self-recovering ability from any damages. However, nature will have difficulties in recovering from tremendous changes.
Citarum catchments area is the main drinking water source for West Java and Jakarta communities. The quality of Citarum catchments area determines the quality of the drinking water source. This research aims to analyze the pattern of water quality fluctuation at Citarum focusing on the BOD5 and DO parameter while also analysing industrial allocation as an alternative to anticipate the changing of river water quality. Hypotheses used in this research were as follows:
1. There was homogeneity in the changes of water quality at Citarum according to time during the year of 1994 to 2000.
2. Water quality at Citarum had a tendency to change according to time during the year of 1994 to 2000.
3. There was homogeneity in the changes of water quality at Citarum according to location along the upper

to the lower stream.
4. Water quality at Citarum had a tendency to change according to location along the upper to the lower stream.
5. The existence of Citarum cascade dam affected the water quality fluctuation at Citarum.
6. Industrial allocation influenced the water quality fluctuation at Citarum.
Those hypotheses were tested using Friedman test to examine the homogeneity in the pattern of water quality fluctuation with the changes of time and location, Z test to examine the trend of water quality fluctuation with the changes of time and location, sen slope calculation to examine the degree of trend of water quality fluctuation; and model simulation with the variation of river flow rate, wastewater flowrate, BCDs level of the wastewater and distance using First Basic Streeter-Phelps Model, a program owned by Perum Jasa Tirta
The research found that:
1. Water quality fluctuation at Citarum was not homogeneous according to time during the year of 1994 to 2000,
2. At the upper stream of Citarum, there was a trend of decreasing BOD5 and COD level and increasing DO level. This possibly because the environmental condition was still well maintained. At the lower stream of Citarum, there was a trend of increasing BOD5 and COD level and decreasing DO level. An increasing fish farming activity at the dam area, increasing industrial activity as well as population growth possibly caused this condition.
3. At the upper stream, the degree of change in COD more than BOD5. It meant that the application of industrial wastewater regulation is effective to decrease COD. At lower Citarum, particularly at Curug dam, the degree of change in COD level change was far more significant than the degree of BOD5 change. It showed the increase of organic content that was not biodegradable possibly came from industrial activities.
4. Water quality fluctuation at Citarum was not homogenous with the changes of location along upper to lower stream.
5. Before Citarum cascade dam, BOD5 and COD tended to increase with the increasing industrial activities. Along Citarum cascade dam, BOD5 and COD level tended to decrease because of sedimentation and aeration process in the dam. After Citarum cascade dam, BOD5 and COD tended to increase with the increasing of industrial activities.
6. Before Citarum cascade dam, the increase of COD level was almost twice the increase of BOD5 level. This showed the relatively high content of organic matter came from industrial activities that were difficult to degrade. Along Citarum cascade dam, COD level decreased with a rate almost twice as BOD5 level. This showed that organic matter that was difficult to degrade decreased quite effectively with sedimentation and aeration process in the dam. After Citarum cascade dam, the rate of COD level increase was almost four times the increase of BOD5 level. This showed that the increase of industrial activities was very high compare to the location before Citarum cascade dam.
7. There are significant difference of BOD5 and DO at variation of distance among industries.
The research concluded that:
1. The pattern of water quality fluctuation at Citarum did not show any homogeneity according to time during the year 1994 to 2000.
2. The trend of water quality fluctuation at Citarum according to time depended on the rate of population and economy growth.

3. The pattern of water quality changes did not show any homogeneity according to location from upper to lower stream.
4. The trend of water quality fluctuation according to location depended on the existing environmental condition and on the activities having a potency to pollute the environment.
5. The existence of Citarum cascade dam affected water quality fluctuation at Citarum as shown by the increase of river water quality after passing the Citarum cascade dam.
6. The allocation of industrial activities influenced water quality fluctuation at Citarum. This was shown by the fluctuation of BOD5 and DO level with the variation of distances from industry.