Statistical analysis techniques for the assessment of the toxicity of raw surface water intended for human consumption—a case study

Eleni M. Smetia*, Demetrios E. Koronakisa, Spyridon K. Golfinopoulosb

aQuality Control Department, Athens Water Supply & Sewerage Company, (EYDAP SA), 156 Oropou St., Galatsi 11146 Athens, Greece
Tel. +30 2102144006/+30 6955690062; email addresses: esmeti@eydap.gr; e.smeti@fme.aegean.gr
bDepartment of Financial & Management Engineering, University of the Aegean, 41 Kountourioti St., Chios 82100, Greece

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ABSTRACT

During a seven-year time period (2000–2006), the data obtained by the monthly toxicological analyses of raw (untreated) water from the main reservoirs supply sources of Athens, the Greek capital with more than 4 million inhabitants, had been registered using a bioluminescence test, which is based on the correlation between toxicity of the water sample and its effects on the light intensity of marine bacteria Vibrio fischeri, measured by the bioluminometer Microtox®. The statistical analysis of the water toxicity over a long time period can provide important and useful information for the management and quality control of the water resources. However, due to the inherent characteristics of the water quality data, sophisticated statistical techniques for their analysis may be required. In this study, the available data were subjected to exhaustive statistical analysis by the usage of specialized nonparametric statistical methods. A small amount of autocorrelation was observed for each time series implying that corrective actions should be made in the statistical analyses. The overall performance of the raw waters was apparently nontoxic. The study of seasonality for each reservoir resulted in no statistical significance. Trend analysis resulted in no statistically significant upward or downward trends. Moreover, no statistically significant differences of the central tendency measures between the reservoirs were observed.

Keywords: Nonparametric statistical methods; Trend analysis; Seasonality; Autocorrelation; Microtox® test.