DOI: https://doi.org/10.30836/igs.iies.2024.35

İlayda Sapmaz[1], Sena Uyar[2], Mutlu İçhedef[1]

(1) Ege University Institute of Nuclear Sciences, 35100, Bornova, Izmir, Türkiye.
E-mail: ilaydaeda19@gmail.com, mutlu.ichedef@ege.edu.tr
(2) Ege University Faculty of Education, Department of Mathematics and Science Education, 35100, Bornova, Izmir, Türkiye. E-mail: sena.uyarr@hotmail.com

DETERMINATION OF RADIOACTIVITY AND HYDROGEOLOGICAL PROPERTIES OF AGORA HISTORICAL SITE AND HALKAPINAR UNDERGROUND WATER RESOURCES

Izmir is the third most populous city in Turkey, after Istanbul and Ankara, with a population of 4,479,525 people as of 2024. While most of this population, approaching five million, is concentrated in the city center around the Gulf of Izmir, the remaining part of the population is scattered in the districts on the periphery. It has been observed that migration to Izmir city center and its surroundings has accelerated in recent years. With the increasing population, urbanization is also gaining momentum, and as a result, population density (population per unit area; person/km^2) is also increasing. According to the last assessment, the population density in the city center was calculated as 366 people/km^2 [1]. Izmir is not considered a city rich in water resources sufficient for its dense population. While there are underground water sources in Izmir, the city can face drought risks due to its climate conditions and geographical structure. Especially during the summer months, the city may experience water scarcity. Therefore, it is important to use water efficiently and to conserve water resources.

One of the most significant sources of water for the city is supplied by Halkapınar Springs. Halkapınar springs, located within the Izmir city area and providing water to the city from the lake in the region for 122 years since 1897, are an important water source for Izmir. The total number of wells was 25 by opening 3 wells (research wells) in 1972, 10 wells in 1973, 6 wells in 1975-1976, and 6 wells in 2009. A total of 19 wells are currently active. The water produced from deep wells is collected in the tank in Halkapınar, purified in the Halkapınar Arsenic Treatment Plant, and transmitted to the city through 2 pump stations with 9 motor pumps [2]. Another water source emerges within the ancient city of Agora. The Agora Archaeological Site, located in Kemeraltı, Konak District of Izmir, is the city center of the ancient city of Symrna, founded between Kemeraltı and Kadifekale, with administrative, social, cultural, and religious functions during the Hellenistic and Roman periods. A significant part of the ruins in the Agora date back to the 2nd century AD.

Fig. 1. The map of study area

This study aims to determine the radioactivity, physical, and chemical properties of Agora and Halkapınar water resources. We began working in September 2023, and approximately 100 water samples have been analyzed in the ongoing study. The radioactivity content (radon and radium), temperature, and silica content of the waters from Halkapınar and Agora are being studied. Radon activity concentrations of waters were determined by RAD7H2O (Durridge, USA). Water samples were taken from each water source with special 250 ml bottles, and measurements were made in the laboratory. Radium concentrations were determined indirectly by measurements using the radioactive balance between radon and radium. For this purpose, water samples in which radon was measured were kept for 1 month and measured again. Temperature and pH were determined on-site using a hand-held pH meter. Silica measurements were performed using the colorimetry method. The obtained results are presented in Table 1.

Table 1. Mean values of groundwaters

Name	Radon (Bq l^{-1})	Radium (Bq l^{-1})	Temperature (°C)	pH	Silica (mg l^{-1})
AGK1	8.4	5.0	19.5	7.3	32.4
AGK2	5.8	3.8	19.5	7.2	35.6
AGK3	12.0	7.5	19.5	7.4	33.7
K4	2.9	-	-	7.1	13.6
K5	3.8	-	-	7.2	13.9
K9	2.9	-	-	7.1	14.2
K11	3.1	-	-	7.1	14.4
K12	3.6	-	-	7.1	13.5
K14	3.7	-	-	7.1	13.4

The studied areas are important because they are strongly connected to the Izmir Fault Zone. Therefore, the water radon levels at the Agora Historical Site show very large variations during the study period. The ongoing study will focus on collecting more data on these sites. Specifically, we will add measurements of ^{2}H and ^{3}H to obtain information on the sources of these waters and the connections between them.

References

1. Türkiye İstatistik Kurumu (TÜİK), “İstatistik Veri Portalı” https://data.tuik.gov.tr/Kategori/GetKategori?p=nufus-ve-demografi-109&dil=1 Son Erişim Tarihi:05.04.2021.
2. IZSU, “https://www.izsu.gov.tr/tr/TesisDetay/1/4/2#:~:text=Halkap%C4%B1nar%20derinkuyular%C4%B1ndan%20%C3%BCretilen%20su%2C%20%C5%9Fehrin,Toros%20b%C3%B6lgeleri%20direkt%20olarak%20beslenmektedir. Access Date: 15:03.2024.