

Determination of Heavy Metals Arsenic and Cadmium in The Refill Drinking Water in Purwokerto

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Kata Kunci

Refill drinking water

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ABSTRACT

Refill drinking water production is now rapidly increasing in several regions in Indonesia, including Purwokerto. According to the Regulation of Health Minister of the Republic of Indonesia (Permenkes) Number 492/Menkes/Per/IV/2010, heavy metal is one of the parameters of drinking water quality which has adverse impacts on human health. In this study, Arsenic (As) and Cadmium (Cd) would be studied. Atomic Absorption Spectrometry (AAS) method was used to find As and Cd concentration in refill drinking water samples. The results showed that only one sample containing As from five samples was collected, there is 1.027 ppb. Nevertheless, there is being safe for drinking according to Regulation of Health Minister of the Republic of Indonesia (Permenkes) Number 492/Menkes/Per/IV/2010. Meanwhile, Cd was not detected in

samples. It can be concluded that refill drinking water samples that were taken from several depots in Purwokerto City are being safe for drinking.

INTRODUCTION

Drinking water is a basic requirement for the life of the people in the world, including in Indonesia. Generally, there are several types of use of drinking water in Indonesia, there are bottled drinking water and refill drinking water. But due to the price of bottled drinking water is getting more expensive and increasing the plastic waste, so refill drinking water business grows well, especially in Purwokerto.

There are many depots of refill drinking water in Purwokerto. Rahayu and colleagues (2016) in her study mentioned that 18 percent of the refill drinking waters in the district of South Purwokerto have bad microbe quality (Rahayu, Suparmin, & Gunawan, 2016). Meanwhile, National Food and Drug Agency of Indonesia (BPOM) has published their study about refill drinking water in Jakarta, Bogor, Depok, Tangerang and Bekasi, Indonesia. They said that refill drinking waters in there have the cadmium content. Million people are exposed to unsafe levels of a chemical contaminant in their drinking water. Monitoring metal in drinking water is needed to supplies provide information to determine the suitability of water resources for humans.

The good drinking water is the drinking water that has good quality and safe for health. According to the Regulation of Health Minister of the Republic of Indonesia (Permenkes) Number 492/Menkes/Per/IV/2010, the quality of drinking water can be known through the obligatory parameter and additional parameter. Heavy metal is one of the obligatory parameters in the quality of drinking water (Kesehatan, 2010).

In this paper, we study some heavy metal. Heavy metals in water occur only in trace levels but are more toxic to the human body (Mohod & Jaya, 2013). Heavy metals are taken into the body via drinking water, inhalation, ingestion and skin absorption (Sandeep, Sangita, Kumar, & Rakhi, 2012). Water that is contaminated by heavy metals negatively impact the health, both in the high and low concentration (Hazimah & Triwuri, 2017). This study focused on heavy metals Arsenic and Cadmium in refill drinking water.

According to the International Agency for Research on Cancer (IARC), As and Cd are classified as a human carcinogen. They are related to cancer risk and skin damage. Cd is linked to kidney damage and cancer (Malik & Khan, 2016). Cadmium is extremely toxic, even in low concentrations and will bioaccumulate in the human body. Long term exposures to Cadmium induces renal damage (Mohod & Jaya, 2013).

Besides cadmium, Arsenic is also one major concern due to its presence at relatively high concentrations in drinking water. Chen and colleagues (2010) in their study mentioned that arsenic via drinking water has been linked to increased urinary cancer risk, including bladder and kidney (Chen et al., 2010). The immediate symptoms of low-level arsenic poisoning include vomiting, abnormal heart rhythm, damage to blood vessels, abdominal pain, diarrhea, numbness, and muscle cramping. Whereas symptoms responsible for long-term exposure to high levels of inorganic arsenic are usually observed in the skin, and extreme condition skin cancer (Muhammad, Khan, Ahmed, & Saleem, 2018).

METHODOLOGY

This study was designed as an experimental descriptive study, was carried out in Harapan Bangsa University. The samples in this study were the refill drinking water produced by the depot in Purwokerto. The study area was Purwokerto, located in Indonesia. DMS latitude longitude coordinates for Purwokerto are 7°25'17" S, 109°14'3.98" E, was mapped out into four sub-area of East Purwokerto, West Purwokerto, North Purwokerto, and South Purwokerto (See Figure 1).

The sample size was determined purposively as much as the number of the district in Purwokerto, there are 5 refill drinking water carried out. They were collected from districts in Purwokerto, there are East Purwokerto, West Purwokerto, North Purwokerto, and South Purwokerto. Five samples of refill drinking water were collected from four regions during Mei 2019.

A population of random sampling was used. Sampling according to the graphical population distribution. Refill drinking samples from the different location were collected in the bottled, about ½ liter water samples was taken from one depot in one location. then samples collected were analyzed in 2-3 days so no preservation required.

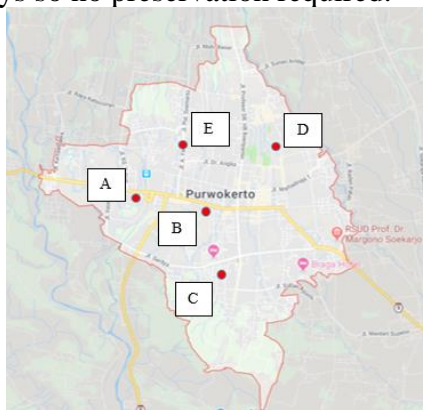


Figure 1. Map of Purwokerto, sampling site

The determination of heavy metals concentrations in refill drinking water were determined by Atomic Absorption Spectrometry Method (Nasional, 2006). The determination of concentration for heavy metals were As dan Cd. The concentration of resulting heavy metals in refill drinking water was compared with the standard national and international organization, there are the Regulation of Health Minister of The Republic of Indonesia and World Health Organization (Organization, 2011).

RESULT AND DICUSSION

The As and Cd concentration of refill drinking water of the study area Purwokerto presented in Table 1.

Table 1. Concentration of heavy metals As and Cd in refill drinking water

Code of Sample	Concentration of heavy metals (ppb)					
	As	Permenkes maximum permissible limit	WHO maximum permissible limit	Cd	Permenkes maximum permissible limit	WHO maximum permissible limit (ppb)
A	1.027	10.00	10.00	< 1.000	3.000	3.000
B	< 1.000	10.00	10.00	< 1.000	3.000	3.000
C	< 1.000	10.00	10.00	< 1.000	3.000	3.000
D	< 1.000	10.00	10.00	< 1.000	3.000	3.000
E	< 1.000	10.00	10.00	< 1.000	3.000	3.000

Table 1 showed that As content in refill drinking water was only detected in A sample, West Purwokerto district. Arsenic content in A sample is 1.027 ppb. But the value of Arsenic concentration was less than the maximum permissible limit according to Regulation of Health Minister of The Republic of Indonesia Permenkes 492/MenKes/Per/IV/2010 and WHO regulation, there is 10 ppb (Kesehatan, 2010). It means the refill drinking water is being safe for drinking.

The arsenic content for Purwokerto refill drinking water was similar to the Arsenic content in refill drinking water in Batam who reported by Hazimah and Triwuri (2018) (Hazimah & Triwuri, 2018). The study reported that Arsenic concentration was less than the maximum permissible limit according to Regulation of Health Minister of The Republic of Indonesia Permenkes 492/MenKes/Per/IV/2010. There is 0.1 ppb for As in that area.

The obtained result showed that people in West Purwokerto district, especially those whose consumption refill drinking water A, were far from exposure to Arsenic. This is because although A refill drinking water containing Arsenic, the concentration was less than the maximum permissible limit according to Regulation of Health Minister of The Republic of Indonesia Permenkes 492/MenKes/Per/IV/2010 and WHO regulation.

In humans, arsenic could damage to the human respiratory system, heart, digestion system and blood circulation system (Hazimah & Triwuri, 2018). Arsenic is one of the heavy metals in the air, water, and soil. In high concentrations, arsenic could lead to death if it went to the respiration system.

Differ with As, Cd was all below the detection limit in the refill drinking water of the study area. This implies that the concentration of Cd in refill drinking water in the study were just too low to be detected by the instrument of analysis, or they had no trace of the cadmium. This is good news since cadmium is very harmful to the human body. On long term exposure, Cd is highly toxic. It causes "itai-itai" disease, cardiovascular system affected and hypertension. High exposure can lead to obstructive lung disease and lung cancer. It also

damages to human respiratory systems. The similar result obtained by Oyem and colleagues (2015), Cadmium was not detected in the groundwater in Nigeria (Oyem, Oyem, & Usese, 2015).

Based on the result of this study in Purwokerto, The refill drinking water in Purwokerto have a good quality of Cd an As. There were tied by some factor: a good process of raw water treatment and good quality of raw water, where raw water should be clean according to Permenkes Number 416/Menkes/Per/IX/1990. The similar result obtained by Mairizki (2017), mentioned that all of the refill drinking water in around Islamic University of Riau was being safe according to chemical parameter on Regulation of Health Minister of The Republic of Indonesia Permenkes 492/MenKes/Per/IV/2010 (Mairizki, 2017)

CONCLUSION

From these results and parameters studied, it was concluded that refill drinking water in Purwokerto is generally meet national and internationally acceptable standards. Therefore they are being safe for drinking with regards to heavy metals arsenic and cadmium.

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