ABSTRACT

Drinking water is one of the primary needs for humans to support daily life. Drinking water itself can be obtained from various sources, one of which comes from rivers. The Citarum River is a source of drinking water for many cities in West Java. The river was named the dirtiest river in 2018 by the World Bank. Being named the dirtiest river certainly proves that the Citarum River has been polluted by various kinds of pollutants, one of which is the heavy metal cadmium (Cd). The level of Cd in the Citarum River is the highest heavy metal content, namely 0.03 mg/l. In another study, it was stated that it was 0.464 mg/l, while the quality standard set by PP Number 22 of 2021 concerning the Cd content of river water used for drinking water was 0.01 mg/l, equivalent to 10 ppb. Therefore, a tool for detecting Cd with low concentrations in liquid samples is needed.

The Cd detection tool, hereinafter referred to as the Cd detection kit, is designed using LMP91000EVM, which acts as a potentiostat, Arduino UNO as a microcontroller that regulates the detection process, ADS1115 as an analog to digital data converter, and HMI Nextion NX8048K050 as a display. The detection kit works with one of the electrochemical measurement methods, namely Cyclic Voltammetry (CV). For CV measurements, three electrodes are required, namely the Working Electrode (WE), Counter Electrode (CE), and Reference Electrode (RE). To obtain high sensitivity for detecting the Cd, WE was modified by graphene-doped ZnO/PVA nanocomposites. ZnO is a nanomaterial that has high electron mobility (~3 cm2/V.s) and a band-gap energy of 3.37 eV. ZnO can also provide active sites for the adhesion of positively charged heavy metal ions. Giving PVA to ZnO nanomaterials to achieve nanocomposites that have flexible surfaces. The addition of graphene to ZnO/PVA nanocomposites as doping is useful for increasing electrical conductivity.

Modification of WE with graphene-doped ZnO/PVA nanocomposite has been proven to produce high sensitivity, namely 4.91541 uA/ppb, with the linearity equation being y = 4.91541x+ 26.48061 and an R-square of 0.96232. Apart from that, the LOD obtained for detecting Cd was 4.080139 ppb. These results were obtained from testing the detection kit which carried out 8 measurements to detect Cd with concentrations of 0, 4, 6, 8, 10, and 12 ppb for each concentration. The test was carried out with a number of cycles of one cycle, a scan rate of 100 mV/s, a voltage range of -1.2 to. 0.7 Volt, internal zero on the LMP91000EVM is 20% of VDD and Gain is 3500Ω. The errors produced in the detection of Cd for concentrations of 0, 4, 6, 8, 10, and 12 ppb were respectively undetermined, 3.8%, 2.7%, 4.6%, 2.26%, and 5.01667%. From the test results, it can be concluded that the Cd detection kit meets

the solution to existing problems, namely that it can detect Cd levels in the Citarum River, which are around the standard standard of 10 ppb.

Keywords : Electrochemistry, Cyclic Voltammetry (CV), Detection Kit, Cd Heavy Metal