Paper-Based Sensor for Preliminary Screening of Lead in Industrial Wastewater

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Nowadays, several heavy metals have been continuously used in industry, where lead (II) ion is the most harmful metal in Thailand. People nearby industrial areas have been inflected with serious human disorders due to lead contamination in consumed water. The objective of this research is to develop an inexpensive, portable testing device, paper-based sensor, for rapid determination of lead (II) level in wastewater. In this paper-based sensor, dithizone ligand was used as a colorimetric agent for lead (II) detection. The principle of this paper-based sensor is reaction between lead (II) ion and dithizone to produce a distinctively red-colored complex on our proposed sensor, which can be clearly observed by naked eyes. After this reaction, lead (II) concentration was quantified from color intensity of product images through a scanner coupled with ImageJ, the image processing software. Moreover, various colorimetric conditions in the lead (II) quantitation were investigated including dithizone concentration, pH, reaction time, and other metals interference. We found that paper-based sensor can detect lead (II) concentration in the range of 10-500 ppm with NaOH 0.1 M (at pH 13), dithizone 2.5 mM, and 5 minutes of reaction time as the optimal conditions. Finally, we have successfully tested the sensor for lead (II) determination in wastewater samples with acceptable correlation with the standard method using inductively coupled plasma optical emission spectrometry (ICP-OES) with 5% error acceptance.

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