

**SMARTPHONE-BASED COLORIMETRIC READER FOR
PHOSPHATE ANALYSIS**

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ABSTRACT

A smartphone-based colorimetric reader (SBCR) was developed for the analysis of phosphate in water and soil. The developed smartphone-based colorimetric reader was designed to be portable and cost-effective tool for analysis of phosphates, thus help in addressing inaccessible laboratory-based analysis, as well as contribute to soil and water nutrient monitoring and management. The SBCR was composed of a colorimetric analyzer box, constructed from cardboards, a 96-well flat-bottom transparent microtiter plate that was used to hold the solutions and a bottom-based illumination was provided by a gadget. To help improve the performance of the SBCR, various physical factors were controlled. The focal length, the bottom illumination intensities and comparison of smartphones were all evaluated in order to determine at which conditions these operating parameters gave a better sensitivity. The operating parameters selected were 15 cm for the height between the smartphone and the 96-well MTP, 0% illumination setting which was offered by the application software used to provide for the light from the gadget, and the usage of Phone A for the image acquisition of the analysis.

The preliminaries gave a basis on the operating parameters used for the SBCR. For the phosphate analysis, the red channel was chosen for analysis of the image since at this channel the sensitivity was at the highest compared with the green and blue channels. The developed method was then evaluated for its analytical characteristics. It has a working range of 0.20-0.70ppm, LOD and LOQ of 0.06 ± 0.18 ppm and 0.18 ± 0.06 ppm, respectively, an intraday precision (%RSD) lower than 2% and inter-day precision of 1.46% (%RSD). In addition, the SBCR analysis application on water and soil samples showed no significant difference between the results from analysis done using spectrophotometric method. The experimental results suggest that the SBCR method could be applied for phosphate analysis for both water and soil samples.