

# Proseding

*by* Ida Farida

---

**Submission date:** 22-Aug-2020 06:15PM (UTC+0700)

**Submission ID:** 1372577368

**File name:** 27\_Smartphone\_-Journal\_of\_Physics\_Q-3.pdf (976.43K)

**Word count:** 2845

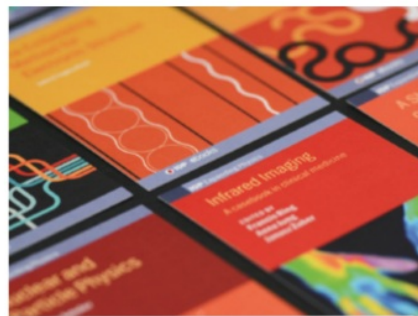
**Character count:** 13975

PAPER • <sup>2</sup> OPEN ACCESS

## Smartphones application in alkali metal flame tests

<sup>1</sup> To cite this article: S Sari *et al* 2019 *J. Phys.: Conf. Ser.* **1402** 055033

View the [article online](#) for updates and enhancements.



**IOP | ebooks™**

Bringing together innovative digital publishing with leading authors from the global scientific community.

Start exploring the collection—download the first chapter of every title for free.

## 2 Smartphones application in alkali metal flame tests

S Sari<sup>1,\*</sup>, E Magfiroh<sup>1</sup>, F S Irwansyah<sup>1</sup>, I Farida<sup>1</sup> and O Sobandi<sup>2</sup>

<sup>1</sup> Department of Chemistry Education, UIN Sunan Gunung Djati Bandung, Jl. AH Nasution No. 105, Bandung, Indonesia

<sup>2</sup> Islamic Education Study Program, UIN Sunan Gunung Djati Bandung, Jl. AH Nasution No. 105, Bandung, Indonesia

\*sari@uinsgd.a.id

**Abstract.** The purpose of this study is to determine alkali metal content by means of flame using smartphone application with experiment. Method stages are performed by making a standard solution and test solution first. Standard solution for determining density line equations to vector norm value. While the test solution is to determine the known concentration of NaCl from the line equations. The standard solutions of each RGB value is tested to get an equation with the value R2 must be close to or equal to 1. The analysis shows that the use values of RGB obtained from a captured image of the video is the color intensity resulting from the flame sodium metal. Level of the standard solution 1 shows result that is quite accurate with test solution levels of 0.0313 g/mL. Likewise with standard solution 2, the result is 0.0063 g/mL and standard solution 3 is 0.00032 g/mL. The value of R2 of the standard solutions must have a value close to or equal to 1. This is because the value of R2 affects the concentration results obtained. If R2 has a value that is very close to 1, an accurate result will be obtained.

### 1. Introduction

One characteristic of alkali metals is flame color [1]. If an alkali metal element or compound is heated, bright colors will be produced that are different for each alkali metal [2]. This causes the light emitted also has certain colors [3]. An alkali metal flame test which has been commonly carried out in the laboratory has difficulty in determining the fires of each light emitted. So there is a need for media that can help determine the color spectra of alkali metals.

Communication and information media in the current era are developing and circulating in society rapidly [4]. Communication media that are widely used by the community as a means of communicating one person to another in another place is a smartphone [5]. Smartphones that have camera applications really help students in learning, especially in the laboratory [6,7].

One experiment that can utilize smartphone applications is the analysis of compounds both qualitatively and quantitatively. This is because data processing carried out through smartphones can be quickly and easily both manually and automatically analysis [8].

The use of smartphone cameras in the laboratory is proven by several experiments that have been carried out. Kehoe and Penn has quantified the different concentration of the compounds in the blue food coloring, lemon-lime beverage, and iron (III) chloride solution using the smartphone cameras [9]. Moraes, et al have used smartphone cameras to identify sodium levels in coconut water and seawater aided by coloring through a flame test. Determination of the smartphone is assisted by the photometer to determine the accuracy of the workings of smartphones processing data [10].



Camera smartphones can be used as a singular spectrometer [11], that is capable of detecting spectra and storing them in files with red-green-blue (RGB) principal colors [12]. These colors are the basic focus for reflecting colors with wavelengths absorbed by light through the use of smartphone cameras [13]. This shows the importance of modern computing processes in chemistry to facilitate both students and lecturers in carrying out a test using coloring [7].

One of the experiments carried out by using a coloring agent in the laboratory is a flame test. Identification of flame tests requires conventional tools which are complicated and expensive [14]. Educational institutions in developing countries have difficulty obtaining sophisticated instruments that can help students to identify metal content [10]. Some high schools and colleges have limited equipment in the laboratory [8]. Therefore the use of smartphones in the laboratory will make it easier for students to identify a substance [6].

Sodium is an alkali metal that can be analyzed by a flame test [2] because it is seen as an object of general clinical analysis [15]. The flame test analysis is related to an atomic emission spectroscopy analysis technique [16]. This is very relevant because of the high sensitivity of atomic emission spectroscopy to color [15]. The flame test for alkali metal is one of the common experiments carried out in the laboratory [2]. Therefore, the experiment conducted aims to test the sodium content in a NaCl solution using a named application RGB Color Detector. Unlike the case with the studies that have been done above. This research is more focused on determining the levels of alkali metal with the flame test using the RGB color detector smartphone application.

## 2. Method

The method used in this study was the experimental method. The tools used in this study were watch glass, metal spatula, analytic balance, 25 mL volumetric flask, 100 mL beaker, stirring rod, methylated burner, smartphone, paperboard, one for each and three spray bottles. The ingredients used were salt 6,66 grams and 225 mL of distilled water. There were three types of variables used in this experiment, namely independent, control and bound variables. The independent variable in this experiment was the standard solution level used to determine the equation which will be used to determine the level of the test solution. The control variables in this experiment were the distance between the camera and fire, as well as the distance of spray with fire. While the dependent variable in this experiment was the level of the test solution containing sodium metal.

This study included the initial procedure performed by 1) a standard solution preparation was done with the steps - steps as follows a) make a standard solution of sodium chloride with various density, b) put the solution in a spray bottle, c) ignite fire in bunsen, d) spray the solution on the bunsen flame while recording e) photograph the flame results with the smartphone camera, f) insert the photos on the video with the brightest color on the RGB application, g) record the results of the intensity on the RGB application, h) process the data in the form of  $\|v\|$  obtained from RGB values and density to get the equation of the line on Ms. Excel. I) determine the density equation for the vector norm value.

Next step 2). Create a test solution done with the steps - steps as follows: a) make standard solution sodium chloride with a variety of density b) put the solution in a spray bottle c) ignite fire on a bunsen d) spray the solution of the bunsen flame while recording and photographing the results of the flame with the smartphone camera e) enter the photos on the video with the brightest flame color on the RGB application f) record the results of the intensity on the RGB application g) process the data in the form of  $\|v\|$  obtained from RGB values and density to get the equation of the line on Ms. Excel.

## 3. Results and discussion

Various metal elements on the block-s produce a distinctive color when burned over bunsen. The colors shown are the result of absorption of heat energy by electrons in an atom that move from lower energy levels to higher energy levels. This condition is referred to as the excitation state. The electron will return to its original energy if the flame color has run out. This is because the absorbed energy is re-emitted in the form of radiation energy and can be detected as a distinctive color [17,18].

The flame reaction produced from these metals is one of the atomic spectroscopy methods. Emission spectroscopy is one of the chemical analyzes used in metal elements. This atomic emission spectroscopy is used both in qualitative and quantitative analysis [16]. The beam of light produced from electron energy emissions from an atom produced from a metal flame can be used as a qualitative analysis. While the intensity of light absorption can be used as a quantitative analysis. This can be done because it is related to the amount of light absorbed by the atom when it is burned [19].

This experiment is done by making a standard solution first to make a line equation which will be used to determine the levels in the test solution. RGB observations for the three standard solutions can be seen in the following table:

**Table 1.** RGB results for standard solutions 1, 2 and 3.

Standard Solution	Type Mass (g // mL)	R	G	B	ll v ll	Line equation	Level test solution
1	0.02	254	229	16	342.36	$y = 336.73x + 336.22$	RGB value (255,235,1)
	0.04	255	227	81	350.88	$R^2 = 0.9773$	$346.77 = 336.73x + 336.22$
	0.06	254	249	10	355.83		$X = 0.0313 \text{ g/mL}$
2	0.002	253	254	9	357.91	$y = 1332.5x + 355.12$	RGB values (254, 249, 75)
	0.004	254	255	14	360.2	$R^2 = 0.9934$	$363.51 = 1332.5x + 355.12$
	0.006	254	254	54	363.24		$x = 0.0063 \text{ g/mL}$
3	0.0002	254	254	14	359.5	$y = 3700x + 358.75$	RGB values (254, 255, 3)
	0.0004	254	255	13	360.2	$R^2 = 0.999$	$359.93 = 3700x + 358.75$
	0.0006	255	255	16	360.98		$x = 0,00032 \text{ g/mL}$

Based on table 1 above, the data obtained is that each standard solution is tested for its RGB value to get an equation with the value  $R^2$  must be close to or equal to 1. The solution tested is a solution which has a known level of 0.03 g/mL; 0.006 g/mL; and 0,0003 g/mL. Then the accuracy of the RGB measurement results can be known.

Based on the results of observational data, the level of standard solution 1 shows result that is quite accurate with a test solution based on RGB of 0.0313 g/mL. Likewise, with standard 2 solutions, the results are 0.0063 g/mL and the standard solution is 0.00032 g/mL. The value of  $R^2$  from the standard solution must have a value close to or equal to 1. This is because the value of  $R^2$  has an effect on the results of the concentration obtained. If  $R^2$  has a value that is very close to 1, an accurate result will be obtained. To see the flame color of each standard solution can be seen in figure 1 below:

Standard solutions 1



Standard solutions 2



Standard solutions 3



Test solution 1



Test solution 2



Test solution 3



Figure 1. Flame Colors of Standard Solutions 1 , 2 and 3.

Based on figure 1, the RGB value obtained from the results of taking pictures from the video is the color intensity produced from the results of the sodium metal flame. The sodium metal has a yellow flame color. The colors shown are the result of absorption of heat energy by electrons in sodium atoms that move from lower energy levels to higher energy levels. This condition is referred to as the excitation state. The electron will return to its original energy if the flame color has run out. This is because the energy absorbed is re-emitted in the form of radiation energy and can be detected as a distinctive color. Atoms that absorb or release energy are atoms that are said to be unstable. Therefore, the most stable atoms are atoms at the basic level. The color intensity that appears in the RGB Color Detector application is the intensity that adjusts to the color that appears. Red-green-blue coloring is assessed and used as a number which will later be converted into a vector norm.

#### 4. Conclusion

The optimum condition for determining the alkali metal content with the flame test using the RGB Color Detector application is when the level of the standard solution approaches the level of the test solution. Levels detected by the RGB Color Detector application on data I is 0.0313 g/mL, in data II is 0.0063 g/mL, and in data III is 0.00032 g/mL.

#### Acknowledgment

We thank the Institute for Research and Community Service (*Lembaga Penelitian dan Pengabdian Masyarakat*, LP2M) UIN Sunan Gunung Djati Bandung, which provided financial support for the publication of this article.

#### References

- [1] Meyer M and Markowitz M 1963 Alkali metal-water reactions *J Chem Edu* **40** 12 633
- [2] Maines L L, and Maines M D 2012 Identification of Unknown Chloride Salts Using a Combination of Qualitative Analysis and Titration with Silver Nitrate: A General Chemistry Laboratory *J Chem Edu* **89** 933-935
- [3] Keenan W, Charles C, Donal, Kleinfelter and Jesse H W 1984 *Ilmu Kimia untuk Universitas Edisi Keenam* (Jakarta: Erlangga)
- [4] Sari S, Anjani R, Farida I, and Ramdhani M A 2017 Using Android-Based Educational Game for Learning Colloid Material *J Phys:Conf. Series* **895** 1-6
- [5] Juraman S R 2014 Pemanfaatan Smartphone Android Oleh Mahasiswa Ilmu Komunikasi Dalam Mengakses Informasi Edukatif **3** 1
- [6] Montangero M 2015 Determining the Amount of Copper(II) Ions in a Solution Using a Smartphone *J Chem Edu* **92** 10 1759–1762
- [7] Lima M G 2016 Integrating a Smartphone and Molecular Modeling for Determining the Binding Constant and Stoichiometry Ratio of the Iron(II) – Phenanthroline Complex: An Activity for Analytical and Physical Chemistry Laboratories *J. Chem Edu* **9**
- [8] Kuntzleman T S and Jacobson E C 2015 Teaching Beer's Law and Absorption Spectrophotometry with a Smart Phone: A Substantially Simplified Protocol *J. Chem Edu* **93** 7 1249-1252
- [9] Kehoe E and Penn R L 2013 Introducing Colorimetric Analysis with Camera Phones and Digital Cameras: An Activity for High School or General Chemistry *J. Chem Edu* **90** 1191-1195
- [10] Moraes E P, Silva N S A, Morais C D L M, De, Neves L S and Lima K M G D 2014 *Low-Cost Method for Quantifying Sodium in Coconut Water and Seawater for the Undergraduate Analytical Chemistry Laboratory: Flame Test, a Mobile Phone Camera and image Processing* 1958-1960

- [11] Kuntzleman T S and Jacobson E C 2015 Teaching Beer's Law and Absorption Spectrophotometry with a Smart Phone: A Substantially Simplified Protocol *J. Chem Edu.* **93** 7 1249–1252
- [12] Lima M G 2016 Integrating a Smartphone and Molecular Modeling for Determining the Binding Constant and Stoichiometry Ratio of the Iron(II) – Phenanthroline Complex: An Activity for Analytical and Physical Chemistry Laboratories *J. Chem Edu* **93** 1 1760–1765
- [13] Hosker B S 2017 Demonstrating Principles of Spectrophotometry by Constructing a Simple, Low-Cost, Functional Spectrophotometer Utilizing the Light Sensor on a Smartphone *J. Chem Edu* **95** 1 178-181
- [14] Koesdjojo M T, Pengpumpkiat S, Wu Y, Boonloed A., Huynh D, Remcho T P, and Remcho V T 2015 Cost Effective Paper-Based Colorimetric Microfluidic Devices and Mobile Phone Camera Readers for the Classroom *J. Chem Edu* **92** 737–741
- [15] Lafratta C N, Jain S, Pelse I, Simoska O and Elvy K 2013 Concentration in a Sports Drink *J. Chem Edu* **90** 372-375
- [16] Anggraeni D and Arif N 2005 Aplikasi Spektrometer Emisi pada Analisis Unsur-unsur Bahan Paduan Aluminium AlMgSi-1 Pusat Pengembangan Teknologi Bahan Bakar Nuklir dan Daur Ulang(P2TBUDU) *J. Teknik Bahan Nuklir* **1** 58-107
- [17] Bretz S L, Vasque A and Mayo M 2017 Development of the Flame Test Concept Inventory; Measuring Thinking about Atomic Emission *J. Chem Edu* **95** 1 17-27
- [18] Baradja 2012 *Demostrasi Sains Kimia; Kimia Deskriptif Melalui Demo Kimia* (Bandung: Nuansa)
- [19] Grasse E E, Torcasio M H, and Smith A W 2016 Teaching UV-Vis Spectroscopy with a 3D-Printable Smartphone Spectrophotometer *J. Chem Edu* **93** 1 146-151



# Proseding

---

## ORIGINALITY REPORT

---

18%

SIMILARITY INDEX

11%

INTERNET SOURCES

12%

PUBLICATIONS

11%

STUDENT PAPERS

---

## PRIMARY SOURCES

---

1	Submitted to Universitas Negeri Jakarta Student Paper	6%
2	iopscience.iop.org Internet Source	5%
3	S Sari, S Rohmah, O Sobandi, D Nasrudin. "Project based learning to develop student's creativities and characters in designing experiments", Journal of Physics: Conference Series, 2020 Publication	3%
4	core.ac.uk Internet Source	2%
5	Submitted to UIN Sunan Gunung Djati Bandung Student Paper	1%
6	Submitted to University of South Florida Student Paper	1%

---

Exclude quotes On

Exclude bibliography On

Exclude matches < 1%