LEARNING FLAME TEST USING A LOW COST EXPERIMENT

O. P. Meena and R. K. Sharma

DESM, Regional Institute of Education,
NCERT, Ajmer-305004
E-mail : opmeenancert@gmail.com

Flame test is the most common way of qualitative analysis of some basic radicals. Metal salts on reacting with concentrated acids impart characteristic colours to the luminous flame and colour of the luminous flame gives valuable information in their detection. Traditionally this test was carried out using costly platinum wire but recently some new experiments of flame test have been designed in which platinum is not required. In the present study a low cost experiment of flame test was introduced for learning of pre-service teachers and results are presented below.

Key words: *Low cost, flame test, metals, colour, pre-service teachers training*

Introduction

Flame test is commonly used to test alkali and alkali earth metal cations in qualitative analysis of their salts. Metal salts on reacting with concentrated HCl, form their chloride and their vapours impart characteristic colour to the flame. The colour may give reliable information about the cation present in the salt. In traditional method flame test is performed using platinum wire. However, flame test can also be performed without using a platinum wire (1-3). During the present study a low cost experiment was used for flame test and its impact on learning of pre-service teachers was investigated. The interesting results of the study are presented in this paper.

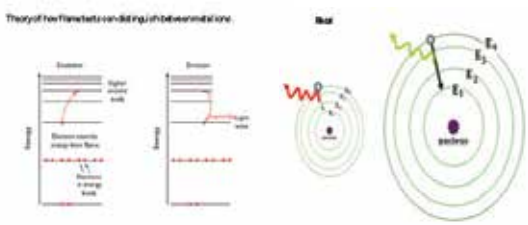
Methods and Procedure

Sample: Pre-service teacher training programmes form the four-year integrated BSc. BEd. course. In the first year of BSc. BEd. there is inorganic qualitative analysis as part of the practical chemistry syllabus. Around 100 students perform the practical experiment in a group of 20 students each. Students of the course are highly meritorious and keen to learn the different aspects of chemistry practicals.

Procedure: Pre-service teachers were very well instructed about the safety aspects while performing qualitative analysis of inorganic mixtures. They were explained about the theoretical basis of the analysis and the principle and role of flame test in qualitative analysis of metal cations. It was explained that:

- Energy and frequency of light are directly proportional to each other $E = h\upsilon$, and frequency/wavelength affects the colour of the light if energy is absorbed from visible region.
- Each element has its own distinct electronic configuration and set of energy levels. Therefore, different elements allow electrons to make different electronic or energy transitions.

- These different energy transitions result in different colours of light being emitted.



A systematic approach of flame test using platinum wire was explained and it was emphasised that platinum is a costly metal so we should use the low cost material to perform the flame test. Recently some experiments have been designed for low cost flame test and direct use of some chemicals to perform the flame test makes it highly economical. The following procedure was explained to perform the flame test using these chemicals:

Take a cleaned watch glass and place 0.5-1.0 gm of salt and then put nearly 10-15 drops of ethanol or methanol over it with a plastic dropper. The salt should properly get moistured with alcohol. Now lighten the heap with a match box. Flame will appear from the heap and may appear for about a minute or more depending on the amount of alcohol added. Now observe the colour of the flame. The following concepts were also discussed:

- Ethanol and methanol are flammable and when mixed with oxygen and ignited create an explosion.
- When an atom's electrons drop from the excited state to the ground state, a wavelength of light will be emitted. Metals have characteristic emissions of light that can be used to identify the individual metal.
- The flame colour will depend on the salt nature and will indicate the cation present and the observed flame colour will be as follows (for different cations as is seen in a flame test with platinum wire).

The colour of flames produced by different metal ions is given below in Table 1.

Table 1

Flame coloration for different metals

S. No.	Metal ions	Flame colour
1.	Na^{+}	Yellow
2.	K^{+}	Violet
3.	Ca^{2+}	Brick red
4.	Sr^{2+}	Carmine–Red
5.	Ba^{2+}	Apple–Green

Since the test does not require any specific or sophisticated arrangement, it can be demonstrated easily in classroom situation.

Fig. 1. Photograph-1: Demonstration of low cost flame test

Feedback of Learners

After performing the flame test for qualitative analysis of inorganic mixture, feedback of

pre-service teachers was taken through interview of the individuals. They reported that this method is easy to perform a flame test. Secondly, results of the flame test are very apparent and they were able to identify the metal present in the mixture on the basis of colouration of the flame. They also reported that performing a flame test using low cost material was enjoyable for them. Overall this was highly appreciated by the pre-service teachers.

Conclusion

Feedback of the pre-service teachers clearly indicates that this method is equally applicable to the traditional method of flame test using platinum wire.This test does not require any specific or sophisticated arrangement and can be demonstrated easily in classroom situation. Thus, such type of low cost experiments should be designed and encouraged in day-to-day practical classes.

References

Flinn Scientific Inc. *Manual*. 2004. www.flinnsci.com

Lange, N.A. 1952. *Lange's Handbook of Chemistry*, *8th Edition*. Handbook Publishers Inc.

Michael, J. Sanger and Amy J. Phelps. 2004. Simple Flame Test Techniques Using Cotton Swabs, *Journal of Chemical Education.* Vol. 81, No. 7. p. 969.