

LOW-COST INSTRUMENTATION FOR COLORIMETRY

by

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Abstract

The development of low-cost analytical instruments is a major step forward in the search for a solution to upgrade and improve the chemical education in Sri Lanka. It will help to overcome some drawbacks in the current education system. In this research the colorimetric devices have been selected to provide the foundation to build a close link between Chemistry, Physics and Instrumentation.

It is well known that the first colorimeter which was invented in the beginning of this century, employed sunlight as the radiation source. Since then the tungsten lamp has been employed with the support of optical filters. The ultimate goal of this project was to fabricate low-cost colorimetric instruments using LEDs as the radiation source and locally available electronic components.

A simple multi-purpose device was constructed using low-cost materials and a classical Spectrophotofluorimeter, to build different models of colorimeters. The effect of radiation sources (tungsten filament lamp, tungsten filament lamp with optical filters and LEDs) on the colorimetric measurements was studied using these colorimeters. The constructed multi-purpose device was successfully applied to monitor the emission spectra of tungsten filament lamps and LEDs. The transmittance spectra of coloured optical filters and coloured solutions were also monitored by the constructed device and they were compared with the spectra obtained by a computerized double beam Spectrophotometer.

Three different types of low-cost colorimeters were designed using LEDs as the radiation source, for the purpose of introducing colorimetry for the secondary level education in Sri Lanka. In these instruments the reagent blank adjustments were arranged in three different stages of the signal amplification. The cell compartments and measurement display units were also different to each other. But the performance of the colorimetric measurements was not different in each colorimeter. These colorimeters which cost Rs. 2000 to 3000 can be introduced to the local market as the first low-cost colorimeters produced in Sri Lanka.

The micro plate reader, which costs about Rs: 4,00,000 is the instrument used for multiple sample analyzing in hospitals. In Sri Lanka, no effort has been taken to develop a low-cost colorimetric instrument to replace this expensive micro plate reader. Therefore a semi-automated multiple sample analyzer was fabricated modifying the colorimetric instrumental arrangement. The mechanism of this instrument was designed to minimize the production cost (Rs: 10,000). Hence it is possible to take a step forward in producing multiple sample analyzers for rural hospitals in third world countries like Sri Lanka.