

Design of a Low Cost Single Beam UV/VIS Spectrophotometer for DNA Measurement

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ABSTRACT: The objective of this research is to design and build a complete simple and low cost spectrophotometer for the DNA measurement. The designed system consists of :two light sources deuterium and halogen lamp ,a monochromator based on Fastie Ebret design ,a photodiode, a chopper amplifier circuit and a data acquisition system. The system is controlled using an Atemga microcontroller .the experimental results show good wavelength accuracy.

KEYWORDS: Chopper amplifier, DNA, Photodiode, microcontroller, Spectrophotometer.

I. INTRODUCTION

DNA (deoxyribonucleic acid) is a polymer found in all living cell, it contains all genetic information needed for controlling cellular growth and development. DNA contains the genetic information necessary for the production of other cell components [23].

DNA has been the subject of many physical and chemical investigations, leading to discovery of genetics code and genome sequencing, this effort lead to identification of point mutations and their correlation to pathologies such as cancer and it is a major target for drug interaction. Thus it is very important to explain the factors that determine affinity and selectivity in binding molecules to DNA [23]. From this point of view the expansions and technological to detect DNA are very important

Spectrophotometers can be used to estimate DNA and RNA concentration and to analyze the purity of the sample. Christian and Wartburg made the first measurement using spectrophotometer for nucleic acid at 260-280nm [20].

Spectrophotometry is more and often the method of choice in the analysis of biomedical substance, assessment of food quality, physical properties of various objects, classification and monitoring of optical telecommunication links [22]

Spectrophotometer is a quantitative method uses the absorbency of light by substance and takes advantage of two laws of the light absorbency [25]. Lambert law proposed that the proportional of light absorbed by a medium is independent of the intensity of incident light [26]and Beer stated that the absorption of light is directly proportional to both the concentration of the absorption medium and thickness of the medium [25] called path length and allow the measuring sample of different path lengths.

$$\text{Absorbency} = \text{concentration} \times \text{pathlength} \quad (1)$$

The major drawback of the absorbency detection in microvolumes is that the optical pathlength through the sample decreases as sample volume decrease and this affects the sensitivity [27]. The spectrophotometer is an instrument used to measure the absorbance of a sample according to beer Lambert law. It contains the light sources, spectrometer, detectors and display unit. The light sources which can be used include deuterium, halogen, xenon, and tungsten lamp, etc..