The Integrating Sphere-Based Setup as an Accurate System for Optical Properties Measurements

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Abstract: Determination of the optical properties of solid and liquid samples has great importance. Since the integrating sphere-based setup is used to measure the amount of reflected and transmitted light by the examined samples, optical properties could be calculated. Our study is a preliminary step toward studying the optical properties of bacterial samples.

1. Introduction

Optical Properties:

The optical properties determination for solid and liquid samples is important in many technological applications e.g. nano-sensing instruments, biomedical treatments and the industrial field. The optical properties (scattering and absorption coefficients) at a specific wavelength can mainly be used to describe the light transport inside the media, which gives information about the interaction of that specific light wavelength with the media [1].

Integrating Sphere-based Setup:

One of the techniques used to measure optical properties is the use of a device known as the integrating sphere. This integrating sphere-based setup measures the amount of light reflected and transmitted by samples at a specific wavelength where the obtained results are used to calculate the optical properties [1,2]. The function of an integrating sphere is to spatially integrate radiant flux. The geometry of the sphere ensures that every point within a sphere receives the same intensity of light. [1,2]

In the field of biomedical optics, determination of the optical properties of various biological materials is essential in therapeutic applications, as an example in the development of tissue light propagation models for various types of laser therapy. For this work phantoms were prepared using Aka-Resin, titanium IV Oxide powder and black carbon powder. Many parameters were examined to prepare the integrating sphere-based setup (Figure 1), to be used in measuring the optical properties of bacterial samples. The resulting measurements of the bacterial samples will be compared with a numerical skin model in order to describe and assess the effect of the bacterial lethal dose on the surrounding skin tissue.

2. Results

Studies were done using solid phantoms made to simulate the human tissue; It is shown in figure 2 that by increasing the phantoms' thickness, there is a change in the diffused transmittance, the total transmittance and the reflectance; Phantoms' measurements were performed using the integrating sphere-based setup.

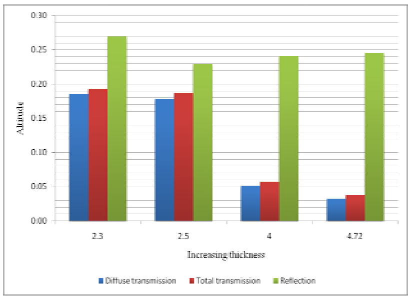

Fig.2 The diffuse and total transmission and reflection measured by the IS setup for different sample thicknesses.

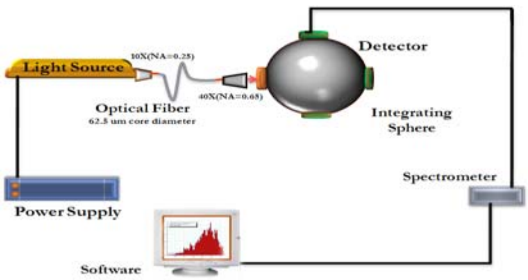

Fig.1The integrating sphere based setup

3. References

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