VOL. 16, NO. 5, MARCH 2021 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

www.arpnjournals.com

PIXEL BY PIXEL PROCESSING TECHNIQUE TO CHARACTERIZE TISSUE IMAGING

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ABSTRACT

Polarimetric Tissue Imaging is a mounting strategy that utilizations polarized source beam light to assess the physical and physiological properties of experimental tissues. Polarization Ellipsometric strategies are utilized to grasp the diversity of polarization properties of light over experimental tissue. The extracted optical mark framework assists pathology department to analyse and survey the experimental tissue analysis and gives some information about the working of the experimental tissue. In this experimental tissue analysis the tissue are obtained from pathology lab of Reputed Medical College, Hyderabad, and are exploited for observing the Mueller values of the experimental tissue and extracting the De-polarization, Di-attenuation and Retardance pictures and to obtain its physical values. Situations to extract an unique Mueller values with pivoting optics are tended to besides are utilized to comprehend the polarization changes in the experimental tissue through a new pixel to pixel method, by means of the standardized Mueller values of the experimental tissue.

Keywords: depolarization, mueller values, di-attenuation, retardance and experimental tissue.

1. INTRODUCTION

The polarization effects that occur in a tissue test of intrigue are effectively understood by exhausting Polarization Elli-psometric strategy by means of the acquired Mueller values, various methods and structures utilized, that portrayed by significant scholars [1-4]. One among them is to comprehend the polarization properties of the experimental tissue assessment by exploiting 16 force pictures attained from a pre-defined Polarization type State Generator (PSG) and Polarization type State Analyzer (PSA) with pivoting wave-plates, Polarizer and Analyzer [1-5].

Final Mueller Polarimeter is the most important one that requirements to obtain essential certain imperatives, most important essential limitations is that the Degree type of Polarization should to be not accurately or comparable to one, scientifically it is represented as

$$P = \frac{\sqrt{\left(S_1^{\,2} + S_2^{\,2} + S_3^{\,2}\right)}}{S_0} \le 1 \qquad \text{---------- (1)}$$

2. THEORY

Source light ray is equivalently denoted by the vector- 'S' interaction on an anisotropic type tissue from a PSG, experiences a change and is analysed by Mueller values 'M' and the changed stokes-vector is composed as

$$\begin{pmatrix} S_0' \\ S_1' \\ S_2' \\ S_3' \end{pmatrix} = \begin{pmatrix} m_{11} & m_{12} & m_{13} & m_{14} \\ m_{21} & m_{22} & m_{23} & m_{24} \\ m_{31} & m_{32} & m_{33} & m_{34} \\ m_{41} & m_{42} & m_{43} & m_{44} \end{pmatrix} \begin{pmatrix} S_0 \\ S_1 \\ S_2 \\ S_3 \end{pmatrix} \qquad \text{---------- (2)}$$

The Mueller values of matrix M can be additionally composed as

$$M = m_{11} \begin{pmatrix} 1 & \bar{D}^T \\ \bar{P} & m \end{pmatrix} \qquad \text{---------- (3)}$$

Where $\bar{D} = \frac{1}{m_{11}} \begin{pmatrix} m_{12} & m_{13} & m_{14} \end{pmatrix}^T$ and

$$\bar{P} = \frac{1}{m_{11}} \begin{pmatrix} m_{21} & m_{31} & m_{41} \end{pmatrix} \qquad \text{---------- (4)}$$

are named as Di-attenuation and Polarizance vectors individually and 'm' is order of 3 X 3 grid matrix [14-15].

Di-attenuation portrays the concentration values of source beam polarization type states. The di-attenuation takes esteem numbers between 0 to 1. All the Mueller values may or it may not be physically truly feasible. Essential requirement for a Mueller values to be genuinely feasible is,

$$\left(MM^T\right)^T = \sum_{i,j=1}^{4} m_{ij}^{\,2} \le 4m_{11}^{\,2} \qquad \text{---------- (5)}$$

3. EXPERIMENTAL PROCEDURE

The experimental tissue was intermingled with laser beam of 10mWatts and 556nmeter wave-length with PSG. Analysing side optics is arranged in order as of the initial source beam alignment through-out the total experimental type analysis to obtain different intensity pictures in the transmission type style and the valid data from the intensity pictures is collected with the CCD, in

PSA type framework then the pictures to be collected in JPEG type. As appeared in Figure-1.

Figure-1. Experimental arrangement.

The experimental tissues collected are from the pathology department. The experimental tissues collected from the department are thyroid type tissue preparation is transmitted in 10% type formalin for appropriate obsession of the experimental tissue. Autolyzed and unfixed experimental tissue can't be prepared. Experimental sample tissue is cleared accordingly and needs to be collected from specific place to select the experimental thyroid tissue that must be distinguished. With the help of a surgical tool cutting edge the specified piece of the experimental thyroid tissue is made into even type shape formed bits and converted in the form of capsules. Tissues in the form of capsules are then further processed through various convergences of liquor for drying out and solidifying of the experimental tissue. Sample is embedded to compartments by liquid wax for the im-pregnation of the wax to the experimental tissues. It solidifies the experimental tissue to get ready in the form of squares, later cut into different forms. Thisim-pregnated experimental tissue is obstructed with liquid wax and the separated surface of the bosom tissue are appropriately adjusted and afterward permitted for solidification. Obtained squares are attached onto a small scale structure which splits the experimental tissues as squares in to 4-5 microns dense areas [11, 12]. Obtained segments are then fixed on the slides then processed by Haematoxylin and Eaosin type pigments and represented in Figure-2.

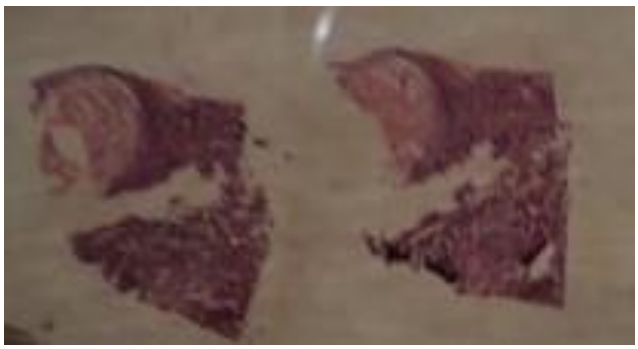

Figure-2. Experimental tissue (Thyroid).

By changing the related optical components in the PSG structure and the PSA structure, 49 various types of the pictures were collected [6]. 49 various types of the images with different directions of Polarizer and Analyser equipment are important to generate the 16 components of Mueller value pictures [7-10]. The 49 different recorded pictures acquired are represented as

$I_{O.O.}$	$I_{O.H.}$	$I_{O.V.}$	$I_{O.P.}$	$I_{O.M.}$	$I_{O.R.}$	$I_{O.L.}$
$I_{H.O.}$	$I_{H.H.}$	$I_{H.V.}$	$I_{H.P.}$	$I_{H.M.}$	$I_{H.R.}$	$I_{H.L.}$
$I_{V.O.}$	$I_{V.H.}$	$I_{V.V.}$	$I_{V.P.}$	$I_{V.M.}$	$I_{V.R.}$	$I_{V.L.}$
$I_{P.O.}$	$I_{P.H.}$	$I_{P.V.}$	$I_{P.P.}$	$I_{P.M.}$	$I_{P.R.}$	$I_{P.L.}$
$I_{M.O.}$	$I_{M.H.}$	$I_{M.V.}$	$I_{M.P.}$	$I_{M.M.}$	$I_{M.R.}$	$I_{M.L.}$
$I_{R.O.}$	$I_{R.H.}$	$I_{R.V.}$	$I_{R.P.}$	$I_{R.M.}$	$I_{R.R.}$	$I_{R.L.}$
$I_{L.O.}$	$I_{L.H.}$	$I_{L.V.}$	$I_{L.P.}$	$I_{L.M.}$	$I_{L.R.}$	$I_{L.L.}$

Here, primary alphabet demonstrates input stage (PSG); another alphabet represents result oriented stage (PSA).

After obtaining the different 49 pictures from different polarizing states obtained by the combination of different polarizing and analysing positions, the 16 pictures related to the generation of the Mueller values are acquired by utilizing the below mentioned algorithm.

$m_{11}= I_{O.O}$; $m_{12}= I_{H.O}-I_{V.O}$
$m_{13}= I_{P.O}-I_{M.O}$; $m_{14}= I_{L.O}-I_{R.O}$
$m_{21}=I_{O.H}-I_{O.V}$; $m_{22}=(I_{H.H}+I_{V.V})-(I_{H.V}+I_{V.H})$
$m_{23}=(I_{P.H}+I_{M.V}))-(I_{P.V}+I_{M.H})$; $m_{24}= (I_{R.V}+I_{L.H})-(I_{R.H}+I_{L.V})$
$m_{31}=I_{O.P}-I_{O.M}$
$m_{32}=(I_{H.P}+I_{V.M})-(I_{H.M}+I_{V.P})$; $m_{33}=(I_{P.P}+I_{M.M})-(I_{P.M}+I_{M.P})$
$m_{34}=(I_{R.M}+I_{L.P})-(I_{R.P}+I_{L.M})$; $m_{41}=I_{O.L}-I_{O.R}$
$m_{42}=(I_{H.L}+I_{V.R})-(I_{H.R}+I_{V.L})$; $m_{43}=(I_{P.L}+I_{M.R})-(I_{P.R}+I_{M.L})$
$m_{44}=(I_{R.R}+I_{L.L})-(I_{R.L}+I_{L.R})$

4. RESULTS

The 49 different pictures collected are utilized to acquire the 16 natural element Mueller values by utilizing the above algorithm; these gathered different pictures are represented in below Figure-3.

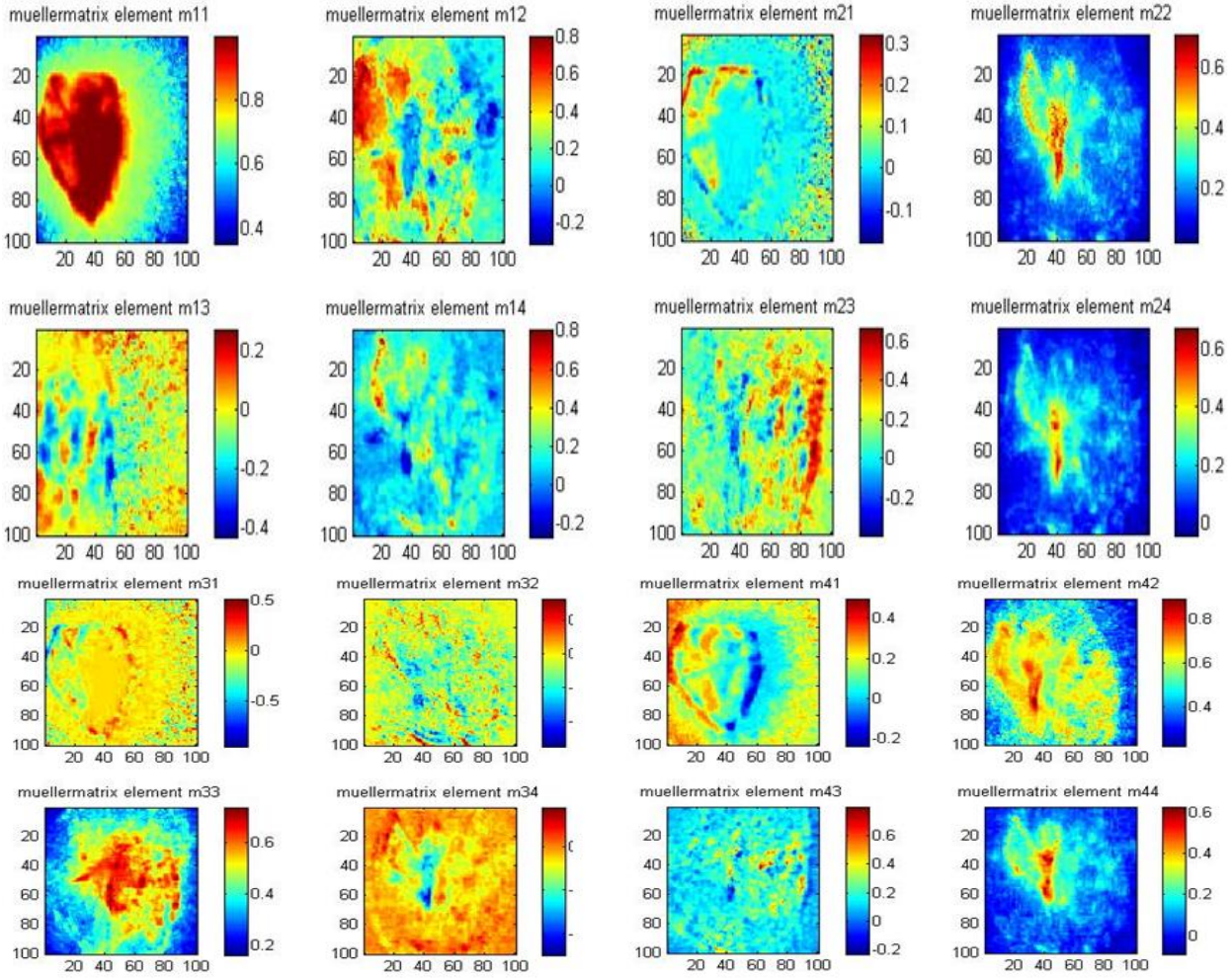

Figure-3. Mueller value related pictures of experimental tissue.

After obtaining the different 16 pictures, the pictures are analysed by using the MATLAB code to obtain the values from each and every part of every single pixel of picture [13]. A Mueller value acquired is standardized by the primary component of matrix framework, separate dependent concentration properties of the pictures, investigates the Mueller Values components that are demonstrated in Table-1.

Table-1. The 16 component Mueller values of experimental tissue.

(M_{11}) **1**	**(M_{12})** **0.2420**	**(M_{13})** **0.0737**	**(M_{14})** **0.1403**
(M_{21}) 0.0111	(M_{22}) 0.0220	(M_{23}) 0.0245	(M_{24}) -0.0214
(M_{31}) -0.0439	(M_{32}) -0.0410	(M_{33}) 0.0341	(M_{34}) 0.0423
(M_{41}) 0.0118	(M_{42}) 0.2301	(M_{43}) 0.0439	(M_{44}) -0.0423

Here we obtained Mueller values the Di-attenuation, Retar dance and De-polarization pictures generated by code and the achieved pictures are signified in Figure-4. Mean analysis of Di-attenuation value is 0.1925, De-polarization value is 0.3425 and Retardation value is 2.2112.

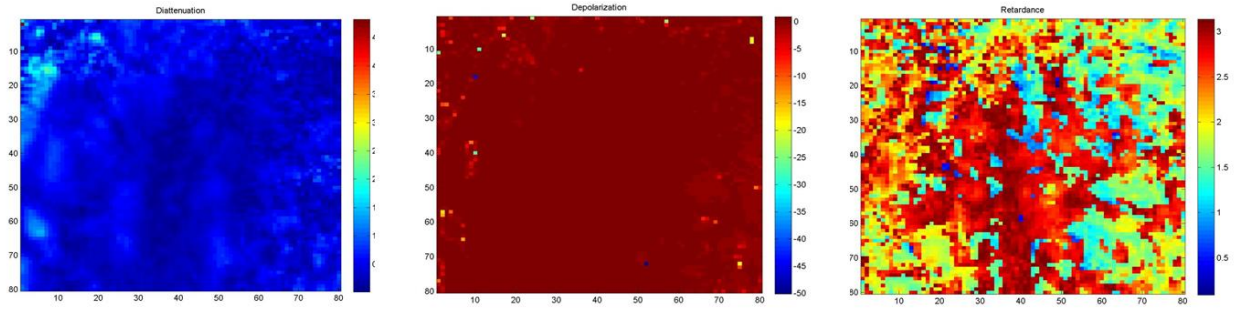

Figure-4. Di.attenuation, De.polarization and Retardance pictures of experimental tissue.

5. DISCUSSIONS

Response of experimental tissue sample seen in means of the changes in the different polarizations showed through the Mueller values; Final Mueller value Polari meter is conceivable through our adjusted investigational arrangement. Estimations of Di-attenuation, De-polarization and Retardance values to be estimated in regarding to our previous experiment done on wood material tests and coffee seeds tests. Experimental work is further processed in progress to correspond the polarizance anisotropic varieties concerning w.r.t. the microbial cell execution of experimental tissue i.e., w.r.t. the amount of stutterers like mito-chondria and so forth in a specific area which occurs in malignancy, then other ceaseless ailments of like type ought to be appeared through the estimations of de-polarization values also.

6. CONCLUSIONS

Final Mueller value Polari meter is conceivable from a P.S.G and P.S.A for experimental tissue it is clear from the pictures and intensity in numerical what we generated. Pixel to Pixel analysing procedure for the obtained pictures viably brought about the understanding of the polarization anisotropic type changes and scattering type variations scatterings existing in various areas of the experimental tissue (Thyroid).

ACKNOWLEDGEMENTS

The researchers might want to thank their parent Institutions and Organizations for their benevolent assistance; we are additionally appreciative to pathology department, Hyderabad for providing the experimental tissue (Thyroid) sample. We thank the Department of Physics, University of Dodoma, Tanzania for the facilities provided to conduct this experiment.

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