SURFACE PLASMON RESONANCE (SPR) CURVATURE PHENOMENON USING OTTO CONFIGURATION AS SATURATED AND UNSATURATED FATTY DETECTION ON CHOLESTEROL FOOD

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Abstract

Surface Plasmon Resonance (SPR) on thin layer of conductive 50:1 PVA-coated silver nanoparticles (AgNPs@PVA) 0.02 M on 11-20 nm using Otto Configuration have been observed for monitoring cholesterol level of crude palm oil time-cooking for food-cholesterol. Its has been proved gap between prism/air/silver on 850 nm. Surface Plasmon Resonance (SPR) phenomenon analyzed by HeNe laser on (= 632,8 nm). SPR curvature has been showed by observing reflectance of laser incident angle variation on the prism. SPR angle for the prism/Ag system is (44.4 ± 0.05)° with the reflectance value on 0.8. Due to the addition of AgNPs@PVA ,also after the reaction for one-time cooking of with quail eggs (high-cholesterol/high-unsaturated fatty), SPR angle shifts to (47,8 ± 0.05)° with the reflectance value on 0.58 using MATLAB simulation. The shifting on SPR angle shows that the sensitivity SPR is a biosensor.

Keywords : surface plasmon resonance (SPR), Otto configuration, cholesterol food

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1. Introduction

Otto configuration will be used in this research as the new observational evidence of SPR method. Otto configuration becomes the role modeling experiment evidence to prove how could SPR works in bio-molecule interaction as biosensor.

Besides Kretschmann configuration, there are other configuration in SPR method is Otto configuration. Otto configuration is very rarely used in SPR experimental method. So that, the use of this configuration as well as method for identifying palm oil frying-usage. It could be the new experimental observation in biosensor using SPR method. The purpose of this experiment using Otto configuration is identifying effect of the air gap existence in nanometer towards SPR phenomenon. Otto configuration usually designs in theoretical and simulation. Because of that, Otto configuration can prove the phenomenon of Plasmon interaction by the air gap-range. According to the orde of air gap usually use in Otto configuration is about nanometer. Otto configuration also can prove surface plasmon resonance based on air gap variation between prism and dielectric materials. it also can prove evanescent wave phenomenon existence by air gap variation. [1]

In the Otto geometry, a high refractive index prism with refractive index interfaced with a dielectric-metal waveguide consisting of a thin dielectric film with refractive index [2].

2. Research Methods

This research consists of two methods , these are identifying SPR curvature in Otto Configuration and proving the simulation of SPR curvature using MATLAB.

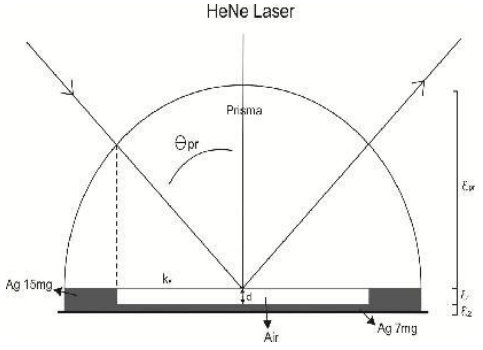

Figure 1. Otto Configuration in SPR System

According to figure 1, those picture is the experimental design of Otto configuration. A light wave incident on the prism-dielectric film interface at an angle of incidence larger than the critical angle of incidence for these two media produces an evanescent wave

propagating along the interface between the prism and the dielectric film. If the thickness of the dielectric layer is proper (typically few microns), the evanescent wave and a surface plasmon at the dielectric-metal interface can couple with each other. For the coupling to occur, the propagation constant of the evanescent wave and that of the surface plasmon have to be matched [3].

3. Results and Discussion

The differences mass of prism describes thickness of silver. SPR curvature of 10mg more tight than 15mg, 20mg and 30mg. it has been proved that thickness of silver give the influences of SPR curvature. Silver mass also gives the influences of the thickness. The biggest silver mass will thicker than the smallest silver mass. SPR curvature of the biggest silver mass will be wider. Although the reflectance not too near from zero, it takes minimum thickness.

Otto configuration still becomes the method of SPR phenomenon although it must be proved on nanometer air gap existence. These are the SPR Phenomenon in Otto configuration based on experimental observation [4].

The critical angle proves left-propagated to bigger value of incident angle. It shows on $41{,}4^{o}$ for all the variation of thickness. It proves that critical angle just gives influence to refractive index. Refractive index of silver mass variation is constant. From the methods, silver on 10 mg, 15 mg, 20 mg and 30 mg have SPR angle at $44{,}4^{0}$; $44{,}4^{0}$; $45{,}1^{0}$; and $45{,}9^{0}$. According to the figure, otto configuration describes how evanescent waves proved on the gap thus cause plasmon therefore ATR curvatures turn up. The equation is

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$$R_5 = |r_{12345}|^2 = \left| \frac{r_{12} + r_{2345} e^{ik_2 d_2}}{1 - r_{12} r_{2345} e^{ik_2 d_2}} \right|^2 \qquad \text{Eq.1}$$

at $(47{,}8 \pm 0{,}05)°$. Because of that, the SPR simulation and experimental shows the shifts around 3,4. This result shows that in experimental observation refractive index of CPO in frying-quail's eggs is increasing. While the increasing of refractive index, yolk percentage of frying-Quail's eggs also are increasing. This shows that saturated fatty acid of frying-Quail's eggs is increasing too[5]. Therefore, the frying-foods cholesterol level can be detected using Otto configuration in biosensor based on SPR phenomenon.

SPR in Otto Configuration Simulation

SPR phenomenons have been observed on experimental and MATLAB simulation. Those results prove that SPR can explain the bio-molecule interaction, it is called biosensor.

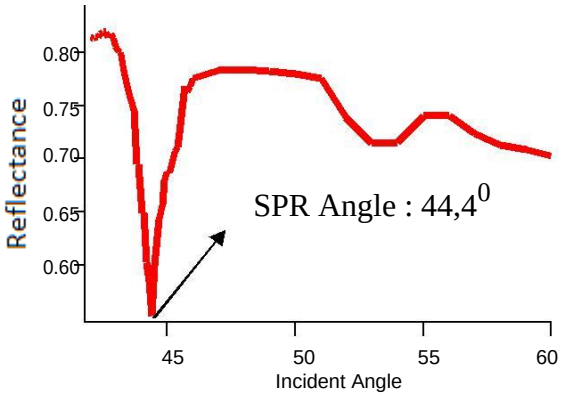

Figure 4. SPR spectrum for the optimum gap of otto configuration in 850 nm Ag thickness

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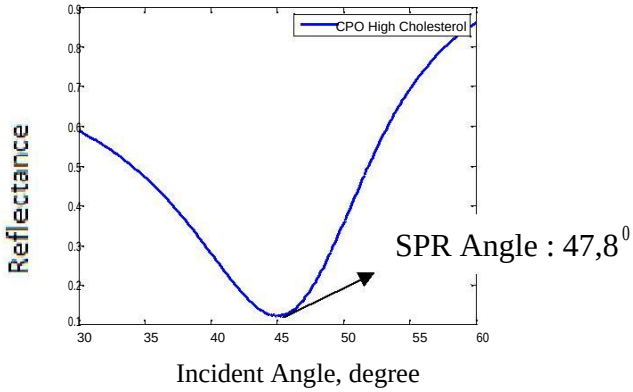

Figure 5. SPR spectrum using MATLAB simulation on high-cholesterol food level in otto configuration

These results describe the angle shift of SPR. SPR angle in the Quail's Eggs. The Quail's Egg is

4. Conclusion

According to this experiment and the theoretical background or the simulation, the conclusions are Otto configuration can be proved in 850 nm as the optimum air gap, SPR phenomenon can be proved by Otto configuration on bio-molecule interaction and Otto configuration becomes the new observational evidence based on SPR phenomenon by justification using computational MATLAB simulation.

Acknowledgement

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