Hepatitis Virus Detection in Medical Diagnosis Using Biosensor

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Abstract— Wireless To improve public health we are using technology such as biosensor. In Medical diagnosis of Hepatitis B virus A biosensor had great impact in diagnosis with analytical methods by restricting sensor nodules for detection of bi-omolecular such as virus, protein, biomarkers, DNA Hybridization and Hepatitis surface antigen antibody ability Surface plasmas resonance biosensors used in detecting Hepatitis B virus using non faradic spectroscopy. In our Paper we are comparing the above methods with different types of biosensor or Hepatitis B virus.

Keywords: Hepatitis B, Biosensor, virus detection, DNA hybridization.

I. INTRODUCTION

A Hepatitis B virus (HBV) infection is one of the major health problems worldwide, transient and chronichep-atitis also known as post-transfusion hepatitis. Blood and plasma sample my contain virus and Hepatitis B may lead to hepatitis, cirrhosis, and liver cancer. It is estimated that there are 2 billion People with a serological profile pastor current HBV infections; 360 million patients with chronic HBV associated liver disease. Over 750,000 people past die of hepatitis B each year infection, Biosensor used for the detection of hepatitis B biosensor is an analytical devices which combines a biological components with a physicochemical detector. In this review focus on principle of biosensor, types of biosensor (electrochemical, optical, piezoelectric), importance of the biosensor.DNA hybridization based method used to detect hepatitis B virus and also used method surface antigen antibody ability. We are comparing these methods results. During the HBV infection, the antigen appears in the the serum of patients duringtheincubation period.Biasensor based on streptavidin nanoparticals used for detection of Hepatitis B (HBV). DNAHBV is spread predominanatly by percutaneous to infected blood and body fluids with numererous forms use

II. PRINCIPLE OF BIOSENSOR

Biosensor includes three segments namely.1.Asensingbioreactor 2. A transducer 3. A detector with digital output, in first segment target analytic interacts with inceptor; the second segment is the detector part that changes the resulting signal from the contact of the analytic through reaction, specific adsorption, or another process such as physical or chemical interaction. Then transducer translates molecular changes to signal which is measure by digital detector module. The man feature of biosensor is exceptional performance, user-friendly operation, rapid response, high sensitivity and specificity, portability, relatively compact size and real-time analysis.

Types of Biosensor

There are several types of biosensors based on sensor devices and the type of biological materials used. A selected few of them are discussed below.

Electrochemical Biosensors

Electrochemical biosensorshave been used in various areas for longtime. Semiconductors screen-printed electrodes based biosensor have typical platform. This biosensor used for monitor any alterations in dielectric properties such as Dielectric properties such as dimension, shape and length charges distribution the electrochemical for detection various type biological targets such as cancer biomarker, nucleic acid, protein sand so on.

Piezoelectric Biosensors

Piezoelectric biosensors are group of analytical device working on a principle of affinity interaction regarding. Apiezo electric biosensor is also known as quartz crystal micro According to record frequency & damming change quartz crystal resonator, this biosensor measures any mass change and visco elasticity of materials. These biosensor have been used in wide variety of applications including hormone, bacteria, cell and so for detect targets.

Optical Biosensor

The optical biosensor is a device that uses an optical measurement principle. These biosensors can be

divided into two groups first is direct optical biosensor and second is indirect optical biosensor. Direct biosensor used for such Immune sensor and free analytic detection. For indirect biosensor, multiple biosensor available in market such as out rode-based fiber optical biosensors, evanescent aver fiber optical biosensor, inter fereometry biosensors & the Surface Plasmon Resonance biosensors. Their detection window is so versatile, and they sense multiple types of physiological and biological specimens.

III. IMPORTANCE OF BIOSENSOR IN MEDICAL DIAGNOSIS

Biosensor and their role in medical science including early stage detection of human interleukin-10Causeing heart diseases, rapid detection of human papilloma virus .several researchers of various field including biologists, chemists ,physicists, medical doctors have been joined to use the bio-sensor such as doing analysis ,diagnosis, food safety, laboratory medicine and so on. Bio-sensors used because have variety of properties such as fast. Analysis, portability, stability, selectivity. These biosensors can quick and multi-analytic detection in point-of-care diagnostics. Other types of biosensor for medical diagnosis including optical, electrochemical, piezoelectric, magnetic, micro-mechanical, thermal l Many technique used biosensor for virus detection in medical

Literature Summary

S.NO	PAPER	ADVANTAGES	LIMITATION
1	Global epidemiology of hepatitis B virus infection: New estimates of age-specific HBs Ag sero prevalence & endmicity	Find a very Large burden of HBs Ag infection in all regions.	HBs Ag prevalence data are lacking in some regions. Not considered in analysis such as genotype information.
2	Production of surface Plasmon resonance based kit for hepatitis diagnosis	SPR biosensor has become a central tool for characterizing& quantifying bimolecular interactions.	Require the affinity &binding constants kinetics studies with SPR using HBs Ag.
3	Detection of Hepatitis B virus DNA with a paper electrochemical sensor.	The slip DNA for detection of HBV DNA using one –step sandwich assay. it is user friendly. It is capable of handling assays that employ MuBs, To detect pcomolar level of HBV DNA target.	The DNA sandwich must be prepared excite which for POC applications is not desirable. Reagent resolving problem. Issue related to nonspecific adsorption.
4	SERS detection of hepatitis B virus DNA in a temperature responsive sandwich hybridization assay.	SERS sensor developed for ultrasensitive detection of HBV DNA. SERS biosensor used in molecules, proteins.	SERS used in ultrasensitive detection of HBV DNA.
5	An impedimetric DNA sensor based.	It used for non-faradic electrochemical impedance EIS.	Consider as sensitive camp red to classical, detection analysis.

Method used for detection of Hepatitis B by biosensor

There are two methods use for detection of Hepatitis B.

1. Global epidemiology of hepatitis B virus infection: New estimates of age-specific HBs Ag Seroprevalence and endemicity
2. Production of surface Plasmon resonance based assay kit for hepatitis diagnosis.

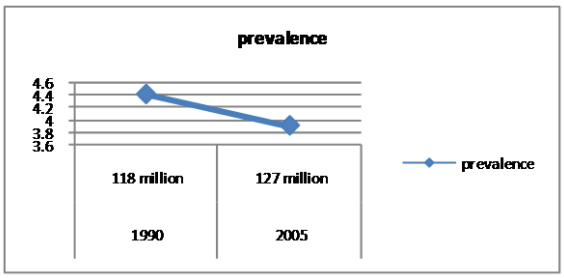
1. Global epidemiology of hepatitis B virus infection: New estimate of age-specific HBs Ag Seroprevalence and endemicity:

In this method HBsAg seroprevalence data extracted. Addition information obtained, number of individuals year of publication, primary author tested for HBs Ag, laboratory test and study year. If year are missing two prior to publication assumed. If age imputed based on contextual information such as army recruits and soldiers between 18 to 45 years Blood and organ between 17 to 65 years Children between 5 to 15 years Data on each parameter are synthesized using a hierarchical empirical Bayesian Model. Des mid fits a Bayesian model using data in that time, age region group and empirical priors for all epidemiological parameters, generating posterior estimates of Incidence, remission, and mortality that is internally consistent. Age and regions HBsAg prevalence was used to calculate the absolute number of individuals chronically infected with HBV. HBsAg testing us the primary way to identify persons with chronic HBV infection.

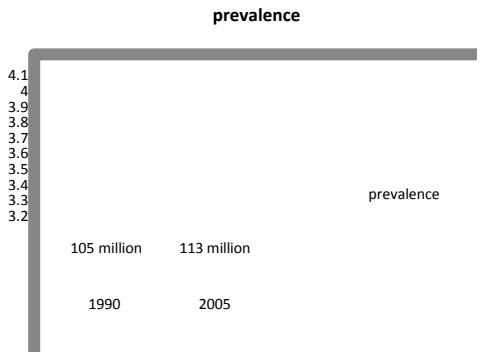
IV. RESULTS

We identified after studies of HBsAg prevalence after applying all inclusion and exclusion criteria. Global diffences between males and females were small, although females had a lower overall HBs Ag prevalence of 3.5% in 2005 compared to 3.9% in males. We estimated 240 million people chronically infected worldwide in 2005. in this graph.

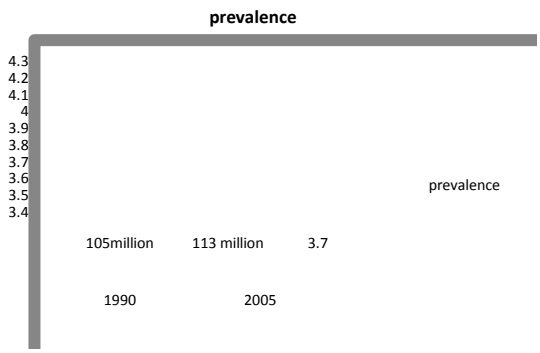
Global HBsAg and males chronically infected graph.



Global HBsAg and females chronically infected Graph



Global HBsAg and both (male, female) chronically infected graph



Production of surface resonance based assay kit hepatitis diagnosis

Surface modification of the SPR chips

1.1 **Alley mercaptane modification:**

Surface of the gold chip modified with alley mera captane. before modification, chip was clean with alkaline piranha solution (3:1).chip was immersed in

20Mlof alkaline piranha solution for 5 min. then, it was washed with pure ethyl alcohol and dried in vacuum oven for 3h.In order to Introduce vinyl groups onto the SPA chip, the chip was immersed in an ethanol/water solution Containing 3.0M alleymer captane for 12h.then, it was thoroughly rinsed with ethanol and dried with nitrogen gas under vacuum.

1.2 **Polymer preparation on SPR chips:**

HBsAg imprinted polymer film on alley mercaptane modified SPR chip surface prepared such as in the first step, HBsAg and MAT monomer mixed with 1.0Ml of MOPS buffer (ph.6.0) the mixer stirred at room temperature for 2h. On other hand AIBN (5mg), initiators dissolved in HEMA (1 ml) and EGDMA (0.5mL) monomer mixture and the complex added into solution to prepare stock monomer solution .Dissolved oxygen removed by passing the nitrogen gas from solution.2.5 aliquot taken from the stock monomer solution and dropped onto the trimethyl chlorosilane coated glass lamella surface. Gold face of SPR chip placed into this solution Polymerization was initiated by UV light at room temperature (100W, 365nm) and continued for 3 min at room temperature under nitrogen atmosphere. After the polymerization process, the glass lamella removed from the chip surface. Polymer coated SPR chip methanol and dried in vacuum oven.

V. RESULT AND DISCUSSION

1. Surface characterization of SPR chips

1.1. **Contact angle measurements**:

In this method surface angle and surface energies which calculated using of state method are summarized in table contact angle value of non-modified surface decreased. During the alleymercatane modification this result shows that SPR chip surface coated with alley mercaptane. Surface energy value increased from 49.46Mm/ to 60.94Mm.after polymerization contact angle increased to 63.3.this result shows that polymeric film formed on the alley mercatane modified surface has hydrophobic character as expected because of the hydrophobic structure of MAT monomer. Surface hydrophobicity increased, so surface energy decreased to 45.85Mm/m.

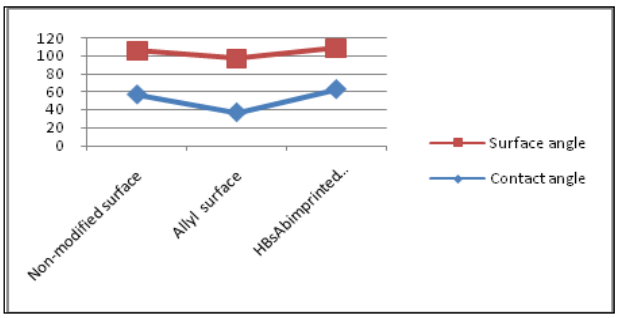


Figure a: relation between Contact angle and surface energies of the non-modified, alley mecaptane modified and HBsAg-imprinted PHEMAT film.

1.2. **Atomic force microscopy studies:**

In this section, allele mercaptane modified and HBsAg-imprinted film formed on SPR chips, non-contact mode atomic force microscope used. AFM images of non-modified, alley mercaptane modified and HBsAg-imprinted PHEMAT film formed on SPR chips were taken in non-contact mode. Root mean square (RMS) values of the gold surface also determined. MS value of non-modified gold SPR chip surface which cleaned with alkaline solution determine as 0.73nm.After alleymercaptane modification, this value increased to 1.41nm.From these result, it understood that surface modification with alley mercaptane achieved homogeneously. After the polymerization process, RMS value of SPR chip surface 4.3 which determined from AFM images.

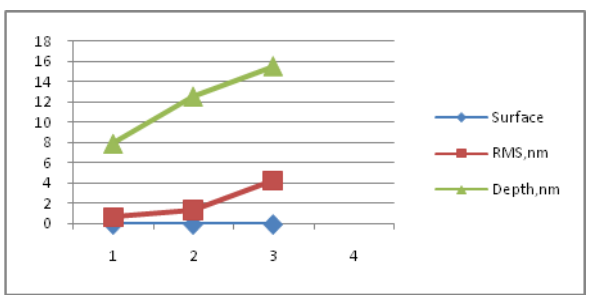


Figure b: The relation between base surfaces, alley mercatane modified surface and HBsAg-imprinted Sur Face.

VI. CONCLUSION

The functionality of the DNA sandwich assay using a one step .it is user friendly; capable of handling assays that employ two stage amplification. it is possible to detect Pico molar levels of the HBV DNA targets. Still, there are some problem, first, the DNA

sandwich used be prepared excite, is not desirable for POC applications the DNA functionalized Ag NP labels in the Intel of the device. This introduces a new problem, including controlling, timing of the hybridization, and issues related to nonspecific absorption. Other problem to introduce more realistic matrixes. Finally, the detection lime it of the DNA sandwich for HBV is too high.

REFERENCES

[1] An Alternative Medical Diagnosis Method Biosensors for Virus Detection.Ye¸serenSaylan;ÖzgecanEr Dem; Serhat Ünal and Adil Denizli.

[2] Lavanchy, D.; Kane, M. Global epidemiology of hepatitisHepatitis B Virus in human Diseases;Human press:Cham, Switzerland, 2016; pp. 18-203. Hassen, W.M.; Chaix, C.;Abdelghani, A.; Besueille, F.; Leon ard, D.;JA rezic-Renault, N. An impedimetric DNA sensor based on functionalizedmagnetic nanoparticle for HIV and HBV detection. Sens. Actuators B-Chem. **2008**, 134, 755 760.

[3] Tam, Y.J.; Zeenathul, N.A.; Rezaei, M.A.; Mustafa, N.H.;Azmi, M.L.M.;Bahaman A.R; Lo, S.C.;Tan, J.S.Hani, H.; Rasedee. AWide dynamic range of surface-Plasmon resonance-based assayfor hepatitisB Antigen antibody optimal comparison with ELISA Biotechnol. Appl. Biochem. **2017**, 64,735–744.

[4] Uzun, L.; Say, R.; Ünal,S.;Denizli,AProduction of surface plasmon resonance based Assay kit for hepatitis diagnosis.Biosensor.Bioelectron.**2009**, 24,2878-2884.

[5] Li, X.; Scida, K.; Crooks, R.M. Detection of hepatitis B virus DNA with paper electro chemical sensor. Anal Chem. **2015**, 87, 9009–9015.

[6] Istek, M.M. ;Erdem, M.M.; Gürsan, A.E. Impedimetric Nano biosensor for the detection of sequence selection. DNA hybridization. Hacet. J. Biol. Chem. **2019**, 46, 495–503.

[7] Zengin, A.; Tamer, U.; Caykara,T. SERS detection of hepatitis B virus DNA in a temperature ressives and which hybridization assay. J.Raman Spectrosc.**2017**, 48 668–672.

[8] Liu, Y.; Shen, T.; Hu, L.; Gong, H.; Chen, C.; Chen, X.; Cai, C. Development of a thermo sensitivemolec--ularly imprinted polymer resonance light scattering sensor for rapid and highly selective detection of Hepatitis A virus in vitro. Sens Actuators B-Chem. **2017**, 253, 1188–1193.