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# WIRELESS SMART TOXIC DETECTION TECHNIQUE

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**ABSTRACT**

*We know that all over the world many soldiers are being killed by their enemies during Biological warfare for instance, during the past century, more than 500 million people died of infectious diseases due to spraying of poison in their food , the 1984 Rajneeshee bioterror attack was the food poisoning of 751 individuals in The Dalles, Oregon, through the deliberate contamination of salad bars at ten local restaurants with Salmonella and many other attacks are unknown to us. From these incidents, it is legitimate to fear that modified pathogens could constitute devastating agents for biological warfare. As we are on the era of advanced technology, we can utilize our technological growths to enhance the safety and security of our soldiers. So here we utilize our technological advancement to enable the immune system for us to survive any such scenarios. Here we are proposing a system where we can easily detect the poison content in the consumable products. A glove based electrochemical Biosensor has been developed as a wearable point-of-use screening tool for defense and food security applications. This is done by swipe sampling the food material using the glove, sensing the presence of poison and displaying the toxic content in the smart phone device using IOT . This eliminates the time complexities of the present system.*

***Keywords: biological warfare, poison, infectious disease, security, soldiers.***

## I. INTRODUCTION

Now a days chemicals are being sprayed on the fruits and vegetables in the form of pesticides. This makes us to fear that modified pathogens could constitute highly destructive agents for biological warfare. In particular, OPH (organophosphorous) nerve-agents represent a serious concern as they can be weaponized for utility as Chemical warfare agents, and are routinely used as pesticides in agricultural and domestic settings. These OP agents severely affects the nervous system and lead to rapid death. Due to the high toxicity of OP nerve-agents and pesticides there are urgent demands for reliable advanced wearable sensor systems for their rapid and selective on-site analyses. The seamless integration of sensors within wearable platforms gives the power of laboratory-based chemical analyses directly on the wearer’s body. These wearable devices allow noninvasive sensing of lactate, glucose, or alcohol in sweat or interstitial fluids, lactate and uric acid in saliva, and glucose in tears. While the majority of these wearable sensor systems have focused on fitness and healthcare applications, there are growing demands for developing wearable sensor platforms for monitoring hazardous chemicals for diverse security and environmental applications. The “on-hand” detection of different OP chemical agents on a variety of surfaces and agricultural food stuffs demonstrate that the new wireless glove biosensor holds considerable promise for real-time on-site screening of chemical threats for meeting the demands of different military, forensic, consumer protection, and food safety applications.

## II.EXISTING METHODS

In traditional detection and identification methods foods samples should be collected as for any other microbiological examination and stored under refrigeration for the shortest time practical.Most of the rapid tests require some sort of extraction and purification procedure before they can detect toxins in food matrices. Some of the components in the food can interfere with the test itself and with the visual interpretation of the test results. It is usually necessary to remove as much of the fat and solid material as possible for the test. Techniques used include centrifugation, filtration through absorbent cotton wool, microfiltration, dialysis, chromatographic separation and the use of immunoaffinity columns.They typically take 3-5 days to obtain the result.

## III.LITERATURE SURVEY

### 3.1.ESTIMATION OF ORGANOPHOSPHORUS PESTICIDE RESIDUES IN FRUITS AND VEGETABLES

This paper describes about the use of pesticides that has turned out to be an obligatory input to agriculture and public health. Versatile use of pesticides had resulted in contamination of all basic necessities of life, i.e. air, water and food. Among various pesticides, organophosphorus pesticides (OPPs), derivative of phosphoric acid, are the most extensively used insecticides or acaricides in many crops. Due to low persistency and high killing efficiency of OPPs, many agriculturalists regularly use this group of pesticides for various vegetables and fruits crops. The continuous use of pesticides has caused the deleterious effects to ecosystem. In response to this, a number of methods have been developed by several regulatory agencies and private laboratories and are applied routinely for the quantification and monitoring of multi pesticide residues in vegetables and crops. The present review pertains to various extraction and quantification procedures used world wide to analyze OPPs residues in various vegetables and fruits[1].

### 3.2. FLOW INJECTION AMPEROMETRIC DETECTION OF OP NERVE AGENTS BASED ON AN ORGANOPHOSPHORUS-HYDROLASE BIOSENSOR DETECTOR:

A flow-injection system with an organophosphorus-hydrolase (OPH)-biosensor detector has been developed and characterized for the rapid detection of organophosphorus (OP) nerve agents. The enzyme was immobilized onto a thin-film gold detector through a cystamine-glutaraldehyde coupling. Factors influencing the performance were optimized. The resulting flow system offered a fast, sensitive, selective, and stable response. The peak current increased linearly with the concentration of paraoxon and methyl parathion over the 1-10 microM range (sensitivity, 2.29 and 1.04 nA/microM, respectively). The OPH-biosensor flow injection systems offered low detection limits (e.g. 0.1 microM paraoxon), along with a good precision (R.S.D. of 3.6% for 20 successive injections of a 1.0 microM paraoxon solution). The OPH-biosensor flow detector offers great promise for rapid field screening of OP pesticides and nerve agents[1,2].

### 3.3.OPPORTUNITIES AND CHALLENGES OF USING ION-SELECTIVE ELECTRODES IN ENVIRONMENTAL MONITORING AND WEARABLE SENSORS:

This paper describes about the great opportunities that exist for Ion-Selective Electrodes (ISEs) in the fields ofenvironmental monitoring and of wearable applications for example as the sensing part in wireless networks[7]. In this review special attention is given to the recent results obtained with Solid Contact Ion-Selective Electrodes and Solid Contact Reference Electrodes. Their combination as disposable sensing platform may offer the best solution to eliminate issues commonly experienced with ISEs and lead in a short term to their commercialization. Future research will likely focus on the miniaturization of the current devices and on the further development of non conventional potentiometric methods, e.g., controlled potential thin-layer coulometry[7,11,12].

### 3.4. WEARABLE RING-BASED SENSING PLATFORM FOR DETECTING CHEMICAL THREATS:

This work describes a wireless wearable ring-based multiplexed chemical sensor platform for rapid electrochemical monitoring of explosive and nerve-agent threats in vapor and liquid phases. A wide range of electrochemical capabilities have thus been fully integrated into a 3D printed compact ring structure, toward performing fast square-wave voltammetry and chronoamperometric analyses, along with interchangeable screen-printed sensing electrodes for the rapid detection of different chemical threats. High analytical performance is demonstrated despite the remarkable miniaturization and integration of the ring system. The attractive capabilities of the wearable sensor ring system have been demonstrated for sensitive and rapid voltammetric and amperometric monitoring of nitroaromatic and peroxide explosives, respectively, along with amperometric biosensing of organophosphate (OP) nerve agents. Such ability of the miniaturized wearable sensor ring platform to simultaneously detect multiple chemical threats in both liquid and vapor phases and alert the wearer of such hazards offers considerable promise for meeting the demands of diverse defense and security scenarios[8].

### 3.5. WEARABLE ELECTROCHEMICAL SENSORS FOR IN SITU ANALYSIS IN MARINE ENVIRONMENTS:

The development of wearable screen-printed electrochemical sensors on underwater garments comprised of the synthetic rubber neoprene is reported. These wearable sensors are able to determine the presence of environmental pollutants and security threats in marine environments. Owing to its unique elastic and superhydrophobic morphology, neoprene is an attractive substrate for thick-film electrochemical sensors for aquatic environments and offers high-resolution printing with no apparent defects. The neoprene-based sensor was evaluated for thevoltammetric detection of trace heavy metal contaminants and nitroaromatic explosives in seawater samples. We alsodescribe the first example of enzyme (tyrosinase) immobilization on a wearable substrate towards the amperometric biosensing of phenolic contaminants in seawater. Furthermore, the integration of a miniaturized potentiostat directly on the underwater garment is demonstrated. The wearable sensor-potentiostat microsystem provides a visual indication and alert if the levels of harmful contaminants have exceeded a pre-defined threshold. The concept discussed here is well-suited for integration into dry- and wetsuits worn by divers and recreational surfers/swimmers, thereby providing them with the ability to continuously assess their surroundings for environmental contaminants and security hazards[9,15].

### 3.6. SOLID-STATE FORENSIC FINGER SENSOR FOR INTEGRATED SAMPLING AND DETECTION OF GUNSHOT RESIDUE AND EXPLOSIVES: TOWARDS 'LAB-ON-A-FINGER:

Increasing security needs require field-deployable, on-the-spot detection tools for the rapid and reliable identification of gunshot residue (GSR) and nitroaromatic explosive compounds. This manuscript presents a simple, all-solid-state, wearable fingertip sensor for the rapid on-site voltammetric screening of GSR and explosive surface residues. To fabricate the new Forensic Fingers, we screen-print a threeelectrode setup onto a nitrile finger cot, and coat another finger cot with an ionogel electrolyte layer. The new integrated sampling/detection methodology relies on 'voltammetry of microparticles' (VMP) and involves an initial mechanical transfer of trace amounts of surface-confined analytes directly onto the fingertip-based electrode contingent. Voltammetric measurements of the sample residues are carried out upon bringing the working electrode (printed on the index finger cot) in direct contact with a second finger cot coated with an ionogel electrolyte (worn on the thumb), thus completing the solidstate electrochemical cell. Sampling and screening are performed in less than four minutes and generate distinct voltammetric fingerprints which are specific to both GSR and explosives. The use of the solid, flexible ionogel electrolyte eliminates any liquid handling which can resolve problems associated with leakage, portability and contamination. A detailed study reveals that the fingertip detection system can rapidly identify residues of GSR and nitroaromatic compounds with high specificity, without compromising its attractive behavior even after undergoing repeated mechanical stress. This new integrated sampling/detection fingertip strategy holds considerable promise as a rapid, effective and low-cost approach for on-site crime scene investigations in various forensic scenarios[10].

## IV.WORKING PRINCIPLE

The proposed system is used to detect the presence of poison in the food with the help of a gloves embedded with Sensor.It is done by swipping the food material with the thumb finger which collects the food samples for

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the test and then by pressing the thumb finger on the index finger so that the presense of poison in sample is sensed by the sensor. The sensor output is provided to the amplifier circuit which amplifies the detected signal. The amplifier output is provided to the ADC.The ADC output is given to the controller. Based on the ADC value, the poison content is obtained.The controller transmits the poison content to the mobile using IOT.

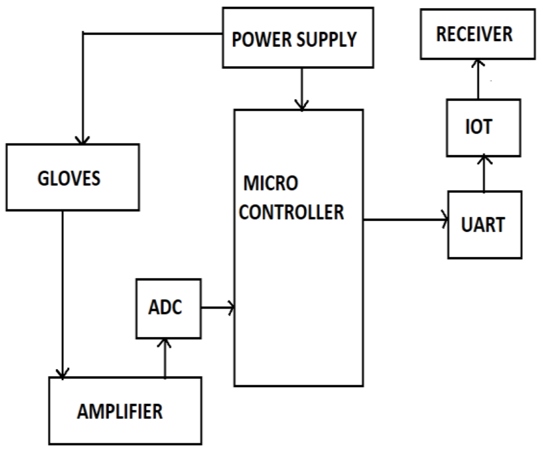


Fig 4.1 block diagram of wireless smart toxic detection technique

## V.HARDWARE DESCRIPTION

**5.1.POWER SUPPLY:**Transformer 230V AC

**5.2.AMPLIFIER:**Instrumentation amplifier with high pass filter.

**5.3.MICROCONTROLLER PIC16F877A:**

The term PIC, or Peripheral Interface Controller, is the name given by Microchip Technologies to its single – chip microcontrollers. PIC micros have grown to become the most widely used microcontrollers in the 8- bit microcontroller segment.The PIC16F877A CMOS FLASH-based 8-bit microcontroller is upward compatible with the PIC16C5x, PIC12Cxxx and PIC16C7x devices. It features 200 ns instruction execution, 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port.It also has the following features,

- Flash Memory: 14.3 Kbytes (8192 words)
- Data SRAM: 368 bytes
- Data EEPROM: 256 bytes
- Self-reprogrammable under software control
- In-Circuit Serial Programming via two pins (5V)
- Watchdog Timer with on-chip RC oscillator

**5.4.UART**

**5.5.IOT MODULE**

 IJARSE
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## VI.PERFORMANCE ANALYSIS

The below picture describes the complete hardware connection of our project. It consist of a glove with a sensor in the index finger and a swipping thumb finger, a transformer, an amplifier, a microcontroller(PIC16F877A), UART, and an IOT module to transfer the information to the mobile phone using WiFi.

Fig 6.1 poison detector

In the below graph it is observed that the conductivity of electrons is different for different chemicals, and when these chemicals are mixed up in any consumable product they will be having different conductivity due to the occurance of chemical reactions.

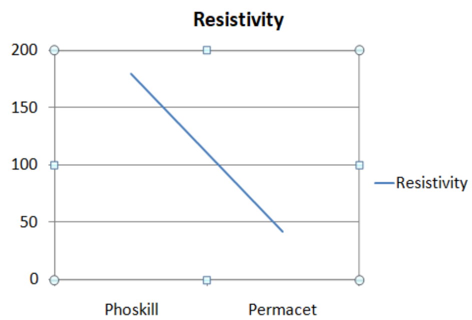


Fig 6.2 describes the resistivity of electrons in different poison.

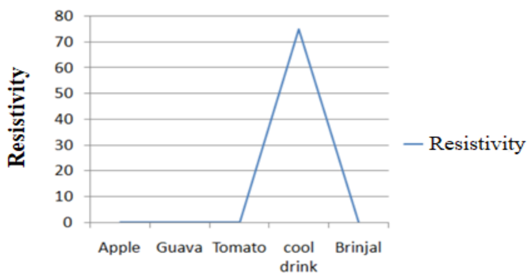


Fig 6.3 describes the resistivity of electrons in the food samples such as apple,guava,tomato,brinjal,cold drink.

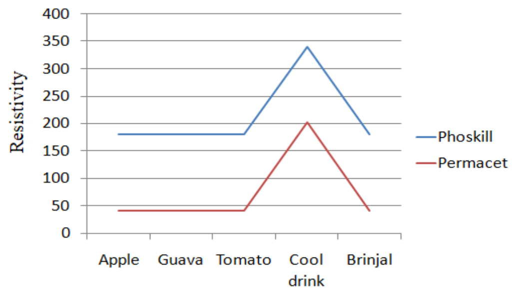


Fig 6.4 describes the resistivity of electrons in the food samples after the mixing of poison.

Based on the calculations from the above graph we can determine the threshold value so that we can check wheather the food can be consumed are not.This information is sent to the mobile phone through an IOT module so that the toxic content is displayed in the mobile screen and it displays whether the suspected material is consumable or not.

## VII.CONCLUSION AND FUTURE WORKS:

In this paper we have designed and constructed a glove and demonstrated its potential for the detection of different hazardous chemicals. The new wearable “lab-on-a-glove” integrates a detection finger, a sampling finger, along with realtime wireless data transmission to a smartphone device. The new glove-based sensor addresses the challenges associated with reliable and rapid field screening and detection of chemical threats. It also offers considerable promise toward food safety and security applications. Future efforts are aimed at further miniaturization of the electronic circuit and expanding the scope of glove biosensors to the analysis of a variety of other chemicals and by extending the database for the storage of information regarding all chemicals. The new generation of glove-based chemical sensors can be used for the wide range of safety, security, and forensic applications in variety of field settings.

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