ISSBN

Volume 1 **February 2017**

ALU

SENSORS TODAY

Department of Bioelectronics and Biosensors

ALAGAPPA UNIVERSITY

SENSORS TODAY

(A periodical journal of sensor research)

Contents

How Your Body Takes Risks – It's the Dopamine In the Brain

-A.C Anithaa, Research Scholar

The meaning behind risk taking defines logic. We can't forecast the reason why people do unpredictable things like skydiving out of a plane. Why certain people tend to live life on the edge involves the reward mechanism neurotransmitter dopamine (DA), brain's feel-good chemical.

DA, one of the most important inhibitory catecholamine, plays significant role in the functioning of the central, hormonal and cardiovascular systems. The excessive concentration of DA in the frontal lobes leads to severe mental illness schizophrenia and too little DA in the motor areas of the brain are responsible for Parkinson's disease. On the other hand, DA is responsible for making us feel satisfied after a delicious meal, happy when our favorite cricket team wins, which can artificially squeeze more DA out of the nerve cells in our brain. It's also in-charge for the cloud nine feel when we do something daring, like skiing down a double black diamond slope or bike/car racing. In the risk taker's brain, there appear to be fewer DA inhibiting receptors which defines that daredevils' brains are more saturated with the chemical, predisposing them to keep taking risks , chasing the next high and driving too fast.

We think a person who finds novelty and excitement more rewarding does so because he/she gets more DA release. But it's one of the big controversies in the field of addiction research now. And it's yet another area for researchers to explore in trying to come up with a better sensor for improving the detection limit.

DA was discovered by Swede, Arvid Carlsson in 1950 and he figured out that the precursor to DA (called L-dopa) could elevate the symptoms of Parkinson's. He was awarded the Nobel Prize in 2000.

Neurotransmitters are the chemicals which allow the transmission of signals from one neuron to the next across synapses. Inhibitory neurotransmitters (INT) decrease the likelihood that a neuron's signals are sent. This opposes or balances the effects of excitatory receptor activation.

INT are responsible for calming the mind and body, by filtering messages, slowing down the system, and inducing sleep. Low INT levels causes anxiousness, monkey mind, can't calm down trouble falling asleep or staying asleep. High INT levels leads to wake up tired, no energy in the afternoons, no motivation for life. ***Which type of neurotransmitter stores do you have to little of? Which do you have to much of? Family? Friends? Children?***

Currently, the direct use of WO_3 plays a vital role to improve the performance of electrochemical detection of DA in the presence of ascorbic acid.

Ref: A. C. Anithaa, N. Lavanya, K. Asokan, C. Sekar, Electrochim. Acta 167 (2015) 294.

Glucose Sensor – A need for the modern world

-K.P. Divya, Research Scholar

MYTH: Diabetes isn't a serious disease.
FACT: NO!! Diabetes is a serious chronic disease which causes more deaths a year than breast cancer and AIDS combined. It doubles your chance of having a heart attack.

Persistence of high blood sugar level for a long period of time leads to a metabolic disease called Diabetes mellitus (DM). There are two types of Diabetes mellitus. Type 1 is caused because the insulin produced by the body is little or none. People with type 1 diabetes can sustain life with the daily administration of insulin treatment. Body of people having Type 2 diabetes is incapable of responding to insulin which is referred as insulin resistance. A recent survey in China (a country with high number of diabetic patients) tells that diabetes was determined as the underlying cause of death on 28.7 %. The mortality rate has increased about 1.78 fold in 11 years of time. according to WHO (World health Organization) 3 million people die every year due to diabetes and its underlying causes around the world. Being a serious disease DM needs to be monitored periodically to check the blood glucose level mainly in the patients as well as normal human being. Several types of glucose sensor has arise over a short period of time. The two broad types of glucose sensor are enzymatic and non enzymatic sensor.

Among the two routes used in enzymatic detection of glucose, one uses the oxidation of glucose by dehydrogenase with subsequent determination of the co-factor. The other route is based on monitoring the formation of hydrogen peroxide, the consumption of oxygen or direct regenerating the active center of the enzyme.

Did you know??? The global glucose monitoring device and diabetes management market is valued at $10,025 billion for 2015

Glucose oxidase and glucose dehydrogenase extracted from *Aspergillus niger* and *Acinetobacter calcoaceticus* respectively are the most commonly used enzymes for glucose oxidation.

First generation glucose biosensor: The first generation glucose biosensor quantified the concentration of glucose by means of the amount of hydrogen peroxide produced by the glucose oxidase in presence of dissolved oxygen.
Second generation glucose biosensor: Here, synthetic mediators were used to enhance the charge transfer and eliminate the oxygen dependency problems faced by the first generation biosensor.
Third generation glucose biosensor: The complications arising out of using second generation biosensors that contained synthetic and natural mediators were avoided by developing third generation biosensors. It mainly focuses on reducing the distance between the enzyme active center and electrode.

Non-enzymatic glucose sensor forms the fourth generation. Here various materials have been used instead of enzymes such as nanotubes, metals, modified metals, chemically modified electrode , alloys, polymer and composites etc.

Throwback: The first glucose meter was developed by Anton Hubert Clemens in 1971 in the USA. This device assessed the color change of enzyme based reagent strips.

Environmental friendly biosensors

- Nathiya. D, Research scholar

The proper use of science is not to conquer nature but to live in it. - Barry Commoner.

Recently researchers have shown interest on developing novel materials which are environmental friendly in nature for energy conservation. So that we could save our earth life from extinction and it is also good for the human health. By using natural materials together we can sense the biomolecules by considering nature's sensitivity and specificity with the advantages of emerging Micro and Nanoelectronics. Main Difficulties in sensing using natural materials are degradability, electrical properties and cyclability (or) long life.

To avoid this kind of situations we could combine the materials which could satisfy these specifications. For eg. Diamond exhibits several special properties like good biocompatibility and large electrochemical potential window, which make it to be a special candidature in biofunctanilization and biosensing. To make it as a compatible biocomposite with protein, the hydrogen terminated nanocrystalline diamond files were modified into amine terminated by using photochemical process. By this process protein structures are covalently attached to the amine modified nanocrystalline diamond. After functionalization of nanocrystalline diamond electrodes with the enzyme catalase, the biofunctionalization property has been confirmed from a direct electron transfer between the enzyme's redox centre and the diamond electrode.

Moreover, the modified electrode was found to be sensitive to hydrogen peroxide with linear range of 0.3 mM to 150 mM. Therefore by possessing dual role as a substrate for biofunctionalization and as an electrode, nanocrystalline diamond with biomaterial is a very promising candidate in biosensor applications. (Andres Hartl1 et al., 2004) The main reason to go eco-friendly is to save the environment and recycle.

NOTE: India, which has emerged as the world's second largest mobile market, is also the fifth largest producer of e-waste, discarding roughly 18.5 lakh tonnes of electronic waste each year. – THE HINDU (2016)

Real time biosensor example –
Nine-times Olympic medalist Merlene Ottey used biosensors in 2012, London olympics to help prolong her athletics career.

Zinc oxide – multi walled carbon nanotube-poly(vinyl chloride) nanoparticle for glucose sensing

-P. N. Manikandan, Research Scholar

Zinc oxide (ZnO), multi-walled carbon nano tubes (functionalized: *f*MWCNT and purified: *p*MWCNT), poly(vinyl chloride) (PVC) (PVC-ZnO-MWCNT) for direct glucose sensing. Cyclic voltammetry (CV), chrono amperommetry (CA) techniques were utilized to study the glucose sensing behavior of the composite (fig.1).

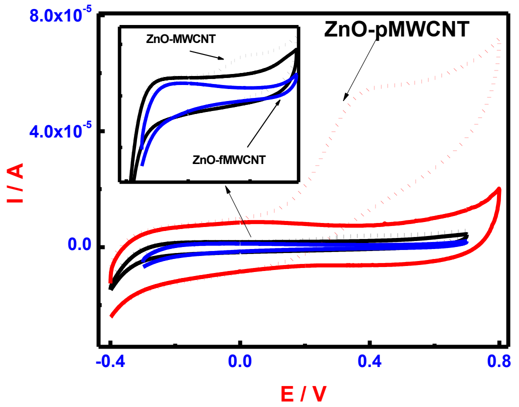


Fig. 1. Cyclic Voltammetric behaviors of ZnO-MWCNT (curves a and b), ZnO-pMWCNT (Curve c and d) in the absence (solid line curves a and c) and presence (dotted line curves b and d) of 1 mM glucose in PBS pH 7.4. Scan rate is 50 mVs-1

The sensor exhibits the dynamic range 20 µM to 17.8 mM (corresponds to the dynamic range 0.36 mg/dl to 320. mg/dl) falls in the diagnostic range required for screening the hypoglycemic and hyperglycemic glucose level without enzyme. The PVC-ZnO-*p*MWCNT composite shows the highest Micahelis-Menten kinetic constant k_M of 21.9 mM compared to the ZnO-glucose oxidase and copper oxide-ZnO systems which exhibit 10 times lower K_M values (fig.2). The prepared composite has been further characterized by quartz crystal micro balance (QCM), Scanning Electron Microscopy (SEM), Fourier Infrared Spectroscopy (FTIR), X-ray diffraction (XRD), Raman spectroscopic and Transmission Electron Microscopic (TEM) techniques.

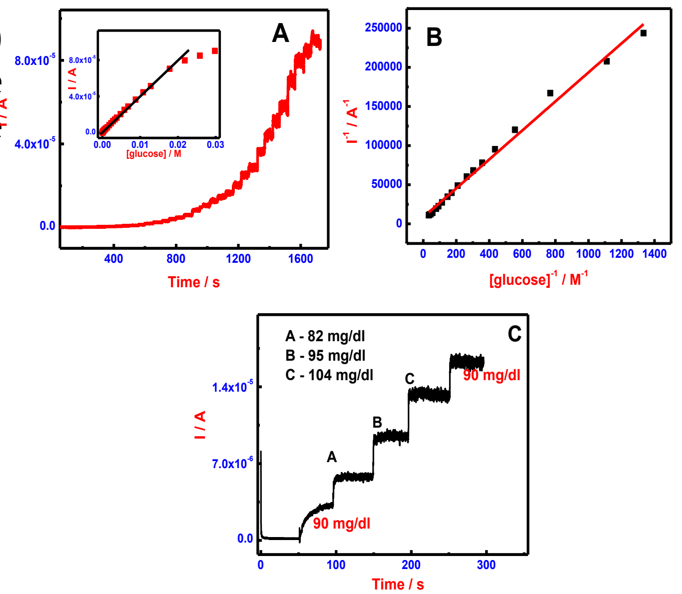


Fig. 2 (A) Effect of glucose concentration on Chronoampermetry behavior of PVC-ZnO-pMWCNT measured at 0.45 V in PBS pH 7.4. Concentration range 2.5 µM to 30 mM. Inset: glucose concentration versus current plot. (B) Line weaver Burk plot (1/current vs 1/[glucose]). (C) Comparative CA measurement of commercial (90 mg/dl) and whole blood glucose (82, 95 and 104 mg/dl). Blood samples are injected into PBS buffer.

Excellent selectivity of the glucose in presence of potential interferences was observed. Blood glucose in different diabetic persons is discriminated very well without affecting the sensor performance. Biocompatibilty of this composite is evaluated in presence of blood proteins (bovine serum albumin and bilirubin), whole blood and bacteria *Staphylococcus aureus and Keblisa pneumonia*. Hemolysis and cell viability studies were made comparitively. It is observed that hemolysis occurs less than 1% on the PVC-ZnO-MWCNTs.

Sensors for Soil Contaminants

- N. Sudhan, Research scholar

Soil and water contaminants such as microorganisms, radioactive compounds, heavy metals, synthetic organic and volatile organic compounds are persist for many years and wander through large regions of soil until they reach water resources and it easily interact with living organisms. Emerging sensor devices are required for protect and prevent the public from the toxic contaminants and pollutants that can be released into environment by soil and water. Different analytical techniques have been used for detect trace amount of these contaminates. However, they were still limited in real-time detection because of expensive instruments and intricate pretreatment. The requirements for application of most traditional analytical methods to detect environmental pollutants analysis often constitute an important impediment for their application on a daily life. So the analysis calls for rapid and low cost analytical techniques to be used in extensive monitoring of environmental contaminants by disposable device for onsite applications has been encouraged [Rodriguez-Mozaz et al.,2015]. In this context, biosensors appear as a suitable analytical tool. Biosensors can be considered as a subgroup of chemical sensors in which a biological mechanism is used for analyte detection.

Biosensors for pesticides determination

Organophosphate Pesticides such as methyl parathion, monocrotophos, malathion, paraxon ethyl and chlropyrifos are widely used to increasing productivity of agriculture. Due to their increasing usage of pesticides, it readily accumulates in human body; it causes several diseases neurological disorder in central nervous system and cardiovascular diseases. So, the continuous monitoring for low pesticide levels in food, water, and air has become a key activity in respect to human health. In the past few years many diverse electrochemical sensors have been developed to observe the level and to calculate the amount of pesticides. Most of them are enzyme based electrochemical sensor. However, the usage of enzyme based sensor is less preferred due to its stability, storage and higher cost. Therefore, there is need to avoid enzyme less electrochemical biosensor have been developed for the precise determination of pesticides. Already, electrochemical sensor has been prepared for methyl parathion without using enzyme [Raju Thota et al.,2016]. In this circumstance we have been eager to detect those pesticides based on simple low-cost ecofriendly biomaterials for on real time monitoring in agricultural developments.

Influence of organic solvents on the direct attachment of graphene oxide on gold electrode for electrochemical sensing of acetaminophen

H. Imran, Research Scholar

Graphene oxide (GO) was prepared following the modified Hummer's method and confirmed by X-RD (X-ray Diffractor), FTIR (Fourier Transform Infra-Red spectroscopy) and UV-Vis (Ultra-Violet Visible Spectroscopy). The GO was dispersed in various organic solvents such as *N*, *N* - dimethylformamide (DMF), *N*-methyl - 2 - pyrrolidone (NMP), tetrahydrofuran (THF), water, acetone, ethanol, formaldehyde, lactic acid, acetic acid, Dimethyl sulfoxide (DMSO) and glycerol by ultrasonication. It was noticed that GOs are not dispersed in benzene, chloroform and chloro benzene. The GOs in DMF, water, DMSO, NMP and formaldehyde exhibited long-term stability and used for modification of gold Electrochemical stability was characterized by Cyclic Voltammetry (CV) and electrochemical impedance spectroscopy (EIS) in $[Fe(CN)_6]^{3-/4-}$ prepared in phosphate buffer saline (PBS). These five different GO modified gold electrodes were applied for acetaminophen sensing. Among these, GO/DMF on gold exhibits high sensitivity in terms of increased peak currents and reversibility than the other GO/solvent modified gold electrodes. This surface is further used for acetaminophen (paracetamol) sensing in PBS using cyclic voltammetry (CV). This is the first report anchoring GO using different solvents on gold electrode for acetaminophen detection.

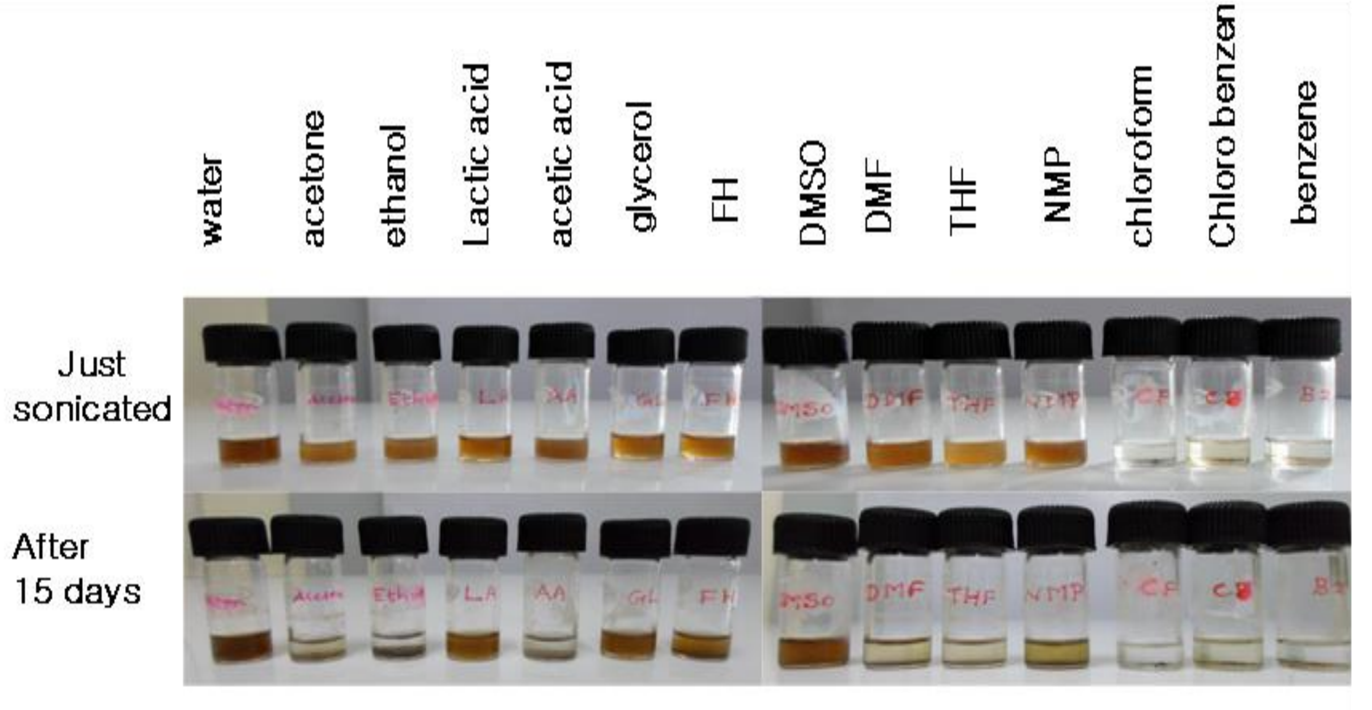


Fig. Graphene oxide dispersed in different solvents (water, acetone, ethanol, lactic acid, acetic acid, glycerol, formaldehyde, dimethylsuphoxide, dimethylformamide, tetrahydrofuran, n-methylpyrrolidone, chloroform, chloro benzene and benzene) by ultrasonication. Top: at the time of dispersed, Bottom: At 15 days after the dispersion.

Nanomaterials based electrochemical biosensors for vitamin analysis

-N. Lavanya, Research Scholar

Vitamins are a large group of organic compounds which differ in their chemical composition, physiological action and nutritional importance. From a nutritional point of view a sufficient intake of vitamins is of great importance and hence, accurate methods of analysis for these vitamins are needed. It is known that the human body needs an adequate supply of 13 different vitamins. Depending on their solubility, vitamins are classified into water-soluble vitamins (B-complex, ascorbic acid, folic acid, pantothenic acid, nicotinic acid, biotin) and fat- soluble vitamins (vitamin A, D, E, K). Vitamins are also called micronutrients though they have no caloric (nutritional) value for themselves. Like other micronutrients, the trace elements, they cannot be produced by the human organism but have to be supplied by the diet, but some of them can be provided in the form of provitamins. These substances are vitamin precursors which are not themselves vitamins, but can be converted by normal body metabolism into vitamins. In opposite to the macronutrients (fats, proteins and carbohydrates) only a small amount is sufficient to cover the recommended daily supply which varies between the milligram and microgram range depending on the kind of vitamin, the age, sex and health status. In general, the requirement of infants, pregnant women and sick persons is much higher than that of the healthy, average population.

Vitamins have a key role in the metabolism as part of enzymes, so-called coenzymes, as antioxidants to prevent undesired oxidative processes in the body and as hormones.

Lacks of vitamins can provocate specific deficiency syndromes. In the minor case the manifestations are unspecific, e. g. nausea, headache, loss of appetite, mental depression and fatigue and can be repaired by giving higher dosages of vitamins. This so-called hypovitaminosis is most often a result of illness, malresorption or wrong nutrition. The more serious case, avitaminosis, occurs very seldom in industrial states but is still known in developing countries. Malnutrition can lead to heavy and even irreversible damage until death. But also the opposite phenomena, a hypervitaminosis, can be very dangerous. Some examples of poisoning due to very high doses of fat-soluble vitamins are reported. The water-soluble vitamins are not harmful in high doses because they are not resorbing in high amounts and leave the body unmetabolised. Vitamin supplements also have been recommended for other individuals who may be at risk for a deficiency because of their particular life style.

Other practices, such as smoking, alcohol consumption, and the use of drugs will increase the need for certain vitamins [1].

For this reason, analytical methods must be available to control the vitamin content in human food.

For instance, Riboflavin (VB2) is a water-soluble B-group vitamin essential to human health which helps the body convert carbohydrates, fats and proteins into energy and supports the body during the stress of daily living.

Riboflavin is converted to 2 coenzymes, favin mononucleotide (FMN) and flavin adenine dinucleotide (FAD), which are necessary for normal tissue respiration. These coenzymes are involved in several reduction oxidation reactions and take part in the metabolism of other vitamins, e.g., folate and vitamin B6. Riboflavin is very stable during thermal processing, storage or food preparation, but it is susceptible to degradation after exposure to light. Lack of riboflavin may lead to itching and burning eyes, sensitivity of eyes to light, sore tongue, itching and peeling skin on the nose and scrotum, and sores in the mouth. Riboflavin is found in various foods, including milk and dairy products, fish, meats, green leafy vegetables, and whole grain and enriched cereals and bread. Therefore, it is essential to develop a sensitive method to monitor their concentration in the wide range from nM to mM for diagnosis and evaluation of therapeutic effects for neurological, psychiatric and cardiovascular disorders. Conventional techniques such as chromatography, spectrophotometry, electrophoresis, titration and others have been used to detect riboflavin. These methods do not allow an easy, rapid monitoring, because they are complex analytical steps with expensive instrumentation, need well trained operators and in some cases, increasing the time of analysis. Nowadays food analysis needs rapid and affordable methods to determine compounds that have not previously been monitored and to replace existing ones. An alternative to ease the analysis in routine of food products is the biosensors development.

Biosensors are a sub group of chemical sensors that integrate biological sensing elements with physical transducers where the interactions between biological sensing elements and target molecules are directly converted into an electronic signal. Biosensors represent a conceptually novel approach to real-time, on-site, and simultaneous detection of multiple biohazardous agents. Samples are minimally processed and they offer rapid testing in the field setting with the option for post-analysis culture in the laboratory. At the moment, no technology is available that provides field-based real-time diagnosis of RF. These devices represent a promising tool for food analysis due to the possibility to fulfill some demand that the classic methods of analysis do not attain.

To have commercial interest, the biosensor must prove to be analogous to the standard analytical techniques offering, additionally, rapidity and cost-efficiency of measurement, without the need for time-consuming or expensive sample preparation. According to the statement by the great scientist Arthur C. Clarke "Any sufficiently advanced technology is indistinguishable from magic''. This statement is particularly true in molecular biosensing based on nanotechnology where the detection limits are 'magically' becoming smaller and smaller, even reaching zeptomolar concentrations in addition to opening up possibilities for ultra-sensitive multiplexed detection. The whole area of biosensor development continues to be an extremely dynamic and growing area for scientific research. Nanotechnology is defined as the creation of functional materials , devices and

systems through control of matter at the 1–100 nm scale. A wide variety of nanoscale materials of different sizes, shapes and compositions are now available. The huge interest in nanomaterials is driven by their many de-sirable properties. Use of nanomaterials in biosensors allows the use of many new signal transduction technologies in their manufacture. Because of their size, nanosensors, nanoprobes and other nanosystems are revolutionizing the fields of chemical and biological analysis. In particular, the ability to tailor the size and structure and hence the properties of nanomaterials offers excellent prospects for designing novel sensing systems and enhancing the performance of the bioanalytical assay.

Among various nanomaterials, SnO_2 is a versatile material with a wide band gap (3.6 eV at 300 K) in its stoichiometric form, but due to lattice imperfections and oxygen vacancies arising during its production, it becomes n-type and conductive. SnO_2 has been of considerable interest because of its combined properties of plentiful oxygen vacancies, high optical transparency, chemical and electrochemical stability, good electrocatalytic activity, nontoxicity, good biocompatibility, and high electron communication features when doped. Chemical doping with appropriate elements (Fe, Cr, Co, Mn, Ni, etc.) is widely used as an effective method to tune surface states, energy levels of semiconductors and transport performance of carriers, and enhance the electrical, electrochemical and magnetic properties of materials. Among these, Cr is the only elemental solid which shows antiferromagnetic ordering at room temperature and below. The ionic radius of Cr(III) is close to that of Sn^{4+}, which means that Cr^{3+} can easily penetrate into the SnO_2 crystal lattice or substitute the Sn4+ position in the crystal SnO_2 is a semiconducting material and its sensing characteristics can further be improved by chemical doping with appropriate elements and/or by preparing composites with carbon nanostructures.

Sensor for the analysis of biochemical contents in the medicinal herbs

- Dr. P. Kanchana, UGC-Post Doctoral Fellow

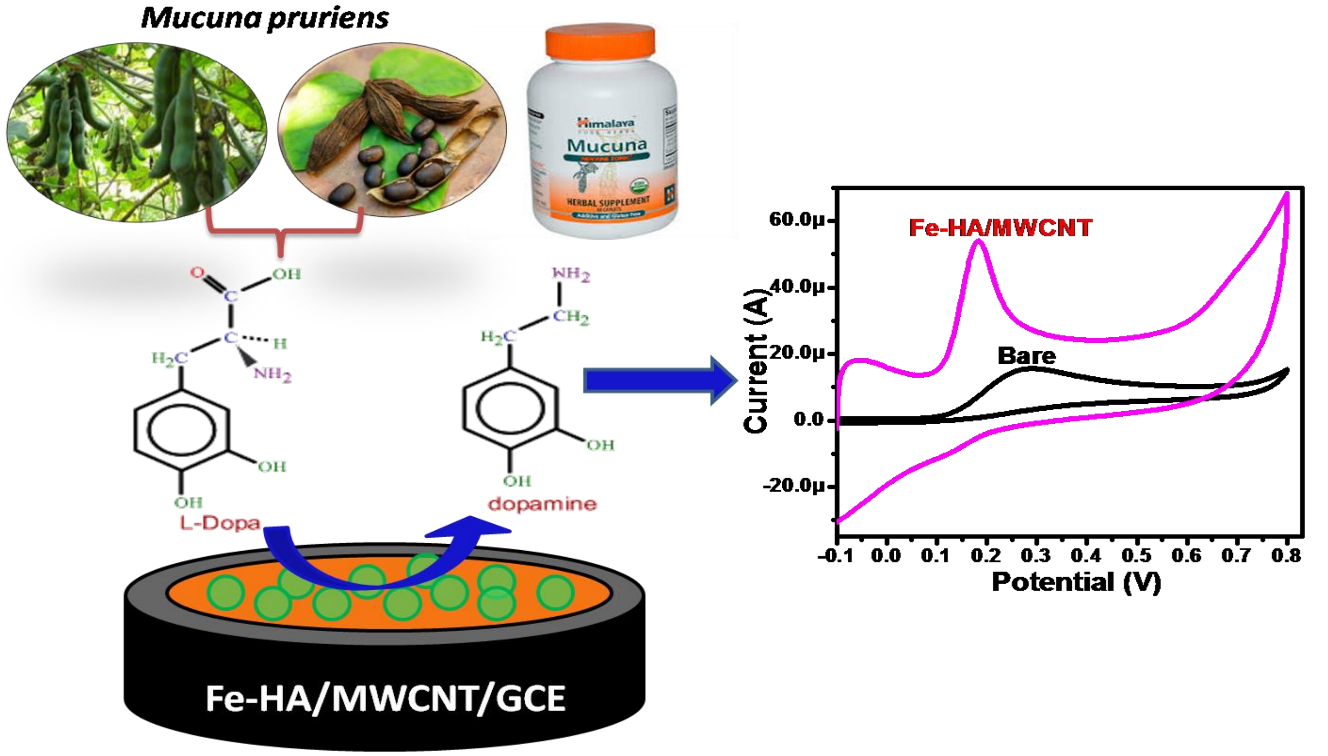
In recent years interest in medicinal plants has increased considerably worldwide. Ayurveda and herbal medicine are two important forms of alternative medicine that is widely practiced in India. Ayurveda medicine is based medications of plant origin. Many medicinal plants that are found in India are routinely used by the practitioners of Ayurveda. In this context, it is important to detect the type and quantity of biochemical present in different medicinal plants.

In our studies, we have chosen the rare medicinal plant m*ucuna pruriens*, commonly known as 'velvet beans'. It is one of the most popular medicinal plants of India and is constituent of more than 200 indigenous drug formulations. All parts of *mucuna* possess valuable medicinal properties. The main plant chemicals found in velvet bean include: alkaloids, alkylamines, arachidic acid, neurotransmitters (L-dopa, dopamine, serotonin and tyrosine), essential amino acids (arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine), vitamins (niacin, nicotine, riboflavin) and etc. This powerful herb can have a direct influence on the brain neurotransmitters (L-dopa, dopamine, serotonin and tyrosine) and potentially have beneficial effects on mental state, energy levels, ability to relax and even body composition and libido. It is also used against a wide range of disorders such as urinary tract, menstruation disorders, constipation, edema, fever, tuberculosis, ulcers and helminthiases like elephantiasis [R. Katzenschlager et al., 2004, J.C. Mehta and D.N. Majumdar, 1994]. Nevertheless, the raw materials used in ayurvedic treatment frequently associated with some side effects such as nausea, vomiting, cardiac arrhythmias because lack of awareness of the quantity of 'biochemical' present in the given medicine. Hence the process of important neurotransmitters and nutritional chemicals detection and its concentration determination is an important feature in medicinal plants and clinical procedures**.** Electrochemical biosensors play an important tool in the detection of chemical and biological components because of their unique features comprising high specificity and sensitivity, rapid response, low cost, relatively compact size and user-friendly operation.

Biosensor has been fabricated using hydroxyapatite (HA) nanoparticles synthesized by microwave irradiation method. HA exhibits excellent biocompatibility with various kinds of cells and tissues making it suitable for applications in dental, orthopedic and tissue engineering applications. In recent years, great efforts have been made in developing nanostructured HA for applications in the field of biosensors.

We have adopted a novel biosensor based on iron doped hydroxyapatite and multiwalled carbon nanotubes hybrid composite (Fe-HA/MWCNT) immobilized on a glassy carbon electrode. Cylic voltammetric (CV) studies indicated that the anodic oxidation of L-dopa occurs at an applied potential of 0.18 V verses Ag/AgCl (3M KCl). Under optimum conditions, the fabricated sensor gave a linear response range of 1.0×10^{-7} -1.1×10^{-6} M with the detection limit as low as 62 nM. The Fe-HA/MWCNT modified electrode displays an excellent selectivity, good reproducibility and long-term stability towards the determination of L-dopa [P. Kanchana and C. Sekar, 2015]. The sensor was successfully applied for the detection of L-dopa in medicinal plant samples. Amperometric responses were carried out with the addition of different concentrations of *mucuna pruriens* seed and leaf extracts in phosphate buffer solution. The observed concentration of L-dopa from 50 mg *mucuna pruriens* seeds and 2 g *mucuna pruriens* leaves are found to be 77.29, 2.46 and 17.78 mg with R.S.D of 7.30, 6.56 and 4.79 %, respectively. These results clearly indicate that the fabricated sensor could be efficiently used for the determination of L-dopa in medicinal plant.

It is proposed to extend the application of the fabricated sensor for the detection of other neurotransmitters and main plant chemicals in *mucuna pruriens* and also estimation of rare medicines in other plants too. This type of study will be helpful for scientific validation of Indian Ayurvedic medicines.



L-dopa detection scheme using Fe-HA/MWCNT modified GCE

Wet-chemistry approach, Pathogenic bacteria decay, Vitamin B_2 sensing

-P. Muthukumaran, Research Scholar

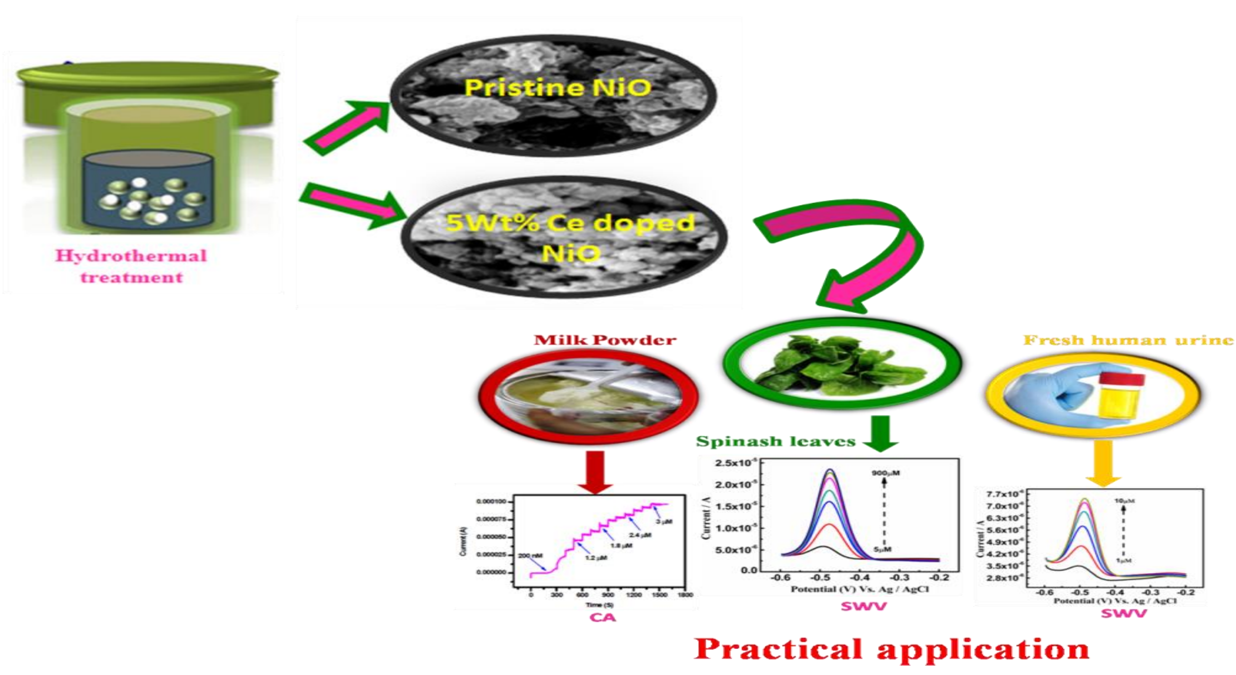
Physicist from Alagappa University researchers have grouped up to lighting a "living sensors" - a sensitive, selective, reproducible use of asthma, diabetic, neural disorder and vitamin B_2 deficiency patient.

In a paper published this highlighted in "NATURE INDIA" 2016 on 24th February, the researchers synthesized rare earth doped material by hydrothermal that could potentially out coming source of developed biosensor group of vitamin B_2 similarly inhibit pathogenic bacteria, both in the bacterial inhibit and urine infection in the human body.

Muthukumaran et al., detect the sensor like riboflavin, so as prepared material modified them on glassy carbon electrodes to detect minute trace biomolecule. Peak current increases with increasing concentration of vitamin B_2. Even though, after completion 100th cycles of scan rate stability of current withstand as 1st cycle 86% with efficiency of riboflavin concentration.

On other hand, nanoparticles play role against bacteria decay also such as *Klebsiella pneumoniae*, *Salmonella typhi*, *Bacillus cereus*, *Bacillus subtilis* and *Staphylococcus aureus*. Influence of electrostatic interactions and generated reactive oxygen species due to the positively charged nanoparticles easily bound to negatively charge bacterial cells through promisingly kill the bacteria[1]. Interestingly, we performed practical utility also carried out in human being sample like fresh human urine and also in milk powder, Spanish leaves to trace riboflavin content in it possibly.

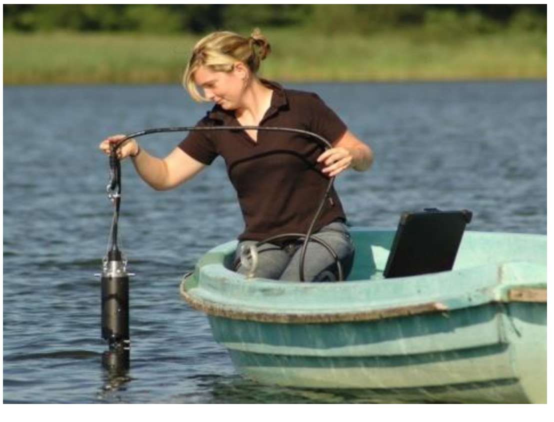
Dr. J. Wilson & Coworkers from polymer electronics lab detect various biomolecules, it's prove a stepping ladder for future application in pharmaceutical field to fabricate a biomarker devices for several disorders.



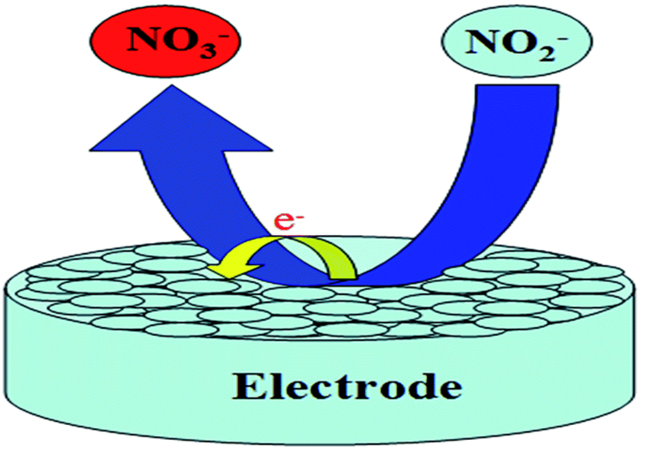
Water pollutant Nitrite Sensor

– R. Ramya, Research Scholar

Sensors are used in everyday objects such as touch-sensitive elevator buttons (tactile sensor) and lamps which dim or brighten by touching the base. There are also innumerable applications for sensors of which most people are never aware. Applications include cars, machines, aerospace, medicine, manufacturing and robotics. In this article focused on nitrite in water pollutant sensor. Nitrite is a problem as contaminant in ground water due to its harmful biological effects. Highly sensitive nitrite (NO_2–) detection has attracted increasing attention in the past decades due to their detrimental effect on both environment and human health. The rapid increasing pollution of ground water resources for human consumption by nitrites due to the anthropogenic activities from agriculture(by using nitrogen based fertilizer) and waste water from industry is receiving worldwide attention.



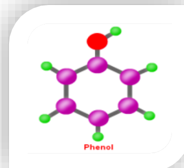
The World Health Organization has fixed the maximum limit of 3 mg L−1for nitrite in drinking water. Nitrite contamination in drinking water can cause different diseases such as methemoglobinemia or "Blue Baby Syndrome" and stomach cancer by the formation of N-nitrosamines when nitrite ions interact with amines. Therefore, it is of great importance to accurately monitor nitrite for public health, environ-mental and food industries. Several analytical techniques have been developed for nitrite determination including spectrophotometry, chemiluminescence, capillary electrophoresis and chromatography.



However, these analytical methods usually have expensive equipments, tedious detection procedure and often time consuming. Compared to these methods, the electrochemical method can provide compact, relatively inexpensive, reliable, sensitive and real-time analysis. Moreover, the development of a rapid electrochemical method for nitrite detection without the sample pretreatment prior to analysis and also no interference from other sources (such as nitrate, sulfate, and bromate ions andoxygen) is highly important. Recently, different kinds of electro-chemical nitrite sensors have been fabricated based on the chemical modification of electrode.

Phenolic compounds

-P. Thivya, Research Scholar



Phenol is an alcohol in which a hydroxyl group is directly attached to a benzene ring. Due to the uses of phenol, it is one of the most important classes of organic compounds. It is also known as carbolic acid and the first instance of its isolation has been reported in the early years of nineteenth century. Phenol finds application in many industries and has been of commercially synthesized on large scales.we discuss about two different types of phenol groups.

- ***Catechol***
- ***Hydroquinone***

Catechol

Catechol is a dihydroxybenzene which are important environmental pollutants due to their high toxicity and low degradability in the ecological system. Catechol widely used in many fields, such as cosmetic, dye, pesticides, medicines, and Pharmaceutical industries. Catechol is mainly distributed in water. The substance must be rigorously contained by technical measures to prevent it from being released to the environment. All effluent releases that may contain the substance must be directed to a sewage treatment plant. In order to ensure an adequate control of the risk for the aquatic compartment, the concentration of catechol before and after treatment must respect stringent limit values to comply with applicable regulation

Hydroquinone

Hydroquinone is an aromatic organic compound, which appears as a white granular solid. In skincare, hydroquinone is mainly used commercially as a skin lightening active. Research studies conducted in order to support the claims of hydroquinone in cosmetics have determined that it is an effective skin lightening ingredient, which can help diminish the appearance of hyperpigmentation (extreme darkening of an area of skin). Hydroquinone functions by inhibiting the enzyme tyrosinase, which is needed to produce the pigment melanin- the molecule primarily responsible for skin coloration.

Some of the uses of phenol

Approximately two-third of the total phenol produced worldwide is used to prepare reagents used in plastic manufacturing industries. We cannot imagine our lives without plastic.. Most of the things around us are either made from plastics or have plastic components in them. The polymerization reaction of phenol with formaldehyde is used to commercially prepare phenolic resins. The resulting resin is known as phenol – formaldehyde resin, commercially it is marketed by the name of bakelite. Bakelite is extensively used in electrical switches and automobiles due to its property of withstanding extreme conditions of heat and resistance to electricity and other chemicals. Phenol is also used in cosmetic industry in the manufacturing of sunscreens, skin lightening creams and hair coloring solutions.

About the Editorial Board

Editor In-chief

Dr. C. Sekar received his Ph.D. degree in Material Science from Anna University, Chennai in the year 1997. He served as post-doctoral researcher at NTT Corporation, Japan and IFW Dresden, Germany for about 8 years. He has received Sir C.V Raman research innovative award. He is a Professor and Head of the Department of Bioelectronics and Biosensors at Alagappa University, Karaikudi since 2010. His research activities include chemo-biosensors for medical, food and environmental applications, nanostructured metal oxides, biomaterials, carbon nanotubes and low dimensional cuprates.

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Associate Editor

Dr. J. Wilson received his Ph. D degree in Alagappa University during the year of 2006 and also holds a membership in Professional bodies like The Indian Science Congress Association and Materials Research Society of India (MRSI). He is an Assistant Professor in the Bioelectronics and Biosensors department, Alagappa University, Karaikudi, India since 2008. His specialized areas are Nanostructured conducting polymers,Metal oxides, Carbon based materials, Biosensors, lithium batteries. Recently one of his research works is highlighted in Nature India Publishing group.