Journal of Science and Technology
ISSN: 2456-5660 Volume 5, Issue 2, March-April 2020, PP 25-31
www.jst.org.in

Exigency for Use of Nano Material Biosensors In Diagnosis of Disease

A. Mohamed Sikkander [1], SK.Rafi[2], K.Kavitha[3]
[1,3] *(Department of Chemistry, Velammal Engineering College, Chennai-INDIA)*
[2] *(Department of Chemistry, Rangarajan Dr Sagunthala R&D Insitute of Science & Technolgy Chennai-INDIA)*
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Abstract: *Nanobiosensors across the world encompass a biological identification molecule immobilized onto the face of a signal transducer. Nanotechnology is having a rational impact on the expansion of a new class of biosensors known as nanobiosensors. Nanobiosensors are being widely used for molecular enlightening of biomarkers coupled with diagnosis of ailment. The application of new nanomaterials in biosensing has inclined biosensing research. The use of high surface area nanomaterials has been important in producing nanobiosensors with greater consideration and shorter response times. This view summarizes the advances in ailment diagnostics, first and foremost through the finding of molecular biomarkers, such as proteins and nucleic acids mediated by use of nanobiosensors. A lot of diseases are accompanied by attribute odors, and their acknowledgment can provide indicative clues, guide the laboratory estimation, and affect the choice of instant therapy.*

Keywords: *nanosensor, biosensors, diagnostic clues, immediate therapy ,biomimetic, high sensitivity , routinemetrics*

I. Introduction

The cram of the chemical opus in human breath using gas chromatography/mass spectrometry (GC/MS) has shown an alliance between the volatile compounds and the occurrence of certain illnesses [1]. The occurrence of those precise compounds can provide a warning to physiological fault and support the diagnosis of diseases. This condition requires an analytical tool with very high perceptive for dimension. The low-power, crammed together tool, called a nanosensor array chip, is used for such an analysis, in-situ and in real time. This tool will make available a non-invasive method for fast and accurate diagnosis at the medical point of care or at home. The sensor chip will have manifold sensors on it for a wide-ranging measurement of chemical composition, temperature, humidity, and pressure.

The sensor chip can be linked directly or via USB to a cellphone for data transmission over a long distance, and receive a tutoring from a doctor's office for instant therapy. A number of volatile compounds, called biomarkers, are found in breath samples.
Usually at low parts per billion (ppb) levels. Generally, the attentiveness of the chemical markers in the human breath is very low and the surroundings relation humidity is high, almost 100%. The technology urbanized in this work uses an array of chemical sensors combined with humidity, temperature, and pressure for synchronized breath measurement to correlate the chemical information in the breath with the state and implementation of different human organs. The high kindliness of the sensors is obtained from the nanostructure materials that possess the high surface area and ordered molecular structures [2]. This system uses a network of nano-chemical sensors combined with a monitoring system self-possessed of humidity, temperature, and pressure sensors assembled on a silicon chip for real-time chemical and physical property dimension of human breath for non-invasive and low-priced medical diagnosis.(Figure:1)

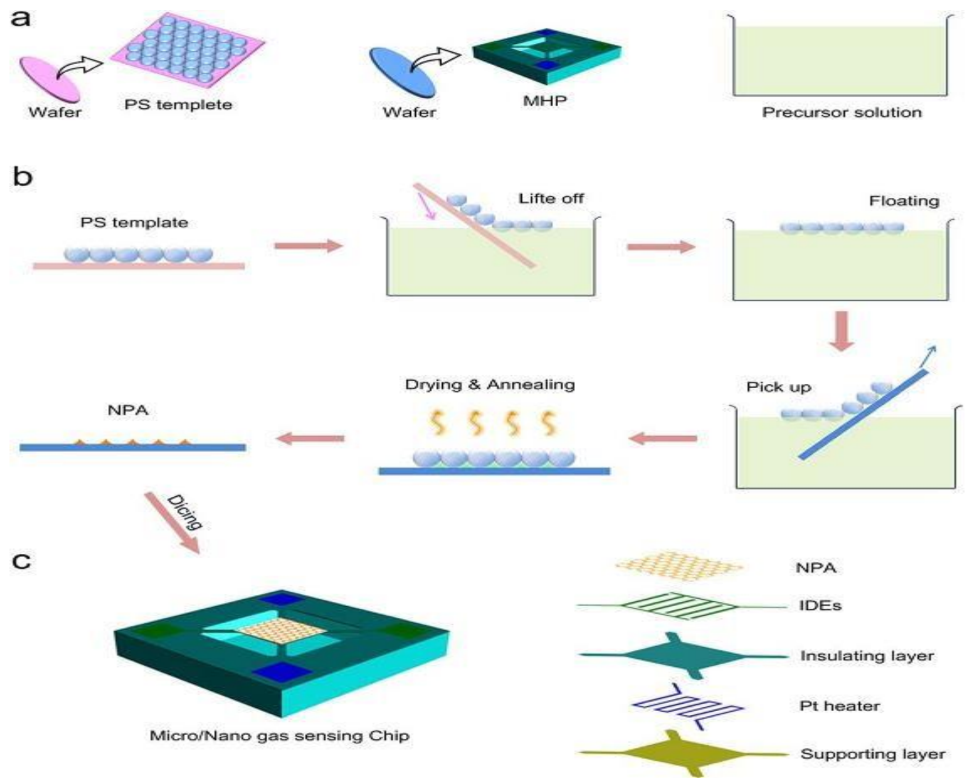

Figure:1Micro/Nano Gas Sensors

This development will be useful for astronaut health monitoring, point-of-care for medical diagnosis, and early caution of any diseases correlated to the excess of chemicals in the biospecies.

II. Nano Sensoring Property

Sensor is a device that responds to a stimulus, whether chemical or physical, generating a indication that can be electronically analyzed. In order to be well thought-out a suitable device, the sensor should have a fast response to outside stimulus, be able to notice an analyte in proportion as low as possible, have low recovery time, recognize the right analyte among others, and be an easy-to-operate system. In addition to that, a low-cost and environmental friendly characteristic is enviable [3].

Thus, there is a requirement to improve systems that have been already used and find new promising alternatives that allow changing mature technologies. A shows probable option is the use of carbonaceous nanomaterials due to their precise properties that make them suitable to be used as technological sensors. (Figure:2.)

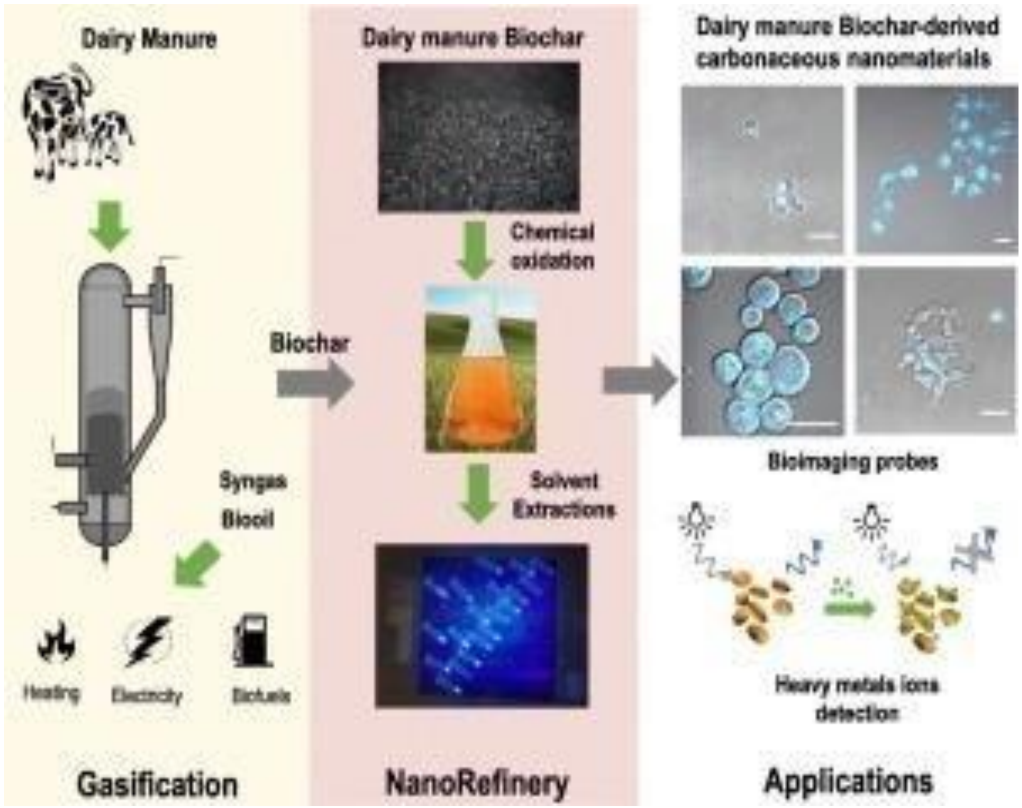

Figure:2.Potential option is the use of carbonaceous nanomaterials due to their specific properties that make them suitable to be used as technological sensors

The far above the ground reactivity of dissimilar carbon structures allows functionalization, which can increase the selectivity of a preferred analyte.The quality of each carbon-based nanostructure allows it to be used in a specific sensor system. For example, sensors based on NDs contain nitrogen-vacancy defect centers (NV) are capable to be used in biological environments [4]. NV defects or NV centers have a fragile quantum nature that can be used to monitor external perturbations, such as magnetic or electrical fields.

These centers are one of the most ordinary defects in the diamond structure and consist of a nitrogen atom and adjacent lattice vacancy and are liable for fluorescence of NDs . NDs sensing can be performed at ambient temperature and show very high compassion. NV centers present in NDs structure enable transducing physical characteristics to an optical transition that can be documented in single photon range, by identifying the magnetic resonance of a single or few nuclear spins. Differences in amount and shape of fluorescent NDs (FNDs) also bang on the photoluminescence, chemical, and biological properties.

FLN has been broadly studied for producing biosensors due to improved electron-transfer kinetics, high surface-to-volume ratio, and biocompatibility [5]. Nanocomposites based on FLN, fundamentally C_{60}, can be used to detect dissimilar biological molecules, including licit and illicit drugs, glucose, DNA,adenosine triphosphate (ATP), and more than a few of others.(Figure:3.)

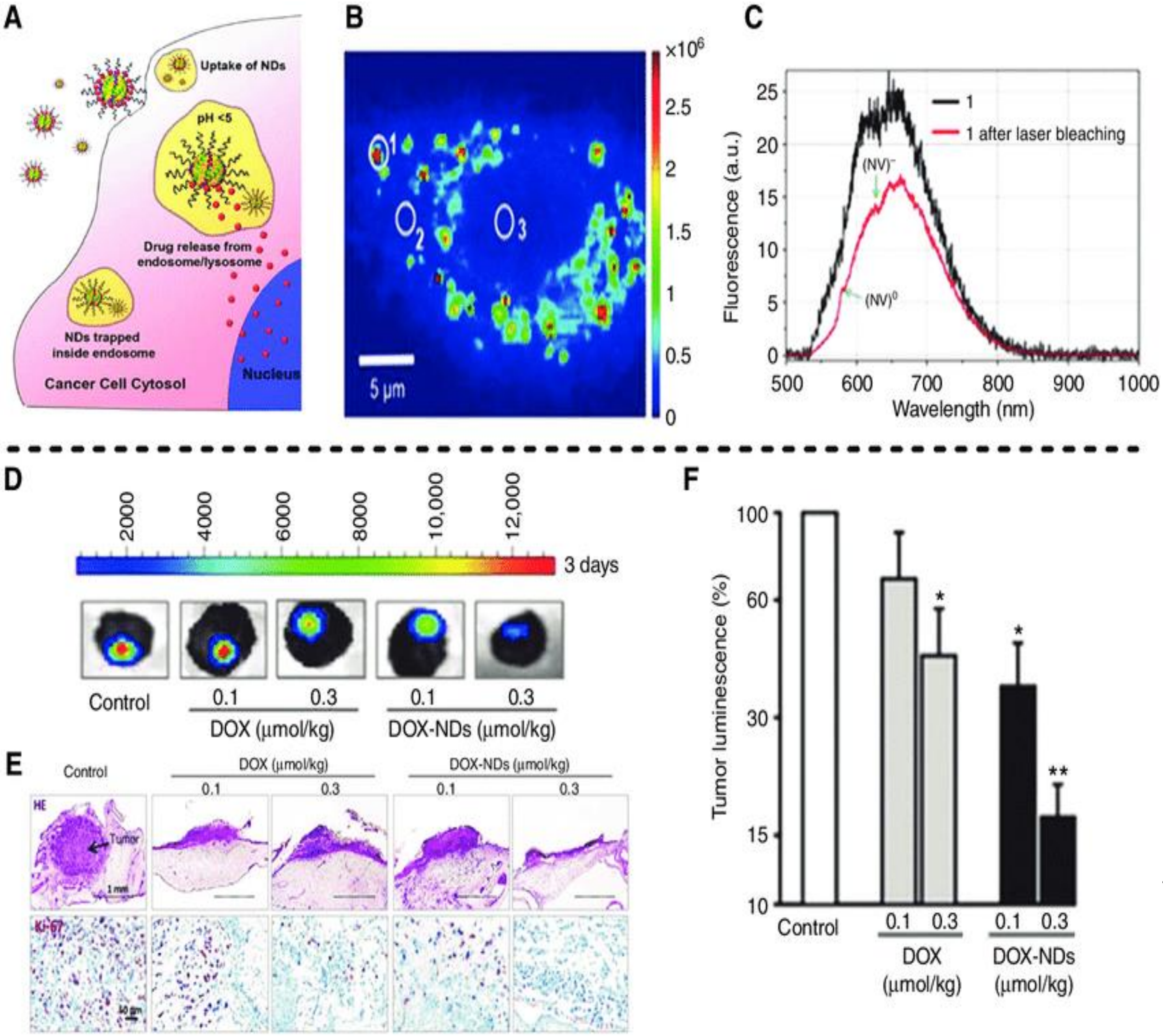

Figure:3.Differences in size and shape of fluorescent NDs (FNDs) also impact on the photoluminescence, chemical, and biological properties

Optical and photoelectrical properties of FLNs were also explored for the spreading out of color sensing materials. In mechanical fields, FLNs present high impact strength and high pliability. The occurrence of fully conjugated π-electrons limited in zero dimension leads to a strong redox commotion and remarkable electronic properties. Also, FLN-shortened icosahedral structure is an outstanding electron acceptor[6]. One of the most significant properties of FLNs is their capability to react with different molecules and functional groups. Chemical functionalization expands their credible of applications, since it increases solubility in dissimilar solvents, and unite their properties with those of other compounds. Even though physically stable, FLNs molecules have high electron affinity and are chemically reactive, in exacting with free radicals.

Due to their high surface-to-volume rate and untenanted structure, CNTs have unique properties. They can absorb a elevated number of molecules onto their surfaces through electronic communications, being considered first-rate candidate to produce chemical and biological sensors [7]. CNTs electrical properties put on show excellent carrier mobilities, near-perfect quantum efficiency, and ultrathin carcass allowing applications at sub- 8 nm scale, which is seen as a limit to improvement of conformist semiconductors.(Figure:4.)

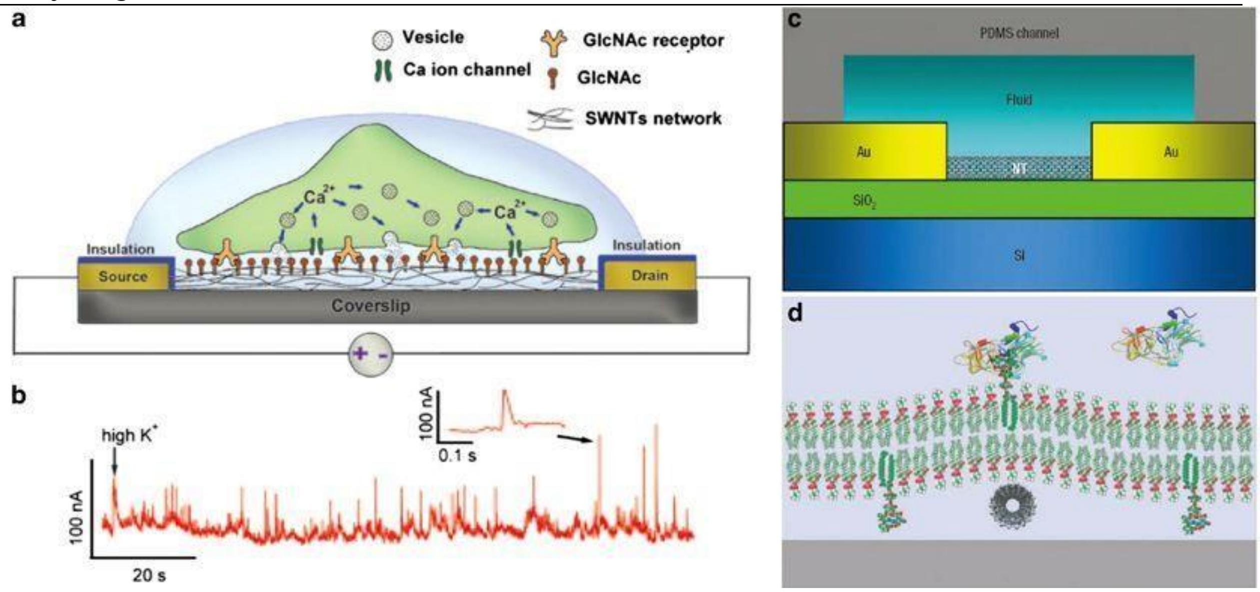

Figure:4. CNTs electrical properties display excellent carrier mobilities, near-perfect quantum effectiveness,andultrathinbody,allowingapplicationsatsub-8 nmscale,whichisseenasalimitto development of conventionalsemiconductors

Advances in CNT-based electronics lead to the development of CNT field-effect transistor considered as a feasible alternative to approximately all current metal-oxide-semiconductor-field- effect transistor applications [8].

GPN and its derivative have been used as a underdone substance for sensors in far removed from applications due to their thermal and electrical conductivity, large facade area, speedy heterogeneous electron transfer rates, and high mechanical potency [9]. Recent studies showed outstanding results for instance better responsiveness, low cost, easy operation, fast response and recovery time, and good selectivity. However, important parameters, such as the best probable number of graphene layers, or which is the best way to measure response and routes of fabrication, is still essential. One of the most common applications of graphene-base sensors is quantifying gases.

Each and every one structures mentioned above clutch properties that can be used as sensing mechanisms depending on the preferred application. Several examples of carbon-based structures applied to sensor devices are obtainable. An assessment of great response sensors with others already reported is presented. Concerning the criteria to develop this review, studies from the last 2 years with a significant application on the sensing field were well thought-out.

III. Conclusion

Within the next decade, investigative devices based on nanotechnology will become available, and be able to execute thousands of measurements very rapidly and inexpensively. Future trends in diagnostics will continue in tininess of biochip technology to the nanoscale range. The most common clinical indicative application will be analysis of blood proteins. Blood in the systemic transmission reflects the state of health or disease of most organs. Therefore, revealing of blood molecular fingerprints will provide a sensitive assessment of health and disease. Molecular electronics and nanoscale chemical sensors will enable edifice of microscopic sensors capable of detect pattern of chemicals in a fluid. Information from a large number of such plans flowing inertly in the bloodstream allows estimation of the properties of tiny chemical sources in a macroscopic tissue volume.

Estimates of reasonable device capabilities have been used to evaluate their performance for typical chemicals released into the blood by tissues in response to limited to a small area injury or infection. These observations indicate that the devices can readily enable demarcation of a single cell- sized chemical source from the conditions chemical concentration in vivo, providing high-resolution sensing in both occasion and gap. With the methods currently used for blood investigation such a chemical source would be difficult to differentiate from background when diluted throughout the blood volume and withdrawn as a blood sample.The trend will be to build indicative devices from the bottom up, starting with the most elementary building blocks. Unless there are early successes that translate into large-volume sales and early adoption, the long range foretell for nanobiosensors in disease diagnosis is promising.

A factor that may support the accomplishment of nanobiosensors is the trend of moving away from fluorescent labeling as trimness reduces the signal intensity, but there have been some improvements assembly fluorescent labeling methods viable with nanoparticles. Nanobiosensors will also make easy the development of non- polymerase chain reaction diagnostic technologies. As a further modification nanotechnology can potentially be used for study of a single cell to enable a genetic diagnosis.

In subsequently decade, nanobiotechnology-based biosensors will participate an vital role not only in diagnosis but also in connecting diagnosis with treatment and development of personalized medicine. Because of the incorporation and interrelationship of several technologies involved in nanodiagnostics, those who conduct these tests or devise innovative tests will be taking a more active part in decision-making in future health care systems. Another significant area of application will be cancer diagnostics. Methods for molecular diagnosis of cancer, including genetic profile, are currently commercially available.

However, by the time a cancer is detected by currently accessible methods, it is often too late for curative treatment.Nanobiosensors can tender ultrasensitivity in detection of biomarkers for cancer, which may be applied in the prospect for early detection as well as treatment of cancer. Nanodevices for this purpose are now in the viability stage. A nanodevice for use in both cancer diagnostics and therapeutics, known as a nanotheranostic device, could be entrenched as a prophylactic measure in individuals who do not have any obvious manifestations of cancer, and cancer shadowing could be conducted by remote monitoring. Such monitoring could detect cancer at the most primitive stages and enable appropriate therapeutic intervention. These monitoring strategies should be biodegradable, and safety must be established before implant.Such an observation system would be the ultimate in personalized prevention of cancer. Early detection would augment the chances of a cure. Such a device would have advantages over detection of biomarkers in specimens of body fluids, because such examinations can be performed only every so often and would be less precise than analyses conducted continuously in vivo.

In the near future, use of nanodiagnostics could diminish waiting times for test results. For example, patients with contagious diseases could make available urine samples when they first arrive at the clinic, and the results could be all set by the time they see the physician. Patients could be getting a prescription immediately, reducing the length of time that the patient has to wait for results, thereby decreasing anxiety, improving compliance, and making the whole process less expensive.

The responsibility of nanobiosensors is to continuously monitor biomarker concentration levels for active track and effectual treatment of disease. It also needs to be a point-of-care device which in turn means simplistic human association towards detection. The best probable solution would be to be able to just drop the sample onto a sensing device and incessantly monitor the concentration of biomarkers in attendance the sample.Nearly everyone important clinical applications of the currently available nanotechnology are in the areas of biomarker innovation, cancer diagnosis, and detection of infectious micro-organisms.

References

1. Kamila Schmidt, and Ian Podmore, Current Challenges in Volatile Organic Compounds Analysis as Potential Biomarkers of Cancer, Journal of Biomarkers 2015,Volume 2015 | https://doi.org/10.1155/2015/981458
2. Nalin Katta, Douglas C. Meier, Kurt D. Benkstein, Steve Semancik, and Baranidharan Raman The I/O transform of a chemical sensor Sens Actuators B Chem. 2016 Sep; 232: 357–368. Published online 2016 Mar 14. doi: 10.1016/j.snb.2016.03.019
3. Jordan J. Hinman ,Fluorescent Nanodiamonds, Literature Seminar October 28, 2014
4. Kevin A. Schug,and Wolfgang Lindner Noncovalent Binding between Guanidinium and Anionic Groups: Focus on Biological- and Synthetic-Based Arginine/Guanidinium Interactions with Phosph[on]ate and Sulf[on]ate Residues *Chem. Rev.* 2005, 105, 1, 67-114 https://doi.org/10.1021/cr040603j
5. Choi JP,and Murray RW. Electron self-exchange between Au140 (+/0) nanoparticles is faster than that between Au38 (+/0) in solid-state, mixed-valent films. J Am Chem Soc. 2006 Aug 16;128(32):10496-502.
6. N. Saifuddin, A. Z. Raziah, and A. R. Junizah Carbon Nanotubes: A Review on Structure and Their Interaction with Proteins Jornal of Chemistry 2012 vol.2013.18-25https://doi.org/10.1155/2013/676815

7. Yong-Bin Kim , Integrated Circuit Design Based on Carbon Nanotube Field Effect Transistor ,Transactions on Electrical and Electronic Materials 12(5) October 2011 DOI:10.4313/TEEM.2011.12.5.175
8. Haizhou Huang, Shi Su,Nan Wu,Hao Wan,Shu Wan,Hengchang Bi, and Litao Sun Graphene-Based Sensors for Human Health MonitoringFront Chem. 2019; 7: 399. Published online 2019 Jun 11. doi: 10.3389/fchem.2019.00399
9. Akhtar Hayat, and Jean Louis Marty, Disposable Screen Printed Electrochemical Sensors: Tools for Environmental Monitoring ,Sensors 2014, 14, 10432-10453; doi:10.3390/s140610432