A Study on Detection Of E-Coli Bacteria in Drinking Water using E-Nose System

Pa. Suriya, K. Naveenkumar, S P Sangeetha, R Divahar, S. Vijaykumar

1Research scholar and Assistant Professor, Department of Civil Engineering, Aarupadai Veedu Institute of Technology deemed to be Vinayaka Missions Research Foundation, Chennai – 603104, India.
2Research scholar and Assistant Professor, Department of Civil Engineering, Aarupadai Veedu Institute of Technology deemed to be Vinayaka Missions Research Foundation, Chennai – 603104, India.
3Professor and Vice Principal, Department of Civil Engineering, Aarupadai Veedu Institute of Technology deemed to be Vinayaka missions Research Foundation, Chennai – 603104, India.
4Associate Professor and Head, Department of Civil Engineering, Aarupadai Veedu Institute of Technology deemed to be Vinayaka missions Research Foundation, Chennai – 603104, India.
5Undergraduate Student, Department of Civil Engineering, Aarupadai Veedu Institute of Technology deemed to be Vinayaka missions Research Foundation, Chennai – 603104, India.

Mail: pasurya1@gmail.com

Abstract. E-nose system is mainly used to ensure the qualitative analysis of microbes accumulated in the water and air. It is an authoritative tool to evaluate the odour compounds during the quality control process. Our aim of the project is to use the E-Nose system for finding the E-coli Bacteria in the public water supply sources for drinking purposes. As the instrument for detecting E-coli Bacteria is not available, and hence we construct an instrument with a sensor having computer connectivity. This work is deliberated to measure the microbial contamination in water segregation system in metropolis and municipalities. However, the range of limits to all factors are associated to sensor with respect to the conventional methods of micro-organism detection. The collection of water from pond at sirudhavoor village in Chengalpattu district. In this sensor system, using an embedded PIC microcontroller is used to detect and quantify the microbial contaminants. The results of this analysis will give the details of CO2 and its bacterial density in drinking water.

Keywords. E-Nose system, E-Coli Bacteria, Drinking water, Microbial contaminants, Biosensor

1. Introduction

Water is a transparent fluid which forms the world’s streams, lakes, oceans and rain and is the major constituent of the fluids of living things. As a chemical compound, a water molecule contains one oxygen and two hydrogen atoms that are connected by covalent bonds. Water covers 71% of the Earth’s surface. It is vital for all known forms of life. On Earth, 96.5% of the planet's water is found in seas and oceans, 1.7% in groundwater, 1.7% in glaciers, a small fraction in other large water bodies, and 0.001% in the air as vapour. Only 2.5% of the Earth's water is freshwater and 98.8% of that water
is in ice (excepting ice in clouds) and groundwater. Less than 0.3% of all freshwater is in rivers, lakes, and the atmosphere, and an even smaller amount of the Earth's freshwater (0.003%) is contained within biological bodies and manufactured products. Safe drinking water is essential to humans and other life forms even though it provides no calories or organic nutrients. Access to safe drinking water has improved over the last decades in almost every part of the world, but approximately one billion people still lack access to safe water and over 2.5 billion lack access to adequate sanitation.

A report, issued in November 2009, suggests that by 2030, in some developing regions of the world, water demand will exceed supply by 50%. Water plays an important role in the world economy, as it functions as a solvent for a wide variety of chemical substances and facilitates industrial cooling and transportation. Approximately 70% of the fresh water used by humans goes.

2. Literature Review
Wedge et al. 2009 has used electronic noses to detect vapour using sensor in chemistry field. E-noses were comprising with series of organic field-effect transistors (OFETs). They are predominantly appreciated in the scope and assortment of the material which they provide concerning analyte binding. These techniques used to analyse the data using Genetic Programming (GP) and dealt with OFETs, which detect airborne in actual field. The variety of parameters which controls, on resistance, offset current and mobility which gives the sensitivity, specificity and speed of sensing. (Kott, 1965) has investigated on the advantages of counting the numbers of viruses using LD 50 method over conventional methods like MPN. The procedure of the MPN method for T2 and bulk T bacteriophages performed consistent and exact over controlled conditions. The merits of such method are to determine the few numbers of bacteriophages in large sizes of fluids. In marine water, the different varieties bulk T bacteriophages with conventional methods. The particular spasm of T bacteriophage on E. coli B permits to use samples deprived of deliberating any healing to remove another bacterium. The consequences show that secondary growth of other bacteria appears. The revealing of harmful microbes in the water is the very slow process and needs the costly equipment (Bertoldi, 2012). In actual scenario, debauched recognition is fundamental for distribution of water in proper networks, the employment of wireless biosensor in the water system to detect the worsen bacteria, which is harmful to consumers. Electronic tongue is used to analyse the microbial detection in water monitoring system to ensure the quality (Lindquist 2001). The sensor system was used to describe the water quality changes using multi-electrode virtual sensor system using signal analysis. Dhoble et al. 2013 has investigated on the food safety and security using the sensor detection in order to develop the hygiene of the consumers. This scheme is established a classical model, which is used to investigate the food items on the source behaviour of the material.

3. Design and description of E-Nose System
The emerging system called E-nose is industrialised for the computerised recognition, understanding the nature of smell, gaseous matter involved. The revealing of harmful matters presents in the form of gases with the help of this device. It is applied in the various sector such as food industries, medical field, air pollutant detection. In order to ensure the quality of the drinking water, which is free from microbial content and other foreign gases. The system consists of series of sensor which is used to measure and recognize in the different pattern shows that chemical involved in the water. Gas detection sensor using Tin oxide (SnO₂) also used to specifically analyse the methanol impurities present in the alcoholic compounds. In this paper, detection of E-coli in potable water using a carbon dioxide (CO₂) sensor. The prospective and superior quality of potable water is an elemental component for the persistence of all living organisms. The source of water is taken for the study in the local village called sirudhavoor at Chengalpattu district.
3.1. PIC Microcontroller - PIC16F877A
The PIC microcontroller is used to interface the energy measurement unit and GSM module. The PIC microcontroller used here is PIC16F877A.

3.2. LCD Module
A liquid crystal display (commonly abbreviated LCD) is a thin, plane parade stratagem made up of any numeral of tint or undistinctive pels arranged in anterior of a light source. It is often utilized in battery-powered electronic devices because it uses very small amounts of electric power. The LCD used is HD 44780. It has been used in parallel mode, which is connected to port-D for data and port-E for control signal of liquid crystal display. The HD 44780U dot-matrix LCD regulator and chauffeur LSI parades alphamerical. It can be constructed to ambition a dot-matrix fluid quartz parade beneath the regulator of a 4-bit or 8-bit microchip. Since all the purposes such as parade RAM, character originator, and fluid quartz motorist, obligatory for lashing a dot-matrix fluid quartz demonstration are within providing on one blemish, a trifling arrangement can be interfaced with this regulator/motorist.

3.3. Hydro CO₂ Sensor
Dissolved CO₂ molecules diffuse through a specialized thin film composite membrane into the internal gas circuit leading to a detector chamber, where the partial pressure of CO₂ is determined by means of IR absorption spectrometry. Concentration dependent IR light intensities are converted into the output signal from calibration coefficients stored in firmware and data from additional sensors within the gas circuit.

3.4. Power Supply
A power supply (sometimes known as a power supply unit or PSU) is a manoeuvre or arrangement that stores electric or supplementary categories of energy to an output load or group of loads. The term is most commonly applied to electric energy provisions, fewer frequently to motorised ones, and infrequently to others. The transformer steps up or steps down the input line voltage and isolates the power supply from the power line. The rectifier section converts the alternating current input signal to a pulsating direct current. However, as you proceed in this chapter you will learn that pulsating dc is not desirable. For this reason, a filter section is used to convert pulsating dc to a purer, more desirable form of DC voltage.

Figure 1. Well Water Sample has been collected
4. Testing of The Samples Using E-Nose System

The exposure of germs in drinking water that are destructive to healthiness, elasticities a antique synopsis of the peril of ailment from pathogens. E-coli is the furthermore copious coliform organism contemporary in the human and animal intestine, and can be existing in faces causing a main concern to health.

![Figure 2. Instrument has been set to ON position and calibrated](image1.png)

![Figure 3. Sample is tested and the readings are displayed in the display screen](image2.png)

![Figure 4. Pure Drinkable water having 18ppm of CO₂](image3.png)
5. Results and Discussion

As per Indian Standards IS: 10500 – 1991 drinking water has its permissible limits to ensure safety to use the water for drinking purpose. The parameters which is to be tested is turbidity, taste, pH value, presence of hardness and presence of E-Coli bacteria in drinking water. For the purpose of detecting the E-Coli bacteria an instrument with a sensor having computer connectivity is constructed. The
system of testing the drinking water is termed as E-Nose system. The prearrangement parades the eminence of drinking water and demonstration the percentage level of microbial contaminants. This work is proposed to distinguish organic water toxins like coliform group of bacteria in drinking water. Yet, a numeral of restrictions is allied over traditional methods of microbial detection.

6. Conclusion

E-nose device is used to found the effectively quantifying the microbial contaminants in the drinking water. the survival of bacterial in water is based on the presence of carbon dioxide content. This study is aimed at qualifying the carbon dioxide content. If the limits of carbon dioxide content in the range of 15 to 50 ppm, then it is considered as a potable water. When the limit exceeds the 110 ppm, it is not fit for drinking purposes. The results were shown that bacterial count and also comparing with the traditional method with sensor response. This system results shows the quality of water and the range of microbial contaminants expressed in percentage. Future studies would be to improve the system by assimilating radical chemical similarity sensors for identifying chemical impurities and hardness of water.

7. References

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