Real Time Quality Detection of Vegetables using Sensors

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Abstract - *Quality detector is a hardware which determines the physical and chemical parameters of the specifically selected vegetables. The aim of this project is to develop quality detection for vegetables using sensors. Due to commercialization of agriculture in India, the focus is now on high yield than in high nutrients. So in need of high yield, food gets adulterated to gain more quantity in short period of time. Moreover, pesticides in vegetables are using above the legal maximum residue limit by farmers to gain more profit in lesser time. Although pesticide is highly effective on pests but they can reside in the environment. Among the OP group, Dimethoate is widely used in brinjal and okra. Dimethoate is an acetylcholinesterase inhibitor which disables cholinesterase, an enzyme essential for central nervous system function. In this fabrication, the moisture and color sensor is used to identify the quality of the vegetables; the pesticide sensor is used to determine the level of pesticide sprayed during off-field and on-field. In the quality detection system, it has been found that the percentage value of organic samples and the contaminated pesticide samples of brinjal and okra are 28.4%, 15.7% and also between fresh produce of farm samples and locally available market samples are 23.5%, 10.7% respectively. The large variation among these samples shows the high contamination of pesticide residue in vegetables. Hence, the system can be successfully used for the detection of pesticide residues in vegetables. The suggest sensor system is easy, rapid and time undemanding method.*

Key Words: **Dimethoate, organophosphate, brinjal, okra**

1. INTRODUCTION

India ranked second in the production of vegetable and fruits after China with 13.4% of total production. Among the total production of 1.21 billion. There are total of 110.7 million comes under the list of farmers. Also India ranked fourth in the world in the production of agrochemicals. Survey conducted by various institutes indicates that 50 -70% of vegetables production are contaminated with pesticide residue. Balwider Singh (2016)

Increase in the population of India produce higher demand for food as well as decrease in land for farming. Therefore to fulfill the increase in demand, food is adulterated to get more quality in short period of time. Mainly pesticides in crops are using the legal maximum residue limit by farmers to gain more profit in lesser time. In this paper, design of a prototype is made to sense the moisture, color and pesticides approximately. Pesticides are chemical substances applied to crops at various stages of cultivation and during the postharvest storage crops. The use of pesticide is intended to prevent the destruction of food crops by controlling agricultural pests or unwanted plants and to improve plant quality. Pesticides use in commercial agriculture has led to an increase in farm productivity. Despite the wide ranging benefits of using pesticides in agriculture have several incorrect applications can result in high and undesirable levels of the compounds in the produce that reaches consumers. These include inappropriate selection of pesticides used on foodstuff, over use of pesticides and harvesting the vegetables before the residues has washed off after application.

Pesticide selection: However, nowadays Organochlorine (OC) pesticides were not used primarily due to their persistence in the environment Jain, A.V. *et al*., 2006. At this time, the use of OPs and CMs glided due to their availability and quick degradation in the environment Organophosphorus pesticides have been widely manufactured and used in the world. And they replaced the chlorinated pesticides.

Dimethoate is a extensively used organophosphate insecticide used to kill insects on contact. It was patented and suggested in the 1950s by American Cyanamid. Like other OPs, Dimethoate is an anticholinesterase, which disables cholinesterase, an enzyme essential for central nervous system function.

Monitoring of pesticides in vegetables samples has increased in vegetable sample has increased in last year's since most countries have established maximum residue level(MRL)for pesticides in food products. With the gradual advance of urbanization construction, the procurement of vegetables are most in markets and supermarkets. However these procurement locations almost have no pesticide residues detection device. Nikitha.R *et al.*, (2019)

2. EXISITING METHODS

There are various methods present for the detection of pesticides in the samples of different vegetables. The traditional methods are the laboratory methods like several types of chromatography techniques such as gas chromatography, liquid chromatography and further joining different techniques such as mass spectrometry with it to get better results. Chromatographic methods added to selective detectors had been traditionally used in pesticide analysis because of their sensitivity, selectivity, reliability and efficiency. They are time-demanding and laborious, and needs expensive equipments and highly skilled technicians. Some other methods are also there some flow injection analysis, enzyme linked immunosensor assay and some electro analytical techniques. All these methods need lot of time for sample preparation and gives result after some duration of time. This limitation results into the need of better detection of pesticide toxicity in vegetables.

Due to the last decade, significant attention has been given to the development of sensor for the detection of pesticide residue as a promising alternative. A promising and most reliable

alternative to previous laboratory techniques is the development of sensors to check different parameters like moisture, colour and pesticide in vegetables. A suggested sensor system is a self-contained device that integrates sensing element (e.g. moisture sensor, colour sensor and pesticide sensor) that recognizes the analyte is used to convert the analog signal obtained into digital required form. Their low cost, easy design, smaller size, safety and time undemanding analysis is the biggest advantages of the device and make it excellent candidate for the development of portable device.

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3. METERIALS AND METHODOLOGY

Dimethoate is (O, O-dimethyl S-[2-(methylamino)-2-oxoethyl] dithiophosphate) in IUPAC used for the analysis.

In this research, various samples of Brinjal (*Solanum Melongena*) and Okra (*Abelmoschus Esculentus*) were collected randomly from the local market of Coimbatore. Total 3 samples of each were taken for the analysis of pesticide residue. The samples from organic farm are also being collected to set reference value.
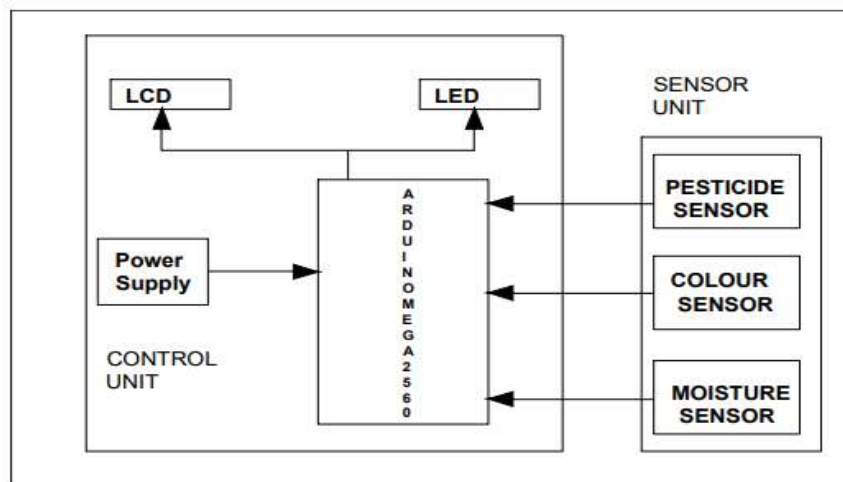

Fig1.Block diagram of quality detection system

3.1 PROCEDURE

- **Step1**: Power supply is given to the equipment Arduino ATmega2560 microcontroller gets started for working.
- **Step2**: When the vegetable is placed in the sample placing tray, first the gas sensor will sense the pesticide residues in vegetable and passes the information to Arduino, which is displayed in LCD in terms of percentage.
- **Step3**: Then the moisture sensor which is fixed near the gas sensor senses the moisture level of vegetables in percentile.
- **Step4**: Finally, the colour sensor T1CS3200 senses the colour of the particular vegetable under the concept of RGB. When the MRL level exceeds, it will indicated through the buzzer and LED.

4. RESULT AND DISSCUSSION

The proposed method determines the moisture, colour and pesticide residues in brinjal and okra samples collected from both market and organic farms. Three samples of each vegetable are investigated. It was found that most of the pesticide containing samples show large variation from the values gets from pesticide free samples. The large variation shows the presence of pesticide in samples and serious threat to human health. The table (1) shows that the different percentage values of various samples pesticide containing and also between organic samples and market samples are more than 5%. Hence, shows the presence of pesticide in both brinjal and okra samples.

SAMPLE	NO.OF SAMPLE ANALYSED	MEAN VALUE		
		Pesticide free sample	**Pesticide containing sample**	**Market sample**
brinjal	3	23.5%	28.5%	25%
okra	3	10.7%	15.7%	13.7%

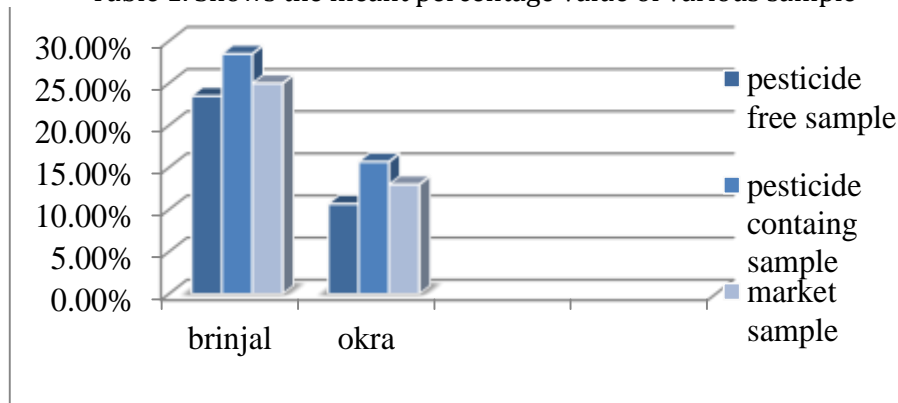Table 1. Shows the meant percentage value of various sample

Fig2.Graph Show the Different Percentage Values of Various Sample

In this project we are used brinjal and okra to find out the moisture content by moisture sensor. It gives the results effectively comparing to microwave oven drying method. The samples which was used in the microwave oven drying method that cannot be useful for further/ future use, but in moisture sensor that can be useful. samewise colour sensor also gives better result to detect colour in vegetable samples. Moreover, this quality detector is cost effective, easy to carry, even uneducated peoples can operate this detector friendly.

5. CONCLUSIONS

The main objective of this study is to control pesticide residue on fruits and vegetables and protect the consumers from the various illness as side effects. Therefore it is more crucial to monitor the pesticide residue in vegetable. This application of the pesticide residue deduction instrument has been performed on real samples. To overcome, the various limitations faced during the use of conventional methods, the new pesticide residual detection method is in progress to improve the existing techniques and mainly to develop the new ones. To improve the reliability of analytical results, this method can be used for various types of other vegetables, moreover even more number of chemicals monitoring in the future.

REFERENCES

[1] Horticultural Statistics at a Glance 2018. National Horticulture Board. 2018,

[2] Season and Crop Report of Tamil Nadu. Department of Economics and Statistics. Government of Tamil Nadu. 2014

[3] Devi PI. (2010) Health risk perceptions, awareness and handling behavior of pesticides by farm workers.

[4] Jeyanthi H, Kombairaj S. Pesticide Use in Vegetables - Frequency, Intensity and Determinant Factors. Agriculture Economics Research Review. 2005

[5] Srinivasnaik S, Kuttalam S, Philip H, Bhuvaneswari K.(2015) Study on pesticide usage pattern by the farmers in major okra growing areas of Coimbatore district in Tamil Nadu.

[6] Kumar BA, Ragini K, Padmasri A, Rao KJ, Shashibhushan V.(2017) Survey on pesticide usage pattern in bhendi (Abelmoschus esculentus L.).

[7]Asi, M. R., A. Hussain, Z. Iqbal and J. Anwar (2002). Validation of some Thin Layer Chromatographic Methods as alternative to GC and HPLC for pesticide analysis in grains 2002, China Agriculture University, Beijing, China.

[8] Qian, C. and D. Liu. (2002). Alternative methods of GC and HPLC for pesticide residues analysis in grain, China Agriculture University, Beijing, China.

[9] APEDA (Agricultural and Processed Food Products Export Development Authority). (2015).

[10] Banerji, R. and Dixit B.S. (2003). Monitoring of pesticide residue in summer fruits and vegetables growing on the riverbed side. Bulletin of Environmental Contamination and Toxicology.

[11] N. Nishant and R. Upadhyay (2016) Presence of pesticide residue in vegetable crops.

[12]Rishi Pal, Rajendra Singh, Ritesh Sharma (2016) Determination of the Organophosphorus Pesticide in Okra Crop, Abelmoschus Esculentus (L.) By Gas-Liquid Chromatography In Meerut Region.

[13] Deepali Gupta, Balwinder Singh, Harpreet Singh(2016) Design and Development of Pesticide Residue Detection System using EC and pH Sensor.