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Pulsed Electric Field based Vegetable Fresher

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Abstract— The current study's aim is to learn about the impact of pulse fields on food and equate them to other thermal methods of food production. Food consistency, food protection, freshness, nutritious food, natural flavour and taste with extended shelf-life are the most relevant factors for market demand today. Pulse field processing (PEF) could also be a non thermal processing technology to kill microorganism present in food by the appliance of short pulses of high electric fields for micro-seconds to milliseconds. It retains the taste, vitamin content, and colour of foods. PEF technology seeks to supply customers with high-quality food goods. It can be used in replace of thermally processed food because it produces the foods that have the great quality as compare to thermally processed food.
Keywords-food, processing,technology,pef,methods,thermal,compare, quality, electric

I. INTRODUCTION

Pulsed electrical fields (PEF) can also be a non-thermal food protection strategy that uses brief electrical pulses to inactivate microbes while causing limited damage to food quality attributes. PEF technology seeks to deliver high-quality foods to consumers.PEF processing is considered preferable to traditional thermal process methods for food safety qualities because it prevents or significantly decreases harmful changes in the sensory properties of foods. PEF technology seeks to deliver high-quality foods to consumers.

PEF technology has been considered superior to other methods of destroying microorganisms, such as heat treatments, since it destroys microorganisms while retaining the unprocessed food's primary colour, taste, texture, and organic process price. PEF technology requires adding high-voltage pulses to liquid or semi-solid foods that are sandwiched between two electrodes.The bulk of PEF research has concentrated on the impact of PEF treatments on microbic inactivation in milk, milk proteins, egg products, juice, and other liquid foods. However, while PEF has published a large number of research papers on the microbiological aspects of food preservation, there is less information available on the effect of this science on food constituents as well as overall consistency and acceptability The use of periodic electrical fields (PEF) in food processing has recently reawakened interest. The PEF treatment has been shown to be highly efficient at inactivating microorganisms, increasing pressing potency and improving juice extraction from food plants, and speeding food dehydration and drying.Because of the rising demand for foods with a high organic process price and fresh-like characteristics, non-thermal processes have gained popularity in recent years as a viable alternative to conventional thermal treatments. Periodic electrical fields (PEF) are a new non-thermal food processing technique that has been widely researched.Several researchers have looked at the PEF mechanism in relation to

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a wide range of liquid foods. Apple and Pomegranate juices are two of the most often studied foods in PEF research. Juices' sensory properties are said to be retained, and the shelf life is said to be expanded.Yogurt beverages, apple sauce, and sauce have also been seen to maintain a fresh-like consistency despite being refined for an extended period of time. Milk, juice, pea soup, liquid whole egg, and liquid egg merchandise are examples of PEF-processed foods.
Food storage technologies have been used to promote the development of microbes or the inactivation of microbes. Foods are maintained in some cases by inhibiting microbicbehaviour by conditions that most successfully affect the expansion and survival of microorganisms, such as temperature, water content, the addition of additives like preservation, pH, and changes in the environment.The microorganisms will not be killed in this situation and will still be metabolically active and stable if moved to an appropriate environment. Since the infection dosage of certain morbific microorganisms is estimated to be extremely low, growth of such microorganisms in foods isn't needed to trigger infection.
To be called an alternative methodology, a modern technique must have a major effect on efficiency while still maintaining the expense of technology within reasonable limits. Many developments have been explored in recent years that have the ability to inactivate microorganisms at lower temperatures than those used in traditional heat treatments.
The use of high-intensity, short-duration electrical fields, ranging from microseconds to milliseconds, may trigger temporary or permanent permeabilization of cell membranes. Since the use of PEF has piqued interest in many scientific fields such as cell biology, biotechnology, medicine, and food science, the effects of PEF on bio membranes have been extensively investigated.The influence of PEF-processing variables on the bioactive composition of foods during their shelf-life is checked and compared to that obtained for various thermal and non-thermal process technologies, with a particular emphasis on the impact of PEF-processing variables.Furthermore, examples of not only the promise but also the shortcomings of PEF technologies are presented when trying to maintain the health-promoting options of plant-based foods. The PEF technology makes use of electrical fields to inactivate the vegetative cells of microorganisms and yeasts in a range of foods.Since microorganism spores are resistant to periodic electrical fields, this technology is primarily used to combat food-borne pathogens and spoilage microorganisms, particularly in acidic foods. PEF technology dominates the microbiological protection of foods in a fast and homogenised manner, in addition to its volumetric effects, The undefeated implementation preserves the sensory and organic process price of foods for a longer period of time without the use of heat. PEF technology has the ability to reduce energy consumption in a cost-effective and efficient manner, while also delivering microbiologically safe and minimally processed foods.The successful implementation of PEF technology suggests a viable alternative to the traditional thermal processing of liquid food products such as fruit juices and liquid egg.

II.PRINCIPLE OF PEF

The application of PEF technologies entails the use of heartbeats with higher electric fields for just a few microseconds or milliseconds, with force varying between 10-80kV/cm. The number of heartbeats sent to the object kept between two anodes decides the contact.Between these anodes is a void known as the treatment hole of the chamber. During the preparation of PEF, high voltage is

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used, As a result, microorganisms present in the food sample are made inactive. Various systems, such as dramatically rotting waves, bipolar waves, or oscillatory heartbeats, use the electric field.Different temperature scales, such as surrounding, sub-encompassing, and more encompassing temperatures, may also be used to express the relationship. After being treated with PEF, the food is stuffed and stored in the refrigerator.

Food comprises a few particles that lend it an unmistakable degree of electrical conductivity, which is the science behind the exchange of electric heartbeats from food.Because of the presence of charged particles, this technique is widely chosen for fluid food types because electrical flow streams through the fluid food more effectively and the exchange of heartbeats from one highlight to the next in fluids is very easy.

A heartbeat generator is used in the basic framework, which induces high-voltage beats,The treatment chamber is connected to the controlling and monitoring devices and handles the item to be dealt with. The food item is placed in the treatment chamber, which is equipped with terminals connected by a nonconductive material that maintains the power progression from one to the next.The object collects high-voltage electrical heartbeats that are transferred to it. The object placed between the anodes is exposed to a charge that causes the bacterial cell layers to burst. PEF creativity is commonly recommended for sanitising a range of foods, including milk, juices, yoghurt, fluid eggs, and soups.In addition, combining PEF with ultrasound, high pressing factor, and bright light medications can improve interaction yield.

MICROBIAL INACTIVATION BY PEF:

PEF's mode of action in reducing microbial load in different food products has been explored in several studies. However, the precise mechanistic methodology driving PEF's microbial inactivation is yet to be thoroughly explained.However, a general process of PEF operation entails the introduction of an electrical field and electromechanical compression, which causes microbial membrane instability and pore formation. Membrane mechanical fickleness is caused by a critical membrane potential created by an electrical field.Electropermeabilization happens when electroporation induces a substantial rise in membrane rupture and permeability. Depending on the degree of membrane organisational modifications that occur in cell death, electropermeabilization may be reversible or permanent.According to the literature, increasing the power of the electric field increases membrane permeability significantly. This increased membrane instability correlates with microbial cell inactivation. In contrast to vegetative cells, spores are said to be more resistant to PEF treatment.

PRODUCT NATURE

PEF administration is often affected by the quality of the food, as PEF treats a wide variety of items, including fruit juices, liquid eggs, milk, and dry herbs. Experimental studies have shown that PEF treatment is ineffective for materials with particles or special properties, such as emulsions.The rate of microbial decontamination is also influenced by the physical and chemical properties of the food. PEF's capacity to inactivate microorganisms is affected by pH, water movement, and electrical conductivity, according to various reports.

The inactivation kinetics of microbes was heavily influenced by pH. Salmonella inactivation was shown to be higher in foods with pH values of neutral or above neutral, according to Jeantet et al.

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Similarly, Alvarez et al. found a significant decrease in the amount of L. monocytogenes in high acid foods like citrus juices.Similarly, the care medium's conductivity has an inverse association with microbial inactivation. Foods with high electrical conductivity have been shown to have fewer microorganism inactivation following PEF therapy. According to Min and Zhang, water activity has a clear association with microbial reduction by PEF treatment.

CHARACTERISTICS OF MICROBES:

Microorganism inactivation using PEF technology is also dependent on microbial characteristics such as microorganism type, species, and strains. In contrast to yeast cells, Gram-positive and Gram-negative bacteria are considered to be more immune. Bacterial and mould spores, meanwhile, are said to be immune to PEF therapy.Due to variations in the production of essential membrane potential, cell size and shape also influence inactivation kinetics. Different bacterial species are affected at different rates by PEF therapy. Salmonella and E. coli, as opposed to Listeria and Bacillus species, are thought to be more vulnerable to PEF.Temperature, growth medium, nutrient concentration, and pH of the treated medium are all factors that affect PEF quality.

III.APPLICATIONS IN FOOD INDUSTRY:

PEF processing has been used to pasteurise a variety of food products, including juices, milk and dairy products, broth, and liquid eggs.It does, however, have certain disadvantages, such as the substance having to be free of air bubbles and having a lower electrical conductivity.Furthermore, particle size should be smaller than the care region's gap to ensure proper treatment. While PEF is not recommended for solid foods, some solid products have been tested to see whether they can be effectively handled with PEF.PEF technologies can also be used to improve plant cell extraction of bioactive components and sugars.The ability of PEF processing to handle less viscous fruit juices with lower electrical conductivity, such as apple, orange, and cranberry juices, has been demonstrated. PEF technology also has a positive impact on fruit juice consistency parameters.Similarly,In addition to microbiological quality, PEF-treated foods maintained their fresh taste, textural, and practical qualities and had a longer shelf life. PEF technology has been used for a variety of applications in recent years, including improving drying speed, modifying enzymatic behaviour, solid food preservation, waste water disposal, and extraction.

PEF IN FRUIT PROCESSING:

The pef processing has potential applications in the citrus industry, especially in terms of inactivating microorganisms and preventing the production of off-flavors during storage. The treatment of apple juice with the pef improved the diffusion coefficients of soluble substances, according to Remain et al.This technology can also be used to disintegrate biological tissues in order to improve the production of intracellular compounds from various fruits.For example, pectin is a very useful component found in many fruits that is typically extracted using an enzymatic reaction, but this reaction is inefficient and produces less pectin.

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BACTERIAL INACTIVATION IN MILK BY PEF

As the involvement of certain pathogenic bacteria, such as Escherichia coli, Listeria, and Pseudocodes SPP, inadequately pasteurised milk can cause a number of health problems.Concerns about the effect of heat treatment on milk production, as well as market desire for goods with fresh-like quality things, have prompted the induction of the pef for milk pasteurisation.The pef-induced microbial inactivation is thought to be an efficient means of preserving milk without compromising its consistency.

The efficacy of PEFmethod for microbial decrement in simulated ultra-filtrate and skim milk has been shown in studies. As a result, validating the value of the pef solution to inactivate bacteria in a dynamic whole milk matrix for a true contrast with thermal pasteurisation is critical.

PEF AND MEAT QUALITY

Owing to the availability of essential micronutrients and high quality protein, Animal items are commonly eaten all over the world. Meat quality is particularly significant because it is perceived to be the most important factor in consumer buying decisions. Pulsed and electric field technology has shown promise in a number of applications in solid foods, including PEF method can be used in the meat processing industry for a variety of reasons, including increasing permeation of cells to improve tenderness, extending the shelf life of meat by reducing microbial load and preserving the volatile portion of meat while storage. PEF technology can enhance enzyme release and glycolysis, both of which are necessary for meat tenderization.

IV.EXISTING TRADITIONALSYSTEMS

SUGARING:

Sugar was used as a preservative in the earliest cultures, and it was popular to store the fruit in honey. Preserves are produced by heating fruit with sugar in northern climates where there isn't enough light to dry foods.

FREEZING:

Freezing is also one of the most common methods for preserving a large variety of foods, both commercially and at home, including packaged foods that may not have needed freezing in their raw state.

BOILING:

Microbes can be killed by boiling liquid food products.

HEATING:

With perpetual stews, heating to temperatures high enough to destroy microorganisms within the food may also be an option. To destroy microorganisms, milk is often boiled before being stored. There are a few other strategies, such as curing, pickling, and jugging.

V.PROPOSED SYSTEM

The proposed system is concerned with the creation of a composite bin based on the pulsed field theory. Food treatment with pulsed field treatment may be a non-thermal option. It's widely believed that increasing the electrical field distribution's homogeneity improves the process's energy

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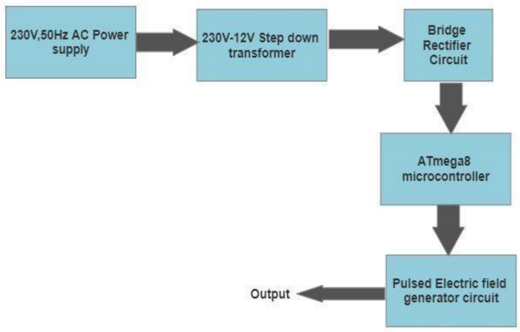
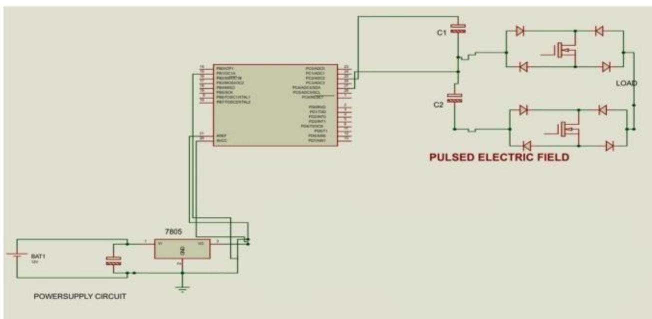
efficiency, assuming that a minimum field strength is required for electrification.

BLOCKDIAGRAM:

The Block diagram is depicted below. The major blocks are Bridge rectifier circuit, Frequency boost converter, PEF electric field generator circuit.

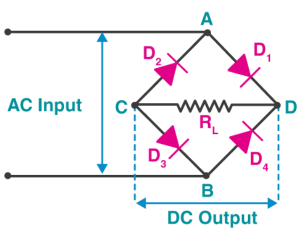


CIRCUITDIAGRAM:



CONSTRUCTION:

Bridge rectifier:The diagram below illustrates the design of a bridge rectifier. Four diodes D1, D2, D3, D4, and a load resistor RL make up the bridge rectifier circuit. To efficiently convert alternating current (AC) into direct current (DC), the four diodes are connected in a closed-loop configuration (DC). The absence of the costly center-tapped transformer is the key benefit of this configuration.



The input signal is applied to terminals A and B, and the output DC signal is obtained by connecting terminals C and D to the load resistor RL. Just two diodes conduct electricity during each half cycle due to the arrangement of the four diodes. During the positive half loop, D1 and D3 conduct electric current as a pair.Similarly, during a negative half loop, diodes D2 and D4 conduct electric

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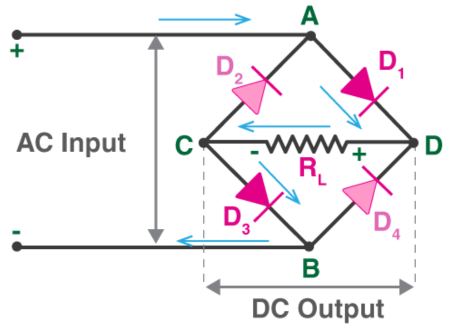
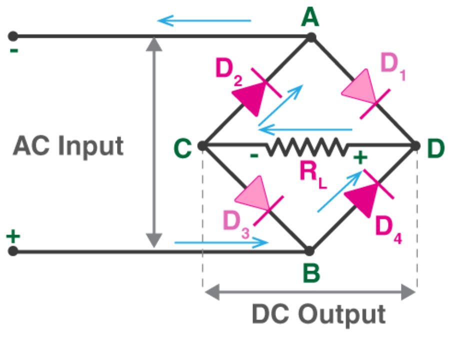
current.When an AC signal is applied through the bridge rectifier, terminal A becomes positive and terminal B becomes negative during the positive half period. D1 and D3 become forward biassed as a result, while D2 and D4 become reverse biased.The flow of current during the positive half-cycle is depicted in the diagram below:

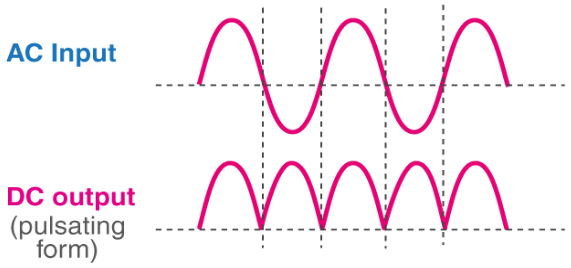


Terminal B becomes positive during the negative half-cycle, while terminal A becomes negative. This induces forward bias in diodes D2 and D4 and reverse bias in diodes D1 and D3.

The current flow during the negative half cycle is shown in the figure below:



The current flow through load resistor RL is the same during the positive and negative halves of the loop, as seen in the diagrams above. The polarity of the output DC signal may be completely positive or completely negative. It is entirely optimistic in our situation. When the diodes' path is reversed, we get a fully negative DC voltage.
As a result, a bridge rectifier allows electric current to flow during both the positive and negative half cycles of the input alternating current signal.
The output waveforms of the bridge rectifier are shown in the below figure.



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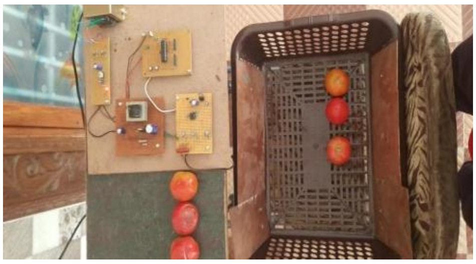
RESULT:

Vegetableskeptatfirstday



Vegetables after two days

VI.CONCLUSION

The composite bin has been designed and put through its paces. The results of the experiment were positive. The system proved to be cost-effective and successful in its service. The ATmega8 microcontroller proved to be a much stronger operating system.We also discovered that this approach has a number of advantages over traditional heat treatments, including 1) increased shelf-life. 2)Pathogen levels are lower.3)Adjusted pro.Pulsed electric field technology is being studied all over the world. The majority of the research done so far done in the lab and on a small scale, and it has yielded positive results.PEF's ability to eradicate microorganisms in food, minimise enzymatic activity, and increase shelf-life with marginal improvements in the consistency of the penultimate product as compared to the first is the basis for this prediction.
The aim of food preservation technologies used by the food industry is to keep microorganisms from contaminating foods after they have done so. The protection against of microbial growth or the inactivation of microbials are the foundations of food preservation technologies..PEFis aeasy non-thermal food preservation technique that could eventually replace traditional thermal processing. Cell membranes create pores when exposed to high electrical field pulses, either by enlarging existing pores or by creating new ones. Depending on the treatment situation, these pores can be permanent or temporary. The pulsed electric processing device is made up of more components.Pulsed electric fields technology is being researched all over the world. The majority of the research done so far has been in the laboratory and on a pilot plant scale, with positive results.Electroporation can be

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reversible or irreversible depending on the intensity of the field power (cell membrane discharge).

VII.FUTURESCOPE

Other parameters such as temperature, pH level, nutritional composition, and optimising the PEF process will be studied in the future scope of this project.

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