



Examining the Use of Ultrasound in Combination with Washing Treatments as a Means of Removing Pesticide Residue from Vegetables and Fruits

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ABSTRACT

The primary goal of the study is to examine the various mitigation approaches that individuals in the agriculture sector and government officials can engage in to guarantee the optimal safety of farm produce. The reason why this issue is a problem is that many people globally rely on food production for their livelihood. Attack by pests is the primary issue faced by farmers as the pesticides used remain on the final produce and they reduce food quality to the point of making it unsafe for human consumption. The problem investigated in the study is how to guarantee the safety of food production. Moreover, the research aims at ensuring whether governments can combine ultrasounds with the available washing treatments when dealing with fruits and vegetables. At that juncture, the study utilizes a qualitative design through the adoption of secondary methods of data collection. The articles relevant for the study are those published from the year 2014 to 2020 to guarantee the accuracy of information as earlier documents may contain data that is inapplicable to current situations. The research specifically concentrates on examining whether the use of ultrasound together with washing treatments can eliminate pesticide residue from vegetables and fruits. The information gathered is crucial and could assist those working in the industry to incorporate safer ways of ensuring that people consume farm produce that are free of any poisonous pesticide residues. More importantly, the discussion examines what different scholars have researched concerning the issues and their views on the factor to gather data on the efficacy of the approach in eradicating pesticide residues. Through this, it remains evident that individuals acknowledge and appreciate the benefits of using ultrasonic cleaning as a method of eliminating pesticide residue in fruits and vegetables.

KEYWORDS: mitigation approaches, pesticide residue, farm produce, pesticides, ultrasonic cleaning

INTRODUCTION

In the current field of agriculture, the use of pesticides has gained a lot of prominence due to their efficiency in eliminating pests, infections, and weeds, which kill and reduce the quality of crops. Another advantage of using pesticides is that they ultimately lead to increased production by enabling farmers to cultivate much food on a significantly small piece of land. The increase in food production translates to the reduction of hunger globally as individuals have access to locally available or imported produce. On the contrary, the use of the pesticides has a downside, as some particles of the chemicals remain on the final produce that is ready for human consumption. The ingestion of these residues by humans could have chronic consequences. However, researchers have stated that the amount of residue found on the fruits and vegetables is not an outcome of the pesticide itself but how long the crop has had exposure to the pesticide in addition to the concentration [1]. Moreover, the skin of the fruits and peels of vegetables are the most toxic parts as they contain the majority of the residue. In connection to that, it remains essential to establish a way in which governments and farmers can ensure that the final product reaching the consumer does not contain pesticide residue and is therefore safe for consumption. The utilization of ultrasound in combination with washing treatments is the main method under examination. The review will firstly highlight the materials and methods adopted during the study to establish how the researcher acquired the information presented. Additionally, the discussion section will detail the data gathered on the efficacy of combining ultrasound and washing treatments as a methods of ensuring that those in the agriculture industry remove any pesticide residues present in fruits and vegetables. The conclusion will detail the key points discussed.

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MATERIALS AND METHODS

Two types of research exist. The quantitative research method aims at quantifying the study to gather information. The purpose of this type of research is to apply mathematical models, hypotheses and theories concerning the occurrences. In most cases, quantitative data is information that is in arithmetic form, whereby the researcher studies the data assisted by numbers expecting the numbers to produce a subjective outcome, which can be widespread to more individuals. Conversely, qualitative research involves severe examination in a particular topic with the aim of recounting and discovering significance through writing [2]. Qualitative studies yield information on the specific circumstances that were studied and more overall conclusions are deliberated as suggestions. Thus, the researcher utilized the qualitative approach since it provided them with procedures that will assist him/her to understand why attitudes may alternate. Additionally, qualitative research makes it possible for honest ideas to be sourced from particular socioeconomic demographics. However, when the researcher was applying this method, it became evident that the mode of research can produce data that is hard to present.

Various modes of data collection are present. The primary technique of data collection is the process by which information is gotten from first-hand sources through the use of surveys, investigation and observations, whereby the information has not undergone processing or manipulation. On the contrary, secondary mode of data collection is when the researcher uses data that was collected and recorded by another individual. Examples of secondary data sources are books, magazines or journals [3]. The researcher adopted the secondary mode of research as it saves time as it does not require a lot of time to look for data since these days; the internet has made it faster and easier to access secondary data through search engines. Also, the digitalization of libraries facilitated advanced searches. When using secondary data, the researcher had a high chance of leading to new unexpected discoveries that might add more value to the data. However, the researcher noticed that secondary data might result in faulty conclusions since secondary data can offer a lot of information that does not meet the objective of the scholar.

The first material for secondary research was the laptop, which the researcher used to access the internet. The researcher used some articles and journals that had information on the use of ultrasound in combination with washing treatments as a means of removing pesticide residue from vegetables and fruits. The material was the most significant since it enabled the researcher to acquire the relevant documents from Google Scholar by typing the key terms under evaluation. Since the primary method of collecting information was the secondary approach, there were minimal ethical concerns present. The reason for this is that the authors had already awarded their consent to researchers by availing the data online. Thus, this meant that the data was viable for use. However, to avoid the issue of plagiarism, the researcher ensured that he referenced all the content utilized appropriately [4].

The inclusion and exclusion criteria were also relevant for the study. Inclusion criteria are the qualities that potential subjects ought to have if they are to be incorporated in a study [5]. Correspondingly, exclusion criteria represents the features that eliminate potential individuals from a study. In connection to that, the study applied the criteria, whereby the researcher used journals published from 2014 to 2021. The reason for this was to guarantee the use of recent content that had a more updated, relevant and accurate information. Additionally, the study strictly utilized the peer-reviewed articles to ensure that the data had undergone appropriate evaluation by the relevant professionals in the field. Also, only the studies that concentrated on ultrasound cleaning as a mode of eliminating pesticide residues were considered for the research. Moreover, the researcher excluded journals published before 2014 as the data in the journals may not be up-to-date and applicable to current research. Ultimately, the entire procedure led to the generation of sufficient data on the topic that promoted the formulation of the discussion section.

DISCUSSION

Ultrasonic cleaning, otherwise referred to as ultrasound-assisted cleaning, is a method of eliminating harmful particles in products through the use of an ultrasound [6]. The ultrasound can operate with water or with other solvents. Hence, the ultrasonic cleaning applies to fruits and vegetables as individuals can use the relevant washing treatments in combination with the process to guarantee the ultimate safety of the final product. The concentration on fruits and vegetables arises from the fact that individuals slightly cook or consume them in their raw status, thereby directly exposing them to the pesticide residues. The use of ultrasonic cleaning has proved effective in the eradication of pesticide residual [7]. For example, compared to other conventional approaches, the adoption of the ultrasonic process has showcased uniqueness as a result of its capability of eliminating any contaminants in food. Also, the approach is environment-friendly and saves on time and money [8]. Thus, the combination of washing treatments with ultrasonic cleaning will ensure the elimination of all harmful residues present as previous researchers have evaluated its competence and proved that it is effective.

The use of cc and washing treatments as a method of removing pesticide residue from fruits and vegetables is effective as the procedure of cavitation guarantees the elimination of all particles on the surface of the produce. The process also ensures the inactivation of any microorganisms present that may harm the life of the humans that consume a fruit or vegetables. The cavitation procedure during ultrasound cleaning entails the establishment, growth, and termination of bubbles that creates a restricted automatic and chemical energy [9]. Through this, it remains evident that governments can safely incorporate ultrasonic cleaning to fresh farm produce in a bid to control microbial pollutions. The use of ultrasound will not alter the nutritional contents of the fruits and vegetables. The statement implies that ultrasound cleaning is a safe method with no harmful consequences to the final produce. Therefore, the agriculture sector should look into the method and utilize it in combination with the current washing treatments to ensure the optimal elimination of pesticide residues in fruits and vegetables.

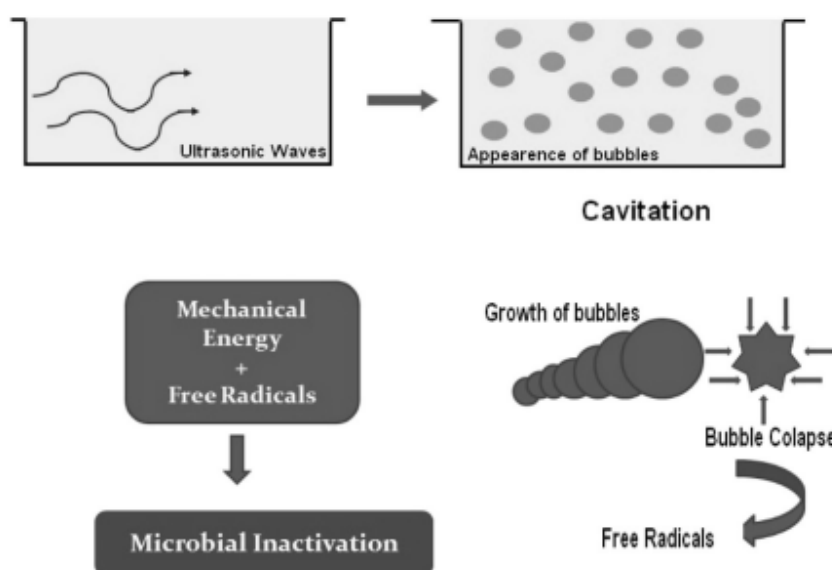


Figure 1: The cavitation process [9]

Most importantly, the utilization of ultrasound together with washing treatments has been effective in the removal of pesticide residue from fruits and vegetables given that the right pressure and concentrations are utilized. For example, when cleaning a tomato to eliminate dichlorvos, it is essential for individuals to use six milligrams of ozonized water, three per cent concentration of detergent solution, and an ultrasonic cleaner with a power output of thirty watts to guarantee success [10]. Another factor that facilitates the removal of dichlorvos residue from a tomato is the total time taken during the process. In other words, this means that the more the time taken by individuals during the cleaning procedure, the more efficient the elimination of harmful residue. Moreover, the combination of these methods when cleaning the tomato did not affect the quality of the final product since the vegetable contained the same nutrients it had before the procedure. Therefore, the government should borrow the success of this experiment and encourage the use of ultrasonic cleaning in the agricultural sector to ensure the safety of farm produce from pesticide residues. Further, the use of ultrasound cleaning in conjunction with washing detergents remains an effective method in the elimination of pesticide residue from fruits and vegetables as it causes an eradication of more than ninety per cent of residues. A study conducted to remove pesticide residues from strawberries led to this conclusion as the researchers examined the best methods of eradicating residue from fruits by evaluating and comparing four approaches. The methods evaluated consisted of the use of tap water, ozonized water, boiling, and the use of an ultrasound. Out of all the four modes, the utilization of tap water was the least effective as it led to the elimination of sixty-eight per cent of pesticide residue, while ionized water eradicated seventy-five per cent of the contaminations [11]. The study revealed that boiling was more efficient in reducing pesticide residue as it eliminated ninety-two per cent of deposits, followed closely by ultrasonic cleaning at ninety-one per cent. Hence, it remains clear that ultrasound cleaning is an effective approach on its own, thereby combining it with other washing treatments will ultimately ensure the safety of fruits and vegetables.

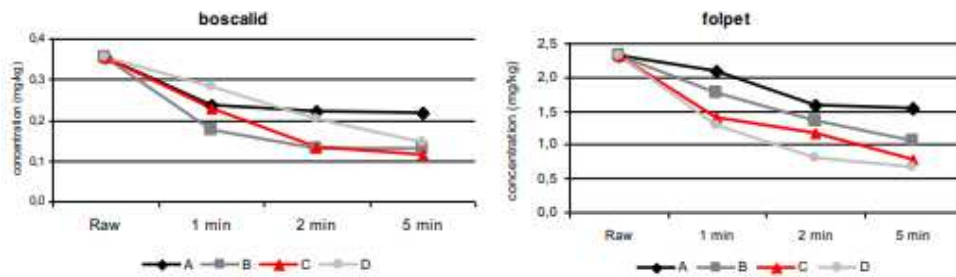


Figure 2: The reaction of various pesticides (A-tap water, B-ozonized water, C-ultrasonic cleaning, and D-boiling) [11]

Additionally, the use of ultrasound cleaning in combination with washing treatments is an effective way of ensuring the elimination of pesticide residues in fruits and vegetables since research reveals that the approach promotes the elimination of pyrethroids from cabbage. The study revolved around the examination of whether the use of an ultrasound can eliminate the three most prevalent pyrethroids, which are: fenpropathrin, cypermethrin as well as deltamethrin [12]. To ensure efficiency, the researcher combined ultrasonic cleaning with multiple absorptions of baking soda. From the study, it was evident that the more the concentration of baking soda, the more the volume of pesticide residue eliminated. It was also clear that the use of ultrasonic cleaning eliminated more microorganisms compared to the use of commercial methods like washing under running water. More importantly, the study indicated that the volume of Vitamin C and proteins, as well as the texture and sense of the cabbage did not change after the procedure, which implies that it did not alter the nutritional compositions of the vegetable. Thus, this proves that the combination of ultrasound cleaning with other washing treatments is efficient in eliminating pesticide residues in fruits and vegetables.

Moreover, the utilization of ultrasound cleaning and other washing treatments methods as a way of eliminating pesticide residue in fruits and vegetables is effective as another study revealed that the approach can attain success given that the individuals in charge limit the power level of the ultrasound since excessive output could lead to destruction [13]. On the other hand, minimal power will not succeed in eliminating all the residues [14]. The research used the ultrasonic bath and probe to examine if ultrasonic cleaning was effective. The results of the study indicated that the ultrasonic probe was more effective in the elimination of residues compared to the bath. As an outcome, government officials as well as those in the agriculture sector can use the findings of this report to develop the best form of ultrasound that will guarantee the safety of fruits and vegetables. Engaging in extensive research on the topic is a guaranteed way of gathering the relevant data on the topic.

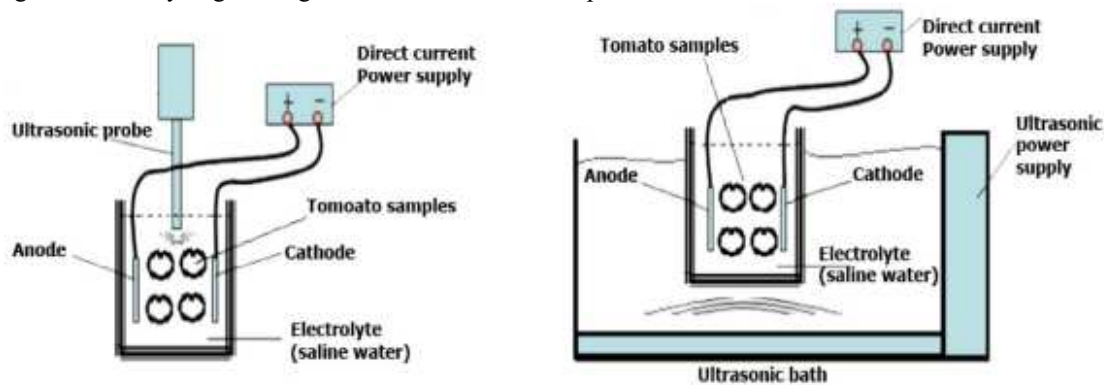


Figure 3: Ultrasonic probe and bath setups [13]

Furthermore, the use of ultrasonic cleaning in combination with other washing treatment approaches in a bid to eradicate pesticide residue in fruits and vegetables is effective due to the evidence presented in previous studies on the notion. A study that focused on evaluating the effect on ultrasound cleaning on the safety of cucumbers revealed that in twenty minutes, the procedure terminated eighty-five per cent of residue [15]. The implication of this outcome

is that the process eliminates more residues with time since the reduction degree of the residues increased the longer the cucumber was subjected to the procedure. Most importantly, it remains evident that the adoption of ultrasonic cleaning relies on the nature of the residue since some remainders may take longer to eliminate than others, depending on the concentration. Therefore, the individuals in the agriculture industry can utilize the information acquired from this study to establish guidelines on how long the process of ultrasonic cleaning should take to ensure sufficient results. Other than that, the use of ultrasound together with washing treatments to ensure the termination of pesticide residues in fruits and vegetables is a viable method as a research conducted comparing the various methods available identified, the use of an ultrasound as the most effective. The study involved the examination of the effectiveness of various techniques in eliminating pesticide residue in three farm produces which were: spinach, cucumber, in addition to kumquat. Another study indicated that the use of ultrasonic cleaning led to the elimination of the bacterial films present in fruits and vegetables [16]. Also, the utilization of this method does not negatively impact the quality of the finished product as the procedure does not trigger the loss of any nutrients. At that juncture, there is sufficient evidence to support the efficacy of ultrasonic cleaning as a mode of terminating pesticide residues in farm produce. Hence, the relevant officials should look into the matter and encourage the adoption of the approach.

In addition to that, there is another research that supports the utilization of ultrasound cleaning as a mode of eliminating pesticide residue in fruits and vegetables. For example, the study examined if the elimination of pesticide residue was most effective through ultrasonic cleaning or the incorporation of other controls. The results of the research determined the use of an ultrasound together with ozone activated the eradication of pesticide remnants in strawberries in three minutes and terminated ninety-eight to ninety-nine per cent of the remainders [17]. The statistics acquired from the experiment prove that the ultrasonic cleaning is an efficient method of eliminating pesticide remnants. Hence, the relevant officials ought to evaluate the best treatments to incorporate in conjunction with the use of an ultrasound to guarantee the ultimate removal of all harmful residues from fruits and vegetables. One consideration to make is the utilization of ozone water, as highlighted in this study.

Lastly, governments and the officials in the agricultural field should consider the use of ultrasonic cleaning as a method of eliminating pesticide residues in fruits and vegetables due to its success in the experiments conducted. For instance, a study testing the applicability of the approach aimed at eliminating three specific residues namely: carbendazim, thiophanate-methyl, in addition to imidacloprid. The combination of ultrasonic cleaning with high performing liquid chromatography and liquid-liquid extraction was effective in eliminating eighty-five to one hundred and thirteen per cent of residue depending on the concentration of the materials used [18]. Therefore, the results of the study can be used by those specializing in the agriculture sector to evaluate the concentrations they ought to use to ensure that all fruits and vegetables are safe for human consumption and free of all pesticide residues that could be harmful. Through this, the issue of consuming unsafe farm produce will cease being a big problem in society.

CONCLUSION

The review emphasizes on examination of the utilization of ultrasound in combination with washing treatments as an approach of removing pesticide residue from vegetables and fruits. It states that in the present market of food production, the application of insecticides has increased a lot of reputation owing to their effectiveness in eradicating pests, contaminations, and unwanted plant, which kill and lessen the value of crops. The paper also concentrates on the methods and materials of research, whereby qualitative and quantitative methods of research are discussed together with their advantages and disadvantages. Ultimately, the researcher chooses to use the qualitative mode of research as it offers the investigator with processes that will help him/her recognize the reason that attitudes could alternate. Further, the researcher chose the secondary form of data collection as it saves time since it is faster to attain information. The review further states that ultrasonic cleaning, or else ultrasound-assisted cleaning, is a technique of eradicating dangerous particles in produces through the usage of an ultrasound. The ultrasound operates with water or other solvents. Therefore, the ultrasonic cleaning is used on fruits and vegetables since people can apply the appropriate washing treatments along with the process to assure the final wellbeing of the end product. Also, the use of ultrasound cleaning together with washing soaps remains to be the best method in the removal of insecticide remains from fruits and vegetables as it roots to the extermination of more than ninety per cent of deposits. Various studies prove that ultrasonic cleaning is a guaranteed way of removing pesticide residue without changing the nutrient composition of fruits and vegetables. However, the officials in various governments and agricultural industries will have to engage in extensive research on the matter to ensure the appropriate application. Through this, they will derive relevant policies guided by evidence that will highlight the time and conditions needed to remove one hundred per cent of pesticide residue in fresh farm produce.

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