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## Reduction of Pesticides and Microorganisms in Fruits and Vegetables by Processing Techniques

			
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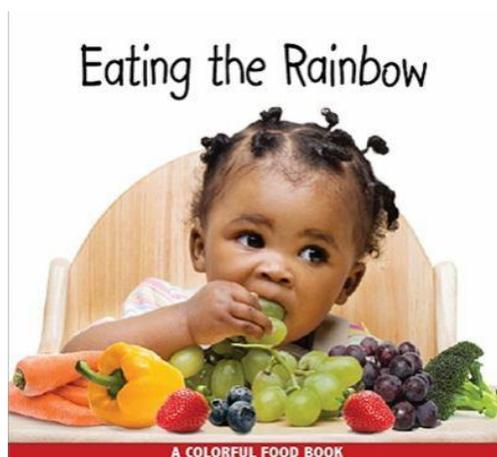
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### ABSTRACT

Pesticides are substances used for destroying insects or other organisms harmful to cultivated plants or animals. Food safety is an area of growing worldwide concern on account of its direct bearing on human health. The presence of harmful pesticide residues in food has caused a great concern among the consumers. Due to several reasons, diffusion and acceptance of this approach in developing countries have been very slow. Food processing such as washing, peeling, canning or cooking leads to significant reduction of pesticide residues and contaminants. There is a real need to find alternatives for preservation of fresh-cut fruits and vegetables, in order to reduce the microorganisms. Alternatives or modified methods have been proposed for antimicrobials such as treatment with ozone and treatment with U.V light. This review article demonstrates that in most cases processing leads to large reduction of pesticide residue levels in fruits and vegetables through washing, cooking and by other operations.

## INTRODUCTION



Fruits and vegetables are important components of the human diet since they provide essential nutrients that are required for most of the reactions occurring in the body. A high intake of fruits and vegetables has been encouraged not only to prevent consequences due to vitamin deficiency but also to reduce the incidence of major diseases such as cancer, cardiovascular diseases and obesity.

A diet rich in various household procedures are carried out by common man to reduce the amount of pesticides and to removing the microbes without knowing the scientific facts. Recently modern techniques are available for the removal of microorganisms. Hence this study focus to carry out a literature review about “Scientific proofs available on reduction of pesticides and microorganism in fruits and vegetables by processing techniques”.

Vegetables and fruits may provide protection against several diseases and it provides more health benefit. Presence of microbes in fruits and vegetables and application of pesticides causes contamination and leads to several health problems. Pesticides being toxic in nature, they should be used with extreme caution.

## TECHNIQUES AND ANALYSIS

### 1. TOMATOES



The study shows the extent of pesticide residues removal from tomatoes through household processing such as washing with tap water, 2% salt solution, 2% tamarind solution, lemon water, baking soda, vinegar, bio wash (available in market) and cooking. For this, tomato crop was grown and application of pesticides such as dimethoate, profenofos, chlorpyrifos, Malathion, phosalone, quinalphos, triazophos and lambda cyhalothrin were carried out at recommended dosage. After 2 hours, the tomatoes were harvested, labeled and brought to the laboratory for pesticide residues.

#### WASHING

- Tap water : one kilogram tomato is washed with four liters of tap water
- 2% salt solution : 80 gram of table salt in four liter water is used to wash 1kg tomato.
- 2% tamarind solution : 80 gram of tamarind in 4 liter of water is used to wash 1kg tomato.
- Lemon water : 4 lemons in four liters of water is used to wash 1 kg of tomato.
- 0.1 % sodium bicarbonate : 4 gm sodium bicarbonate in 4 liter water used to wash 1kg tomato.
- 4% acetic acid : 160 ml acetic acid in 4 liter water used to wash 1kg tomato.
- Cooking in pressure cooker : 1 kg tomato cooked in pressure cooker for 10 minutes.
- Bio wash : 8 ml bio wash in 4 liter water is used to wash 1 kg tomato.

## ANALYSIS

After dipping for 10 minutes followed by analysis, the samples were prepared for extraction of pesticide residues to determine the effect of traditional processing.

## RESULT

Sl No.	TECHNIQUE OF WASHING	PERCENTAGE REDUCTION
1	Tap water	37 -73.2
2	Lemon water	42.5-72.3
3	2% tamarind solution	26.1-69.1
4	2% salt solution	44.3-78.7
5	0.1% sodium bicarbonate	24-65.1
6	4% acetic acid	17.1-58.5
7	Bio wash	44.5-75.2
8	Cooking in pressure cooker	42.9-83.2

## DISCUSSION

The analysis of data revealed that organophosphate pesticides are highly effective against pests at low dosages in tomato samples. It is considered that the reduction of pesticides is more effective in the case of 2% salt solution and biowash.

## 2. GRAPES



The study shows the extent of pesticide residues removal from grapes through household processing. The analysis of data revealed that organophosphate pesticides are highly effective against pests at low dosages in grapes samples.

## WASHING

- Tap water : 4 liters of water is used to wash 1 kg grape dipped in tap water
- 2% salt solution : 80 gram of table salt in 4 liter water is used to wash 1kg grape.
- 2% tamarind solution : 80 gram of tamarind in 4 liter of water for washing 1kg grape.

- Lemon water : 4 lemons in 4 liter of water for washing 1 kg of grape.
- 0.1% sodium bicarbonate: 4 gm. sodium bicarbonate in 4 liter water for washing 1kg grape.
- 4% acetic acid : 160 ml acetic acid in 4 liter water for washing 1kg grape.
- Bio wash : 8 ml bio wash in 4 liter water for washing 1 kg grapes.

## ANALYSIS

After dipping for 10 minutes followed by analysis, the samples were prepared for extraction of pesticide residues to determine the effect of traditional processing.

## RESULT

Sl No.	TECHNIQUE OF WASHING	PERCENTAGE REDUCTION
1	Tap water	43-56.10
2	Lemon water	57.6-80.40
3	2% tamarind solution	58.80 (more effective)
4	2% salt solution	59-81.20 (more effective)
5	0.1% sodium bicarbonate	45-58
6	4% acetic acid	47-59.32
7	Biowash	52-57

The water soluble contact pesticide residues such as organophosphate pesticides can successfully remove from grapes by 2% salt solution or 2% tamarind solution.

## 3. ORANGES



The orange samples were subjected to different traditional techniques in order to determine the extent of pesticide content in it.

## WASHING

- Washing with cold water, hot water, soap and dishwashing soap was carried out during 30s in order to mimic real washing processes at home or in restaurants.

- The temperature of cold water was approximately 15°C.
- The temperature of hot water was between 60-70°C
- Washing in the ultrasonic bath was carried out during 10min at room temperature.

## ANALYSIS

Out of 14 pesticides analyzed two-thiabendazole and imazalil-were found in oranges. The maximum residue limit for those two pesticides in oranges is 5mg/Kg.

Thiabendazole and imazalil are both mainly used as post harvested pesticides.

This means that they should be located on the peel of oranges. At the same time, a small amount of imazalil was found in the pulp.

## TREATMENT OF ORANGE PEEL

TREATMENT	IMAZALIL,mg/kg	THIABENDAZOLE,mg/kg
Without washing	0.93	0.28
Cold water	0.58	0.24
Hot water	0.56	0.00
Soap	0.92	0.13
Dishwashing soap	0.67	0.00
Ultrasonic bath	0.44	0.13

## DISCUSSION

Washing with hot water and with dishwashing soap removed residues of thiabendazole, but none of the used methods could completely remove imazalil. The level of pesticide residues in oranges was acceptable.

## 4. BRINJAL



Farmers use variety of pesticides, of which organophosphate and synthetic pyrethroids are predominant. Farmers are not looking at the safety intervals while harvesting the Brinjal thus resulting in pesticide residues.

Samples were divided into four equal parts to follow different household preparation decontamination methods, viz., (Running tap water washing, 2% salt water washing, direct cooking, and salt water washing plus cooking).

## WASHING

Washing can be done by various methods, such as

- Washing with tap water
- By direct cooking
- With 2% salt solution
- With 2% salt solution + cooking

## ANALYSIS

SI. No	Techniques	Percentage Removed
1	Tap water	47-53
2	Direct cooking	56-61
3	2% salt solution	70-89
4	2% salt solution + cooking	1-100

## DISCUSSION

The residues of Dimethoate, Methyl parathion Quinalphos, Endosulfan and Profenofos in Brinjal sample have got substantial reduction by different households processing methods.

## 5. SPINACH



Residues of dimethoate present in locally available spinach varieties- Palak; *Beta maritima*, Vendhai; *Trigonella foenum graecum*, Thandan; *Amaranthus mangostanus*- green and red were determined. The quantification was carried out using RP-HPLC for unprocessed and processed (washed, washed and cooked) spinach samples.

## WASHING

SL. No.	Technique	% Removed
1	Washing (3 times under ordinary tap water)	28-50
2	Cooked samples (Boiling for 15 minutes)	58-71

## ANALYSIS

In case of greens, it should be washed 3times with ordinary water and cooked (cooked for 15 minutes) so that the pesticide residue is very much reduced and it will be well within the tolerance limit as specified by EPA.

## RESULT

The concentration of dimethoate residues found in unprocessed samples was above EPA tolerance level (2ppm) in case of Palak and Vendhai spinach whereas red thandan and green thandan spinach were within the tolerance limit. It is considered to reducing the amount of pesticides by washing and cooking methods.

## ANTIMICROBIALS

- Soil and water where the fruits and veggies are grown can contain harmful bacteria hence it is important to wash the product in right way.
- Contamination also occurs after product is harvested, when it's being stored or prepared.
- The goal of canning process is to destroy any microorganisms in food and prevent recontamination by microorganisms.
- Heat is the most common agent used to destroy microorganisms.
- Removal of oxygen can be used in conjunction with other methods to prevent the growth of oxygen requiring microorganisms.

- Phytoalexins that play an important role in the resistance to disease of many plant systems and activates genes encoding pathogenesis related Proteins.
- Treatment with UV light offers several advantages to food processors as it does not leave any residue in treated food, is easy to use and lethal to most types of microorganisms.

### **TREATMENT WITH ULTRAVIOLET LIGHT**

- Fresh fruits and vegetables are highly susceptible to microbial spoilage.
- This can be avoided with the application of surface treatments.
- The treatment of their surface has to be as gentle as possible for keeping the integrity and the freshness of fruits and vegetables.
- Minimal processing techniques such as ultraviolet (UV) light treatment meet these requirements.
- The use of UV light treatment proved to be effective at reducing microbial loads of pathogens on fresh fruits and vegetables.
- The aim is to review the available literature data and provide a general review of the application of UV light treatment on fresh fruits and vegetables surface for decontamination, preventing diseases and enhancing their shelf life and quality.

### **TREATMENT WITH OZONE**

- Ozone ( $O_2$ ) is the natural substance in the atmosphere and one of the most potent sanitizers against a wide spectrum of microorganisms
- $O_3$  is generated by the passage of air or oxygen gas through a high voltage electrical discharge or by ultraviolet light irradiation. It has a strong oxidative power and is used for sterilization, virus inactivation, deodorization, bleaching (decoloration), decomposition of organic matter etc.
- $O_3$  is considered to be most suitable for removing residual pesticides from vegetables and fruits and controlling microbes of food safety concern.

- Residual pesticides in leafy vegetables can be removed by immersion in ozonated solution.

## CONCLUSION

Farmers use variety of pesticides, of which organophosphates and synthetic pyrethroids are predominant. Farmers are not looking at the safety intervals while harvesting the products, thus resulting in pesticide residues in products at both farm gate and market points. Hence, it is essential to look for cheap and best method which can be adopted easily at home, thus keeping the requirement in mind, and the study was planned to evaluate certain scientific methods for removal of pesticide residues.

It is concluded that a thorough rinsing can reduce the number of microorganism on fresh produce by about 90 percent. Different washing techniques are available for the fruits and vegetables to remove the contaminants and pesticides.

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