Summary: Research in washing vegetable

Asist. Prof.Dr.Pharrunrat Tanaviyutpakdee
Institute of Nutrition
Mahidol University

Francisco et al., 2010 (Food Microbiology 27 (2010) 199–204)

Cross-contamination of fresh-cut lettuce after a short-term exposure during pre-washing cannot be controlled after subsequent washing with chlorine dioxide or sodium hypochlorite.

Experiments

To determine the prevention of cross-contamination of fresh-cut lettuce by Escherichia coli
using chlorine dioxide (3 mg/L) or sodium hypochlorite (100 mg/L) as sanitation agents

- During washing with sanitizers
  - none of the tested sanitation agents significantly reduced E. coli counts in both inoculated and cross-contaminated lettuce.

These results suggest that when cross-contamination occurs subsequent sanitation steps are inefficient for inactivating *E. coli* cells on the vegetable tissue.

Yang et al., 2012 Food Control 28 (2012) 99-105

Synergistic effect of washing and cooking on the removal of multi-classes of pesticides from various food samples

- Focused on eight pesticides, including acetamiprid, azoxystrobin, fenobucarb, fosthiazate, iprobenfos, lufenuron, propiconazole, and trifloxystrobin.
- Detection in nine food samples including colored rice, glutinous rice (white rice), glutinous rice (unpolished rice), green chili, ginger, butterbur, chinamul, spinach, and perilla leaf.
- Result: washing and cooking tended to substantially reduce or eliminate pesticide residues in a synergistic manner.

Butterbur

Radwan et al., 2005 (Food and Chemical Toxicology 43 (2005) 553–557)

Residual behaviour of profenofos on some field-grown vegetables and its removal using various washing solutions and household processing

- To The effect of different washing solutions and some household processing on the removal of such residues from treated vegetables

- Results

Tap water, potassium permenganate and acetic acid solution gave high percent removal of profenofos residues from hot and sweet pepper fruits,

No detectable residues was found in eggplant fruit after washing with soap and acetic acid solutions.

In general, all tested washing solutions gave higher percent removal of profenofos residues from eggplant fruit than the two other pepper fruits.

Blanching and frying of pepper and eggplant fruits resulted in great reduction to almost completely removed (100%) of the deposited profenofos.

Ling et al., 2011 (Food Control 22 (2011) 54-58)

The effects of washing and cooking on chlorpyrifos and its toxic metabolites in vegetables

Result

- Cooking on removal of chlorpyrifos residue was more effective than washing. Chlorpyrifos degraded into 3,5,6-trichloro-2-pyridinol during cooking,

Klaibe et al., 2005 (Innovative Food Science and Emerging Technologies 6 (2005) 351– 362)

Quality of minimally processed carrots as affected by warm water washing and chlorination

- To compare the different applications of cold and warm tap water (4 °C and 50 °C) with and without chlorinationin reduction of aerobic mesophilic bacteria.
- Washing uncut carrots with cold chlorinated water (200 mg/l, 4 ° C) and reduced aerobic mesophilic bacteria by 1.7 $\log_{10}$ colony forming units per gram (cfu/g)
- Washing with warm tap water (50 ° C) reduced 2.0 $\log_{10}$ cfu/g.
- Washing with warm chlorinated water (200 mg/l) resulted in a 2.3 log10 cfu/g reduction.

Nastou et al., 2012 (International Journal of Food Microbiology 159 (2012) 247–253)

Efficacy of household washing treatments for the control of *Listeria monocytogenes* on salad vegetables

- Inoculated vegetable pieces (fresh lettuce and cucumber) were immersed in washing solutions and surviving *L. monocytogenes* enumerated.
- Results
  - The effect of exposure time to acetic acid (up to 30 min immersion) indicated that immersing the vegetables for more than 10 min is of minimal benefit.
  - The most significant factor affecting washing and decontamination efficacy was the vegetable itself:
  - L. monocytogenes colonizing cucumber epidermis was far more resistant to removal by washing and to acid treatment than that on the leafy vegetables.

Francisco et al., 2009 (International Journal of Food Microbiology 133 (2009) 167–171)

Prevention of Escherichia coli cross-contamination by different commercial sanitizers during washing of fresh-cut lettuce

- To study the efficacy of chlorine, Tsunami®, Citrox® and Purac® on non pathogenic *Escherichia coli* reductions in processing water and on fresh-cut lettuce.
- Results
  - Chlorine and Tsunami were able to inactivate *E. coli* in wash water, avoiding cross-contamination between contaminated and non-contaminated product.
  - However, Citrox and Purac at the recommended doses did not prevent transfer of *E. coli* cells between inoculated and uninoculated fresh-cut lettuce and therefore indicating cross-contamination.

Keikotlhaile et al., 2010 (Food and Chemical Toxicology 48 (2010) 1–6)

Effects of food processing on pesticide residues in fruits and vegetables: A meta-analysis approach

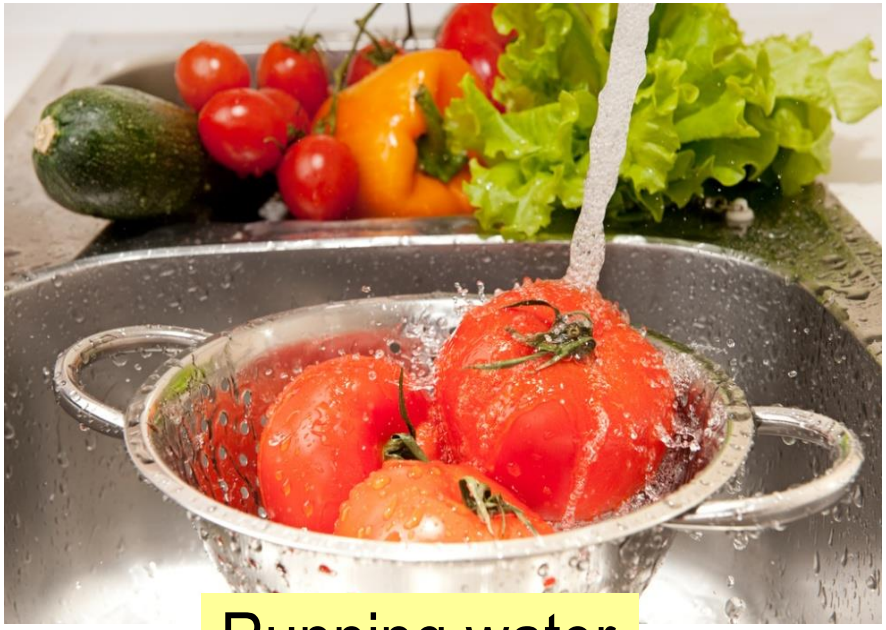
- Results
  - Reduction of residue levels was indicated by blanching, boiling, canning, frying, juicing, peeling and washing of fruits and vegetables with an average response ratio ranging from 0.10 to 0.82.
  - Baking, boiling, canning and juicing indicated both reduction and increases for the 95% and 99.5% confidence intervals.

Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables

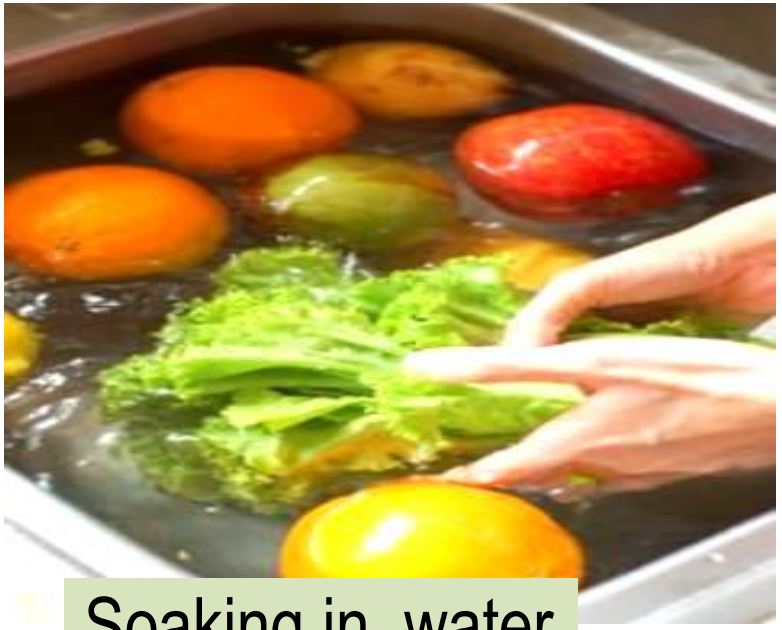
"Current technologies cannot eliminate all potential food safety hazards associated with fresh produce that will be eaten raw."

How to wash fruit and vegetables

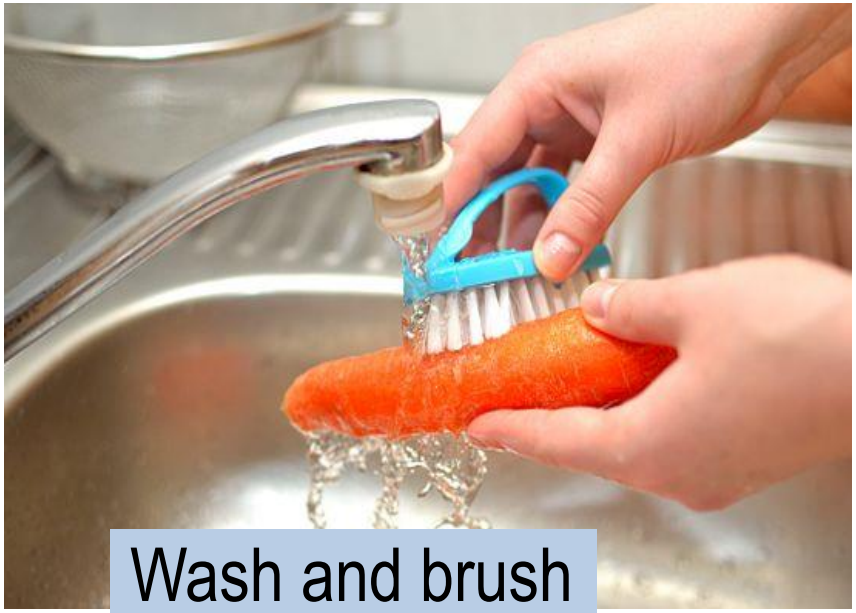
- To wash your vegetables clean **you will need:**
  - Plastic bowl which is large in size
  - Vegetable brush
  - Plastic dish pan
  - Baking soda or apple cider vinegar



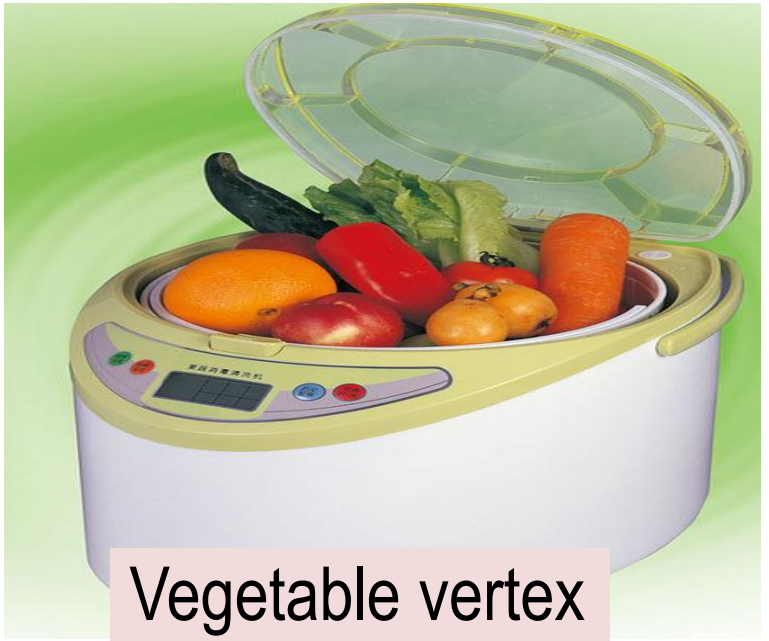
Running water



Soaking in water



Wash and brush



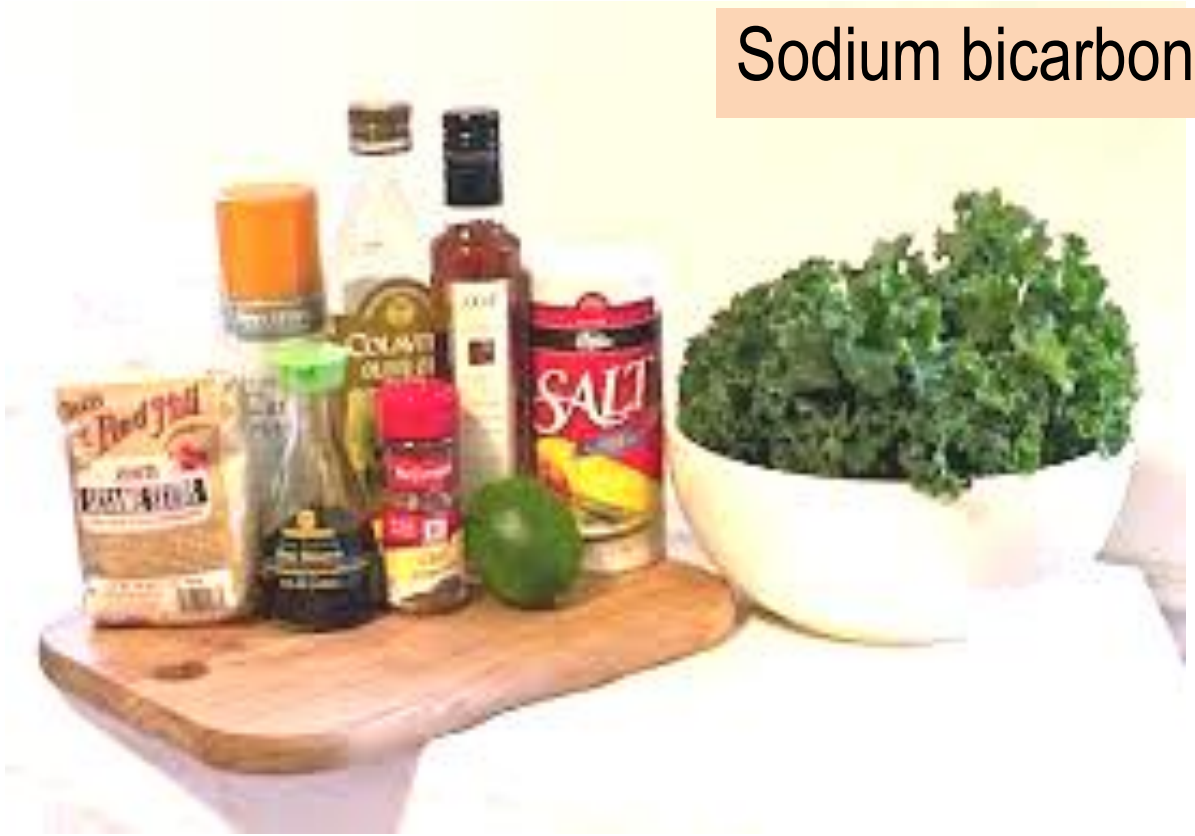
Vegetable vertex

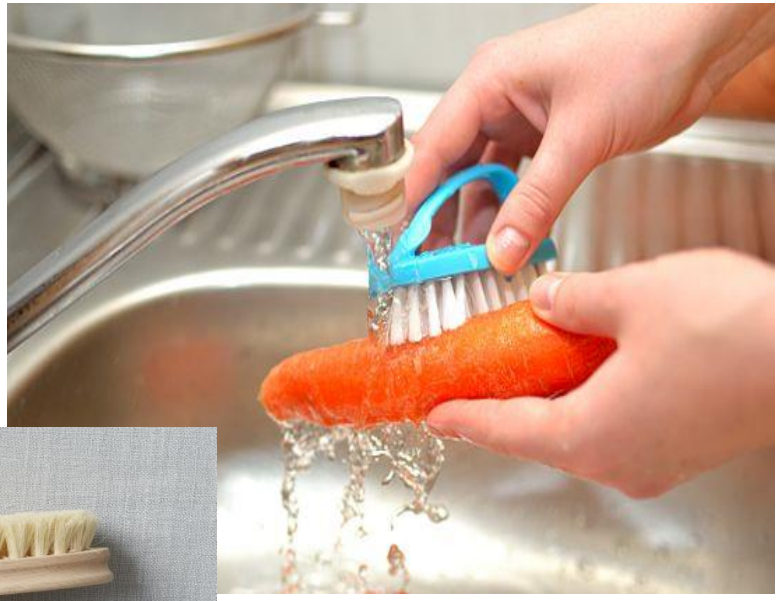
Chemical used for fruit and vegetable washing

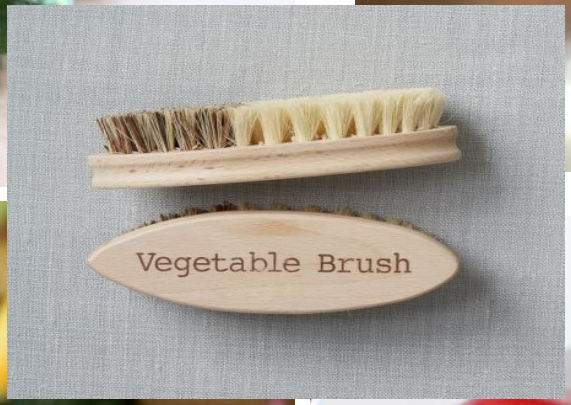
Salt

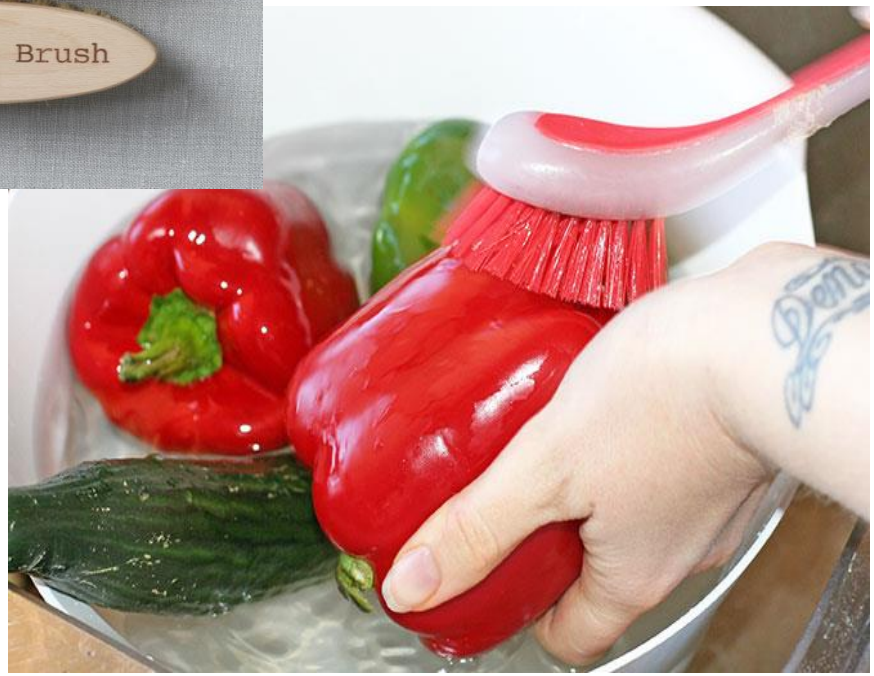
Vinegar

Sodium bicarbonate






Vegetable Brush



Method	% Toxic agents Reduction
1. Vinegar (5 %) 2 tb. With 4 lit water 10- 15 minutes	15-76 %
2. Running water 2 minute	24-63 %
3. Peeling & soaking	27-72 %
4. Blanching/ Boiling	40-50 %
5.Table salt 1-2 tb. with 4 lit water 10 minute	20-70 %

Department of agriculture Thailand

Demonstration

- Determination of pesticide residue in vegetable and fruit by test kit
- Determination of salicylic acid (unpermitted antifungal agent) in foods by test kit
- Determination of sulfite in food by test kit
- Determination formalin in food by test kit

Group separation

- **Group 1** Washing vegetable and select 2 kinds of vegetable to test for pesticide
- **Group 2** test for salicylic acid
- **Group 3** test for sulfite
- **Group 4** test for formalin

Salicylic

- Salicylic acid is used as a food preservative, a bactericidal, and an antiseptic.
- Some people are hypersensitive to salicylic acid
- Salicylic acid overdose can lead to salicylate intoxication, which often presents clinically in a state of metabolic acidosis.

- **Metabolic acidosis** is a condition that occurs when the body produces excessive quantities of acid or when the kidneys are not removing enough acid from the body.
- Metabolic acidosis leads to acidemia, i.e., blood pH is low (less than 7.35) due to *increased* production of hydrogen ions by the body.
- Its causes are diverse, and its consequences can be serious, including coma and death.

Sulfite (Bleaching agent)

– sulfur dioxide,
– sodium sulfite,
– sodiumbisulfite

- Sulfiting agents are additives in foods and drugs may cause severe allergic reactions in susceptible individuals, especially asthmatics.

Some people use in fresh vegetable such as
bean sprout, sliced ginger

Sulfite toxicity

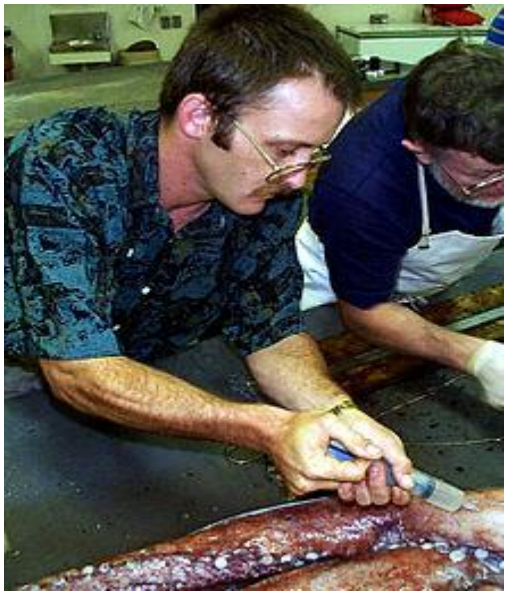
- Symptoms which have been reported as commonly experienced by sulfite-sensitveindividuals include:
  - wheezing,
  - laboredbreathing,
  - chest-tightness, cough
  - extreme shortness of breath, respiratory arrest,
  - loss of consciousness, blue discoloration of skin,
  - flushing, angioedema, hives, laryngeal edema,
  - hypotension, generalized itching, contact dermatitis,
  - episodic swelling of hands, feet and eye areas,
  - mood changes
  - abdominal cramps, nausea, diarrhea and
  - anaphylactic shock.

Formalin

Normally

In laboratory

- The addition of formaldehyde to foods to extend shelf life.
- Formaldehyde is highly toxic to all animals, regardless of method of intake.
- Ingestion of 30 mL (1 oz.) of a solution containing 37% formaldehyde has been reported to cause death in an adult human.



Injecting a giant squid specimen with formalin for preservation.