VI. MONITORING SOURCES OF CONTAMINATION DURING POST-HARVEST OPERATIONS

1. Water as a source of produce contamination

Introduction

Water is used for irrigation as well as for washing fresh produce after harvesting. Water is also a carrier of food-borne pathogens, especially when it is contaminated with sewage and manure. Although the outer surface of fresh produce may appear to be intact to the naked eye, all plants and fruits have respiratory openings such as lenticels and stomata through which water can enter.

Purpose

The purpose of this task is to demonstrate how food-borne pathogens in water used for washing can penetrate/infect fruits and vegetables.

Materials

Materials for the task should include:

- Fresh produce (apples, pears, tomato, sweet potato etc.);
- A scalpel/knife;
- A beaker/bowl;
- 1 litre of water;
- Blue food colouring;
- Tongs to remove produce from water; and
- A drying rack.

Procedure

This task can be carried out as a group exercise, with different groups investigating different fruits and/or vegetables.

- Place water in a bowl and add 10 drops of food colouring; mix
- Submerge produce samples in the water for 10 minutes
- Remove samples from water with tongs and drain for 10 minutes
- Observe the amount of dyed water on the surface of the produce
- Remove a 2cm-slice from the stem end of the produce; observe and record the amount of dye penetration
- Clean the knife and cut the produce in half
- Observe

Results

Evaluate the dye penetration using the following scale:

- 4 = lots of dye
- 3 = moderate amounts of dye
- 2 = some dye
- 1 = slight amounts of dye
- 0 = no dye

Produce item	Outer surface	Stem end	Cut surface	Damaged area

Question and discussion issues

- How much dye was present on the surface of the produce?
- How much dye was present in the interior?
- What kinds of barriers prevented the dye from penetrating throughout the product?
- What effect did damage to the surface of the produce have on colour penetration?
- Suppose the dye represents micro-organisms in the water. What conclusions can be drawn in terms of damage to produce as a means of facilitating these organisms in contaminating produce?

2. Monitoring the hygiene of surfaces

Introduction

Surfaces collect dust and liquids such as fruit juice, dirty wash water etc. Surfaces are also frequently touched by people. In order to minimise contamination of fruits and vegetables, all surfaces, including those of baskets, crates etc. that are used to contain or transport fresh produce, must be kept clean at all times.

Purpose

The purpose of this task is to demonstrate the microbial contamination of surfaces.

Materials

Materials for this task should include:

- Sterile swabs;
- Sterile water;
- Nutrient agar in Petri dishes;
- A spreading rod;
- A burner;
- Ethanol; and
- A micropipette with tips.

Procedure

This task can be carried out as a group exercise, with different groups investigating different sampling points.

Swab sampling of a 5 x 5cm surface

- Slightly moisten the swab with sterile water
- Press the swab firmly on to the selected surface and sample as shown in figure 1

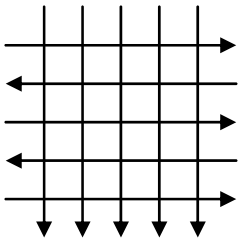

Figure 1. The swab sampling technique[4]

- Transfer the swab back into a sterile tube
- Send the swab to a certified laboratory for determination of total viable count (TVC) or for the determination of the presence of a specific food-borne pathogen or faecal contamination indicator

Determination of total viable count (TVC)

- Place the swab into 9ml of sterile water; mix well
- Prepare a dilution series and plate out onto nutrient agar plates
- Incubate at room temperature for 24-48 hours
- Count the number of colonies between 30 and 300 per plate
- Calculate the number of cells per $5cm^2$

Results

Sample point	Total viable count (TVC)

Questions and discussion issues

- Discuss the microbial counts obtained at the various sampling points

3. Demonstrating the importance of effective hand washing

Introduction

Hands are the main source of contamination with food-borne pathogens since they are the tools with which humans handle everything. The human skin is also the natural habitat of *Staphylococcus* species, including *S. aureus*. These microbes live and hide in the small crevices of the skin. Ordinary hand washing will not remove all microbes from the skin. Correct hand washing, however, cleans the hands adequately to allow for proper handling of fresh produce.

A correct hand washing procedure should remove transient bacteria, skin cells, sebaceous secretions, sweat and other organic material picked up during daily activities. During hand washing, all areas of the hands, including fingertips and thumbs should be thoroughly washed.

[4] Redmond, 2006.

Hand drying is as important as hand washing in preventing cross-contamination and the transfer of micro-organisms, since wet hands can transmit up to 500 times more bacteria than dry hands.

Purpose

The purpose of this task is to demonstrate the effect of hand washing on the microflora of the skin.

Materials

Materials for the task should include:

- Soap;
- Warm water;
- Paper towels; and
- Nutrient agar in Petri dishes.

Procedure

- Press the three middle fingers of the left hand onto the surface of a nutrient agar plate for 30 seconds
- Close the lid and mark on the back of the plate 'not washed'
- Wash your hands with warm water and soap* and dry thoroughly with paper towels
- Repeat the first step and mark the plate 'washed'
- Incubate the plates at room temperature for 48 hours

**Correct hand washing and drying procedure*

- Adjust water to a comfortable temperature and wet hands; dispense a small amount of soap into the palms of the hands creating a lather
- Using as much friction as needed, thoroughly clean all surfaces of hands including between the fingers
- Pay attention to the nails and nail beds by rubbing the nails of one hand across the palm of the other, creating enough friction to clean underneath the nails
- Rinse the hands under running water, being sure to hold the hands in a downward position
- Use paper towels or a warm air blower to dry the hands thoroughly
- Using the same paper towel, turn off the water supply

Questions and discussion issues

- On which plate were the most colonies observed?
- How many types of colonies were present on each plate?
- Did you succeed in removing all the micro-organisms from your hands?

Note:

Food handlers must wash their hands after:

- Handling money
- Using the toilet facility
- Touching face or hair
- Blowing the nose
- Handling raw meat/poultry
- Handling trash
- Eating or drinking
- Doing any other activity that may contaminate their hands