
# Quality Washwater

A recent study on the quality of waste wash water used on Australian vegetable farms revealed some treatment would be needed for it to be safely re-used.

Some persistent herbicides were found in high enough concentrations to cause damage to future crops and organic matter levels were usually too high to effectively use disinfectants for the control of water and soil-borne diseases.

Water treatment depends on a range of factors such as intended use, quality of source water and quality after existing treatment or storage operations. There is no single answer and decisions should be based on careful consideration and advice for each situation.

*Taking samples of washwater*

## Why treat water?

- Remove objectionable odours. Odours are derived from microbial degradation of organic matter in the absence of oxygen
- Improve water quality so current water disinfestation treatments are effective against human and plant pathogens
- Efficiently use a scarce resource and lower overall water consumption on farm

## Removal of impurities

Water impurities vary in size and character from plant material, sand and soil to fungi, bacteria, viruses and chemicals. Coarse material, such as plant pieces, can be caught by coarse mesh in a sediment pit, where coarse and fine sand may also fall out depending on the settling time.

Extremely small particles (colloids) do not dissolve in water and are generally stable; they don't separate out or clump because each particle has a similar electrical charge, which repels like particles.

Chemically assisted sedimentation: colloids and fine particles (e.g. iron) take a long time to settle when not combined into larger, heavier particles (flocs). Chemically assisted sedimentation involves two steps, coagulation and flocculation, which neutralise the external charge and allow the colloids to combine into larger particles.

Coagulation destabilises a colloid through the addition of organic or inorganic substances: primary coagulants such as aluminium sulphate or a suitable cationic polyelectrolyte.

Flocculation is where destabilised particles are further clumped to form larger flocs. Flocculation is assisted by the addition of chemicals known as flocculants – polyelectolytes. The flocs either sink or float to the surface and are easily removed by skimming, settling or filtering the water.

Aeration: excess organic matter and metal ions may be removed by running water over a pebble or gravel trickle bed, providing a drop (1-2 plus metres) over a rough surface or bubbling air through water.

## The Bottom line

- Washwater recycling cuts the water cost of washing to around $5/tonne of produce. This is based on an average use of 135,000L water/tonne of produce at a cost of $37/ML.
- However, low cost water treatment may be necessary to ensure the use of recycled water does not lower the food safety standards of the product due to contamination with bacteria or agrochemicals.

## Removal of nutrients

Constructed wetlands are a low cost, low maintenance method which can reduce Biological Oxygen Demand, Total Suspended Solids and some pesticides, and remove excessive phosphorous. Nutrients are also removed by plants (the best is the common reed - *Phragmites australis)* and other wetland organisms.

A recent study on constructed wetlands (which incorporated horizontal flow sub-surface systems) showed that a hydraulic retention time (HRT) of five days allowed 86% of all nitrogen and phosphorous to be removed (Headley et al. 2001).

These systems involve water flowing through basaltic gravel fill in a trench lined with water (impervious barrier and planted with common reeds). This below gravel surface design stops mosquito breeding and wildlife polluting the water.

Surface water wetlands may be constructed so effluent is introduced into a series of ponds with a succession of shallow and deep water zones. Each zone has different types of vegetation. Wetland edges could have plants such as dwarf cyperus or common reed, while deeper water may be planted with water lilies and floating plants such as duck weed.

Treatment occurs through physical, chemical and biological processes: sedimentation, adsorption, volatilisation, filtration, plant uptake, and microbial action. Constructed wetlands of this type have been shown to degrade some agrochemical residues such as atrazine and linuron.

Constructed wetlands are cost competitive with other wastewater treatment methods and, depending upon land availability, may be a much less expensive option than other methods of water treatment. Operation and maintenance costs are often significantly lower than conventional advanced secondary treatment.

## Water disinfestation treatments

Chemical disinfestation research for the Australian Nursery Industry has found fungal plant pathogens similar to those potentially causing problems in the vegetable industry.

A range of options are available for the control of human and plant pathogens in water. Recycled water is usually high in organic matter, which can act as a neutraliser, thus sodium hypochlorite is not recommended. Registered chlorine dioxide based chemicals are less likely to be affected by high organic matter load and more efficient in obtaining correct disinfectant concentrations.

*Small settling dam for a carrot washing facility*

Ozone can potentially provide a wide range of water treatment services. It breaks down organic matter, decolourises pigments and coloured compounds in water, decomposes agrochemicals, assists with metal ion removal, kills and flocculates algae and kills human and plant pathogens.

## Further Reading

Headley TR, Huett DO and Davison L (2001) The removal of nutrients from plant nursery irrigation runoff in subsurface horizontal flow wetlands. *Water Science and Technology* 44, 77-84.

Lake, J (2000) Artificial wetlands- A solution for nursery runoff. *Australian Horticulture* April, 59-60.

Mebalds, MI, Bankier, M and Beardsell, D (1997) Water disinfestations control pathogens. *Australian Horticulture* April 1997, 66-68.

Mebalds MI, Hamilton A (2002) Quality washwater for carrots and other Vegetables: Insurance for clean food and minimising environmental impact. Final Report for HAL project VG99005

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