

# The use of redox potential to estimate free chlorine in fresh produce washing operations: Possibilities and limitations

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## Abstract

Maintaining free chlorine (FC) residual at appropriate pH values is a control approach used to prevent pathogen cross-contamination during tomato dump tank handling and fresh-cut produce washing operations. Oxidation reduction potential (ORP) is a rapid measurement of oxidant-based sanitizer strength, and has been used to estimate FC residual. However, factors, in addition to FC and pH, which influence ORP are not fully understood. This study examined the relationship between ORP and FC under chlorine demand (CLD) free conditions and during fresh produce washing. An equation predictive of FC was developed in the form  $\log FC = f(\text{ORP}, \text{ORP}^2, \text{ORP} \cdot \text{pH})$ . A good correlation between ORP and  $\log FC$  was maintained when other variables changed, but the resulting ORP- $\log FC$  curve changed (slope, intercept). A decrease in pH or temperature led to an increase in ORP. Using tap water to wash the produce instead of distilled water significantly changed the ORP. For different types of tested produce, i.e., fresh-cut carrot, onion, romaine and iceberg lettuce, and for whole tomatoes, increasing the product-to-water ratio (i.e., increasing the organics transferred into the water) led to a decrease in ORP for a specific FC residual. The choice of acidulant during washing also influenced ORP. Overall, the correlation of ORP with  $\log FC$  is more reliable at the lower end (5 mg/L FC) than at the higher end (100 mg/L FC) of the FC range used in fresh produce washing. However, since the ORP in fresh produce wash water is affected significantly in multiple ways by the wash water and process conditions, the predicted FC values with ORP under certain fresh-cut produce washing conditions cannot be generalized for other conditions.