# Evaluation of hand washing efficiency

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The importance of hand washing in preventing the spread of infection is well documented and there is now a growing awareness of its relevance to food handlers where it is reported that unwashed or poorly washed hands are a factor in up to 40% of food related outbreaks of illness.

Although the importance of hand washing is a well known fact it is surprising that the compliance rate is so low even in high care industries with reported hand washing compliance rates of 30-40% for food service operators.

The implementation of an effective hand washing programme is difficult as there is no easy method to assess whether workers have washed their hands efficiently.

Micro-organisms on the skin can be described as two types of populations – resident micro-organisms that permanently inhabit the skin's epidermis and do not usually cause foodborne illness and transient micro-organisms that are picked up from the atmosphere or from contact with a contaminating source and can include pathogenic bacteria, which can cause food poisoning. A correct hand washing procedure should remove these transient bacteria in addition to skin cells, sebaceous secretions, sweat and other organic material picked up during daily activities.

It is a well published fact that people tend to wash their hands in such a way that soiling and micro-organisms are not removed from all areas of the hands equally. A correct hand washing procedure should include areas that are frequently missed such as fingertips and thumbs and these areas should be part of any hand washing monitoring programme.

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

Although gloves may be used to minimise contact between food handlers and food in compliance with the 1999 Food Code, gloves can give a false sense of security. The gloves still need to be changed or washed regularly since they can leak and often worse contamination can be present due to the warm/damp environment inside them.

However, even if operators have been fully trained in the correct hand washing procedures there is no easy method available to routinely monitor hand washing efficiency or even if it has been done at all.

| Operator | Result | Action required Yes/No | Re-swab result |
|---|---|---|---|
| 1 | 468 | No | – |
| 2 | 192 | No | – |
| 3 | 116 | No | – |
| 4 | 309 | No | – |
| 5 | **652** | **Yes** | 431 |
| 6 | **1502** | **Yes** | 295 |
| 7 | 453 | No | – |
| 8 | 186 | No | – |
| 9 | 164 | No | – |
| 10 | 148 | No | – |
| 11 | 189 | No | – |
| 12 | 178 | No | – |
| 13 | **743** | **Yes** | 251 |
| 14 | **745** | **Yes** | 69 |
| 15 | 508 | No | – |
| 16 | 267 | No | – |
| 17 | **1460** | **Yes** | **854*** |
| 18 | **2281** | **Yes** | 370 |
| 19 | 331 | No | – |
| 20 | 132 | No | – |

*Bold = failed results/*Re-training of hand washing technique required*

***Table 1. A sample of typical results from routine monitoring of the ATP levels on the operators' hands immediately post washing (once a day) over a number of days.***

The most comprehensive accepted method for monitoring the resident and transient flora is the glove juice method but this method is laborious and therefore limited to testing of hand hygiene products and is not suitable for routine monitoring of hand washing.

As with most traditional microbiology the results are not obtained in real time and are often too late to ensure food safety.

Rapid hygiene monitoring, based on ATP (Adenosine Tri-Phosphate) bioluminescence technology, is one method that may be used as part of a hand washing monitoring programme to obtain results in real time. ATP is the energy molecule found in all living cells including bacteria, skin cells and sebaceous glands.

When ATP is combined with the enzyme luciferase, a reaction takes place which results in the production of light. The light produced is measured in a luminometer and is expressed in Relative Light Units (RLUs). The higher the levels of ATP, the greater the light produced, the greater the light, the higher the RLU value.

ATP assessment can be used:

- During induction training of hand washing technique by showing a reduction in general soiling before and after hand washing.
- To monitor efficacy of hand washing by swabbing clean hands immediately after washing and before hands come into contact with anything.

## Case study

Operators from different food preparation areas of a food processing company were tested routinely (once a day) immediately after washing their hands. The operators washed their hands with soap and water for approximately 30 seconds, dried them and then applied an alcohol gel. Once the hands

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were dry the palms were swabbed with CleanTrace and the devices measured in a Uni-Lite Xcel luminometer.

A pass/fail limit of 600 RLU was set following the initial wash. If the levels were above 600 RLU, operators were told to re-wash their hands and were re-tested.

If the ATP levels were still above 600 RLU the operators were re-trained on their hand washing technique (see Table 1).

During the routine testing, 25 out of a total of 83 tests failed the specification of less than 600 RLU following the first hand wash.

The operators who failed the specification re-washed their hands and three of the 25 failed again after re-washing hands. These were re-trained in the hand washing technique and told to use more soap and sanitiser.

In additional tests, the operators were tested at random immediately post washing at other times to the scheduled routine once a day testing and the results gave similar failure rates to that shown during routine testing with 25% failures following the first wash.

One third failed the specification again after re-washing their hands and required further training in hand washing technique.

The overall failure rate of participants with post-washing results of greater than 600 RLU was approximately 30% (28/95) with approximately 4% (4/95) failing after the second hand wash and requiring re-training.

## Conclusions

Studies show that ATP can be used to monitor hand washing in the following applications:

- **Induction training.**

ATP assessment to show a reduction in general soiling after an effective hand wash following training on a hand washing technique – although natural levels of ATP vary from individual to individual, hands that have been properly cleaned will always show a drop in ATP levels post washing.

- **Routine monitoring.**

– Assessment of ATP levels pre/post hand washing. A minimum of 80% drop in ATP following hand washing would indicate a reasonably effective hand wash.

– Assessment of ATP levels immediately post hand washing. Studies suggest that there is a minimum RLU level that is attainable following an effective hand wash. The studies show that the RLU level post hand washing is almost always below 1000 RLU and below 500-600 RLU in most cases. We recommend setting a realistic pass/fail limit depending on the environment. Factors to consider may include type of food handled (for example raw meat would result in a higher initial RLU), frequency of hand washing and type of soap/sanitiser used.

It should be noted that ATP cannot be used to monitor hand cleanliness at random because individuals will shed skin and therefore ATP at different rates resulting in a wide range of ATP levels from person to person. Not even general microbiology methods are suitable for this application because TVC also vary from hand to hand so a log reduction in microbial load cannot be relied on.

If ATP is used to validate hand washing the operator must be tested immediately post hand washing as there is an increased risk of the operator inadvertently touching the face, hair or other surfaces with time.

- **Assessment of efficacy of soap/sanitiser.**

Our studies suggest that some soaps are more effective in reducing the ATP levels than others and ATP can therefore be used to assess effectiveness of soap on soil removal. The effectiveness of the soap should be assessed by testing with ATP before and after a thorough correct hand washing procedure (minimum of 80% reduction in ATP required); the hands should then be re-washed again to see if the ATP levels reduce again significantly. ■

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