Assessing Cleanliness of Swine Transportation Trailers

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Visual inspection of newly cleaned trailers is not sufficient in assessing trailer cleanliness

Pig transportation is widely recognized as a significant risk for transmission of swine diseases. With the outbreaks of Porcine Epidemic Diarrhea (PEDv) and the potential for PRRS, a great deal of effort has been put forth to ensure transport trailers are properly washed, disinfected and inspected for organic matter and microbial contamination prior to use. Typically, visual inspection is carried out to assess the cleanliness of trailers after washing/disinfection/drying procedure, supplemented by microbiological testing using the culture method (CSHB, 2011) in certain situations.

However, work at the Prairie Swine Centre has found visual inspection to be not consistent or very reliable assessment. While traditional microbiological culture method involves the use of plated media which need to be incubated and analyzed to obtain an indication of the contamination of the sampled surfaces. Also relies heavily on the quality control process of sampling and analysis. This can cause significant down-time for trailer operation, and delays implementation of corrective actions while waiting for test results. Work led by Dr. Bernardo Predicala, at the Prairie Swine Centre set out to find an alternative reliable, rapid and easy to use means of monitoring surface cleanliness of swine transport trailers.

Over the last decade, the ATP method (adenosine triphosphate bioluminescence) has been used in other industries (food, hospitals, cattle) for monitoring surface cleanliness and microbial contamination, the opportunity of the ATP method was explored for practical application within the pork industry. This particular method uses bioluminescence as an indicator of the level of residual ATP present on swabbed surfaces. Once a surface is swabbed, the sample is exposed to an ATP-releasing agent (lysis buffer) and an ATP-activated light-producing substrate and enzyme (luciferin and luciferase). The amount of ATP present on the tested surfaces can then be quantified by the amount of light emitted

during the enzymatic reaction (in terms of relative luminescence units, RLU). The intensity of light is proportional to the amount of ATP and the degree of contamination.

Samples were taken from dry, cleaned trailers using an ATP swab by swabbing an area of 10 cm x 10 cm in multiple locations in the trailer and were tested for microbial contamination level using an ATP bioluminescence meter. Results obtained from ATP testing were compared to the co-located samples taken using standard microbiological techniques with MacConkey and R2A agar contact plates (diameter = 60 mm). From a total of more than 500 samples (for each method) collected from 18 commercial swine transport trailers across Saskatchewan, a moderate correlation was found between ATP bioluminescence method and standard microbiological technique using R2A agar plates. Poor correlation, however, was found between ATP method and MacConkey agar plate counts. Unlike R2A that detects a wider group of bacteria, MacConkey agar supports only the growth of selected Gram-negative bacteria while ATP bioluminescence detects ATP from both microbial and organic sources. Threshold values in assessing the effectiveness of swine transport trailer cleaning protocol using ATP bioluminescence method were established with 570 RLU per 100 cm2 and below as 'Pass' while 800 RLU per 100 cm2 and above as 'Fail' or has high risk of disease propagation.

The benefit of the ATP method is the ability to provide results within minutes, as opposed to a number of days for traditional microbiological testing, making ATP bioluminescence a good alternative for quick monitoring of surface cleanliness of transport trailers.

Take Home Messages:

- ATP bioluminescence method can be used as a tool for rapid assessment of surface cleanliness of swine transport trailers, complementing the procedures.
- Dirty areas in trailers can be conveniently and rapidly identified using ATP method, and corrective actions on the current washing/disinfection protocol can be made.
- Visual inspection of newly-cleaned transport trailers is not sufficient in assessing surface cleanliness.
- Trailer floors posed the highest risk of microbial contamination among the six critical areas tested.

Table 1. Threshold values in assessing effectiveness of swine transport trailer washing/disinfection/ drying protocol using MCA, ATP bioluminescence and R2A

Assessment criteria from CSHB, 2011			*Threshold Values*	
Category	*Remarks*	*MacConkey*	*ATP agar[a]*	*R2A agar[c] bioluminescence[b]*
Pass	*Maintain wash, disinfection. and drying protocols*	*0 – 10*	*0 – 430*	*0 – 140*
Critical	*Risk of disease propagation, . improve protocols. Room for improvement*	*11 – 50*	*431 – 850*	*141 – 625*
Fail	*High risk of disease propagation. Identify problem and correct the wash, disinfect and drying protocol and its observance.*	*>50*	*>850*	*>625*

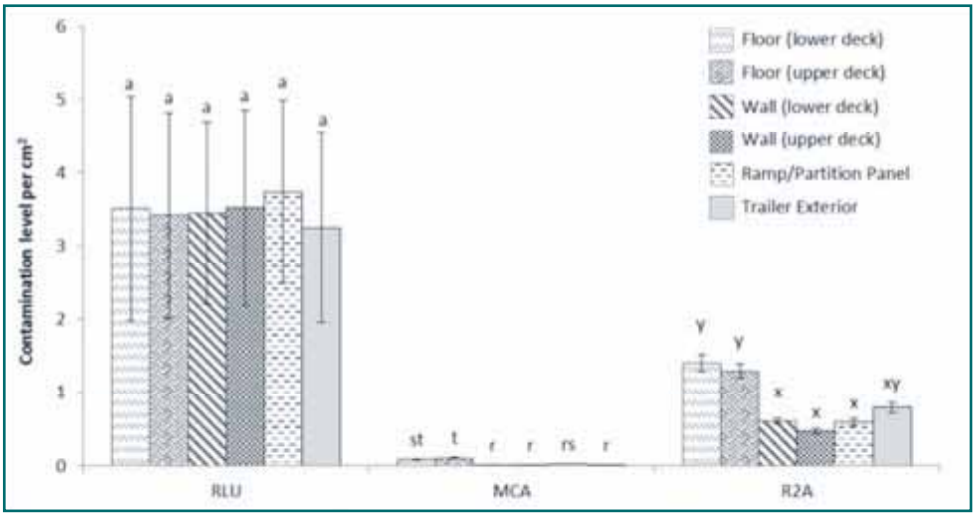

Figure 1. Mean (±SE) contamination levels (n = 16) of different sampling locations in the trailers as detected by the ATP bioluminescence meter (in RLU per cm2), and MCA and R2A agar plates (in CFU per cm2). Means with the same letters are not significantly different (p>0.05).

Estimate of cost for testing a two-deck swine trailer:

Number of locations: 6

Number of samples per location: 2

Number of samples per trailer: 12

Microbial Culture Method (MCA/R2A):

at $6.73 per contact plate

a. In-house incubation and counting: cost is ~$80/trailer (+ incubator ~$500)

b. Commercial lab (incubation and counting): ~$480/trailer (+ shipping)

ATP Bioluminescence: at $3.72 per swab, cost is ~$45/trailer

(+ ATP luminometer ~$2,000)

Note: in both cases, user conducts the sample collection on the trailer (labour cost not included).