RESEARCH ABSTRACT

SWINE HEALTH

Title: Evaluating the effects of chemical treatments to reduce the likelihood of PEDV transmission by feed manufacturing equipment. **NPB #15-208**

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Scientific Abstract:

Two experiments were conducted to determine the effectiveness of chemical mitigation compounds when applied to various feed production surfaces on elimination of porcine epidemic diarrhea virus (PEDV) genetic material. Additionally, treated and untreated rice hull flushes were used to determine if PEDV cross contamination could be prevented utilizing equipment like that used in commercial feed production.

In Exp. 1 different materials used in feed manufacturing surfaces were evaluated using liquid and dry chemicals that could be used in feed mills as sanitizers. Treatments were arranged in a 5 × 10 factorial arrangement with the main effects of 5 different feed manufacturing surfaces and 10 sanitizing treatments. Surface samples (4 × 4 in.) included stainless steel, plastic, rubber, woven polypropylene tote bag, and sealed concrete. One mL (1×10^5 $TCID_{50}$/ml) of stock PEDV was applied to each surface and allowed to dry completely for 60 min. Next, 1 of 10 potential sanitizer treatments was applied: 1) no sanitation (control); 2) untreated rice hulls; 3) rice hulls treated with formaldehyde-based commercial product (Sal CURB; Kemin Inc., Des Moines, IA), 4) liquid formaldehyde-based commercial product (Sal CURB; Kemin Inc., Des Moines, IA); 5) dry commercial benzoic acid and probiotic blend (VevoVitall and CRINA; DSM Nutritional Products Inc., Parsippany, NJ); 6) liquid ammonium chloride, isopropanol, and hydrogen peroxide-based commercial food-grade sanitizer (DrySan Duo; Ecolab, St. Paul, MN); 7) a liquid hydrogen peroxide commercial product (INTERvention; Virox Technologies Inc. Ontario, Canada); 8) liquid quaternary ammonium glutaraldehyde commercial product (Synergize; Preserve International, Reno NV); 9) liquid sodium hypochlorite commercial sanitizer (Bleach; Clorox, Oakland, CA); and 10) liquid medium chain fatty acid blend of caprylic, capronic, and capric acids. After treatment, the surfaces rested for 15 min., were then swabbed and the quantity of PEDV RNA was determined using qRT-PCR. There were 3 replicates per treatment. All main effects, interactions, and comparisons were highly significant ($P \leq 0.001$). Liquid Sal CURB and liquid bleach were the most effective chemical treatments to reduce the quantity of detectable PEDV RNA, but their application is limited in field settings due to their liquid state and potential corrosiveness.

In Exp. 2, PEDV infectivity during feed manufacturing was evaluated using untreated rice hulls and rice hulls treated with MCFA or formaldehyde. Initially, feed without evidence of PEDV RNA contamination was inoculated with PEDV. Based on PCR analysis, this feed had a Ct = 30.2 and was confirmed infective in bioassay. After manufacture of PEDV positive feed, untreated rice hulls, or rice hulls treated with Sal CURB, 2%, or 10% medium chain fatty acid blend (MCFA; 1:1:1 ratio of caproic, caprylic, and capric acid) were flushed through laboratory-scale paddle mixers. For the untreated rice hulls, 3 of 6 samples had detectable PEDV RNA (avg. Ct = 41.4) while 1 of 6 Sal CURB treated rice hull flush samples and 2 of 6 of the 2% MCFA rice hull flush samples had detectable PEDV RNA. However, PEDV RNA was not detected in any of the 10% MCFA rice hull flush samples. Additionally, rice hulls treated with 10% MCFA were mixed and discharged through a production-scale mixer and bucket elevator following manufacturing of PEDV positive feed. In the production scale system, no rice hull flush or feed samples from the mixer following chemically-treated rice hull flush had detectable PEDV RNA. However, one 10% MCFA rice hull sample collected from the bucket elevator discharge spout had detectable PEDV RNA.

Dust collected following mixing of PEDV-contaminated feed had a large quantity of PEDV RNA (avg. Ct = 29.4). Dust collected immediately after the 10% MCFA rice hull flush batch had a reduced quantity of PEDV RNA (Ct = 33.7), and the subsequent feed following the 10% rice hull flush had no detectable PEDV RNA. Pigs inoculated with dust collected after manufacturing PEDV-positive feed were shedding PEDV RNA by 2 dpi and continued to have detectable RNA until necropsy. Dust collected from the 10% MCFA rice hull flush batch or the subsequent batch was not infective.

Overall, it is possible to decontaminate feed manufacturing equipment, but sanitizers that are effective, practical to use, and safe for workers to handle are unavailable. The use of rice hull flushes effectively reduced the quantity of detectable RNA present after mixing a batch of PEDV-positive feed. Chemical treatment of rice hulls with Sal CURB and 10% MCFA provided additional reduction in detectable RNA present in the rice hull flush samples and was not infective via bioassay. Finally, dust collected after manufacturing PEDV-inoculated feed contains a very high quantity of viral RNA and was found infective, demonstrating it has the potential to serve as a vector for PEDV transmission.