Post-processing contamination chemical mitigation strategies to control PEDV in feed and feed ingredients

Courtesy of Cassandra Jones, Kansas State University

Objective:
Evaluate the effectiveness of various chemical mitigation strategies on post-processing contamination of PEDV in feed and feed components.

Industry Summary:
Post–processing contamination of PEDv in feed and feed ingredients is a significant concern to the swine industry. Irradiation and thermal processing have both been hypothesized as possible mitigants of the virus, but both are point-in-time solutions that do not provide residual benefits to prevent potential recontamination or cross-contamination within manufacturing, transportation, or storage. This study aimed to find a possible mitigation strategy to help minimize the threat of recontamination in feed and feed ingredients. The results suggested that feed and/or feed ingredients can be treated with different chemical treatments as a means to mitigate PEDv contamination, with medium chain fatty acids, essential oils, and formaldehyde being particularly effective. Importantly, the success of various chemical mitigants was dependent upon matrix, and the PEDv stability over time was also matrix-dependent, and more stable in meat and bone meal and spray-dried animal plasma compared to blood meal or a complete swine diet. This research helps provide potential mitigation solutions that can mitigate PEDv infectivity when transmitted by feed, and thereby ultimately lessen PEDv associated losses to the swine industry.

Table 1. Treatment main effect for chemical means for chemically treated PEDv inoculated feed matrices [1]

Item	Control	Organic acids	Sodium bisulfate	Sodium chlorate	Termin-8	SEM	*P* =
CT value [2]	29.9^{d}	30.4^{c}	29.7^{d}	29.3^{e}	32.5^{a}	0.08	< 0.0001

[1] A total of 582 samples were used for the analysis.
[2] Cycle time required to detect the genetic material. A higher CT value means less genetic material present.
^{abcde} Means within a row lacking a common superscript differ.

Table 2. Treatment main effects for feed matrix means for chemically treated PEDv inoculated feed matrices [1]

Item	Swine diet	Blood meal	Meat/bone meal	Spray dried animal plasma	SEM	*P* =
CT value [2]	32.0^{b}	32.9^{a}	28.1^{d}	29.2^{c}	0.06	< 0.0001

[1] A total of 582 samples were used for the analysis.
[2] Cycle time required to detect the genetic material. A higher CT value means less genetic material present.
^{abcd} Means within a row lacking a common superscript differ.

Table 3. Treatment main effects for day means for chemically treated PEDv inoculated feed matrices [1]

Item	Day 0	1	3	7	14	21	42	SEM	*P* =
CT value [2]	29.0^{e}	28.8^{e}	29.8^{d}	30.6^{c}	31.1^{b}	32.1^{a}	32.3^{a}	0.08	< 0.0001

[1] A total of 582 samples were used for the analysis.
[2] Cycle time required to detect the genetic material. A higher CT value means less genetic material present.
^{abcde} Means within a row lacking a common superscript differ.

Table 5. Feed matrix × day interaction for chemically treated PEDv inoculated feed matrices [1]

Item	Day 0	1	3	7	14	21	42
Diet	30.1^{gh}	30.1^{gh}	30.7^{f}	32.6^{cd}	32.6^{c}	33.9^{b}	34.2^{b}
Meat/bone meal	26.5^{p}	26.1^{p}	27.7^{o}	28.5^{n}	29.0^{klm}	29.3^{ykl}	29.4^{ijk}
Blood meal	30.3^{fg}	30.4^{fg}	31.6^{e}	32.2^{d}	34.2^{b}	35.6^{a}	35.9^{a}
Spray dried animal plasma	28.9^{lmn}	28.6^{mn}	29.4^{ijk}	29.2^{jkl}	28.9^{lmn}	29.7^{hi}	29.6^{ij}

[1] A total of 582 samples were used for the analysis.

Table 6. Treatment × day interaction for chemically treated PEDv inoculated feed matrices [1]

Item	Day 0	1	3	7	14	21	42	SEM	*P* =
Control	28.4st	28.3st	30.0^{opq}	30.0^{op}	30.5^{m}	31.2^{hijk}	31.8^{fgh}	0.22	< 0.0001
Termin-8	30.6^{lm}	31.9^{efg}	31.5^{ghijk}	32.5^{bcde}	32.7^{bc}	34.1^{a}	34.2^{a}		
Sodium bisulfate	28.3st	28.0^{stu}	29.2^{opq}	29.8^{no}	29.8^{nop}	31.4^{ghijk}	31.6^{fghij}		
Sodium chlorate	27.8^{tu}	27.1^{v}	28.5^{rs}	29.2^{opq}	29.7^{op}	31.2^{ijk}	31.2^{ijk}		
Organic acids	29.2^{pq}	29.1^{qr}	29.7^{nop}	31.0^{klm}	31.0^{klm}	31.7^{fghij}	31.4^{ghijk}		

[1] A total of 582 samples were used for the analysis.
^{abcdefghijklmnopqrstuv} Means within a row lacking a common superscript differ.

Table 7. Treatment × feed matrix interaction for chemically treated PEDv inoculated feed matrices [1]

Item	Diet	Meat/ bone meal	Blood meal	Spray dried animal plasma	SEM	*P* =
Control	30.7^{f}	27.5^{m}	33.42^{c}	28.1^{kl}	0.17	< 0.0001
Termin-8	32.2^{d}	29.3^{k}	34.3^{b}	34.1^{b}		
Sodium bisulfate	30.2^{g}	27.9^{lm}	32.3^{d}	28.6^{ij}		
Sodium chlorate	29.6^{h}	27.0^{n}	32.4^{d}	28.0^{klm}		
Organic acids	31.5^{e}	28.5^{ij}	33.5^{c}	28.2^{kl}		

[1] A total of 582 samples were used for the analysis.
^{abcdefghijklmn} Means within a row lacking a common superscript differ.

Editor's comments: Since feed can be a source of transmission for farms, this evaluation of feed components and treatments is a needed follow-up to epidemiological investigations and bioassay studies. It identifies a formaldehyde product as having the most reduction in detectable viral RNA in the sample. The study also shows some data in Table 5 which provides plausibility to viral particles remaining infectious in spray-dried porcine plasma products longer than whole feed as was seen in Canadian outbreak investigation bioassays. Given spray-dried plasma's ability to keep viral particles intact over more time than in other feed components, another notable observation of the study is in Table 7 showing the formaldehyde product's effectiveness at reducing detectable RNA particles and perhaps infectivity in spray-dried plasma compared to other chemical treatments.

Dr. Jones' research updates and other NPB research updates can be found at http://www.pork.org/pork-checkoff-research/pedv/pedv-research/