Kansas Agricultural Experiment Station Research Reports

Volume 5
Issue 8 *Swine Day*

Article 35

2019

The Effects of Filter Type and Warm-Up Time on Pellet Durability Index Using the Holmen NHP100 Portable Pellet Tester

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Recommended Citation

Evans, C. E.; Kort, R. N.; Saensukjaroenphon, M.; Wecker, H. K.; Paulk, C. B.; and Stark, C. R. (2019) "The Effects of Filter Type and Warm-Up Time on Pellet Durability Index Using the Holmen NHP100 Portable Pellet Tester," *Kansas Agricultural Experiment Station Research Reports*: Vol. 5: Iss. 8. https://doi.org/10.4148/2378-5977.7865

The Effects of Filter Type and Warm-Up Time on Pellet Durability Index Using the Holmen NHP100 Portable Pellet Tester

Abstract

The Holmen NHP100 (TekPro Ltd, Norfolk, UK) is a portable forced air pellet tester commonly used by the feed industry to determine the pellet durability index (PDI). The objective of this study was to determine the effect of filter type and machine warm-up time on PDI. A corn-soybean meal-based grower diet was conditioned at 185°F for 30 sec and subsequently pelleted using a laboratory pellet mill (Model CL5 California Pellet Mill Co., Crawfordsville, IN) equipped with a 0.16- × 0.5-in die. Production rate was 120 lb/h. Once cool, pellets were analyzed for PDI using the NHP100 with a 60-sec run time. Air temperature and pressure within the NHP100 were recorded throughout the experiment. Treatments were arranged in a 3 × 8 factorial with varying filters (none, factory tissue filter, or commercial paper towel filter) and machine warm-up time (0, 3, 6, 9, 12, 15, 18, or 21 min). There were three replicates per treatment. Pellets were sifted before and after analysis for separation of fines and pellets using a U.S. #6 standard sieve. There was a filter × warm-up time interaction ($P \leq 0.05$) for air temperature. The air temperature without warm-up time (0 min) was greater with the factory filter and paper towel compared to no filter. Air temperature remained similar regardless of filter type as the warm-up time increased from 6 to 21 min There was a filter × warm-up time interaction ($P \leq 0.05$) for air pressure. At 0 min warm-up time, there were no differences in air pressure between none, factory and paper towel filters. At 3 to 21 min warm-up time, air pressure remained similar between factory and paper towel filters, while no filter was greater than the paper towel filter. There was a filter × warm-up time interaction ($P \leq 0.05$) for PDI. For no filter, increasing warm-up time from 0 to 6 min increased PDI with no further increase from 6 to 21 min. However, there were no differences in PDI with increasing warm-up time when using the factory filter or paper towel. Using the factory filter or paper towel had similar PDI, but resulted in greater PDI compared to no filter. In conclusion, warm-up time did not influence air temperature, pressure, or PDI when using a filter. Therefore, it is suggested to use a filter when conducting PDI analysis using the Holmen NHP 100.

Keywords

pelleting, pellet durability index, Holmen NHP100

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K-STATE Research and Extension

Swine Day 2019

The Effects of Filter Type and Warm-Up Time on Pellet Durability Index Using the Holmen NHP100 Portable Pellet Tester

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Summary

The Holmen NHP100 (TekPro Ltd, Norfolk, UK) is a portable forced air pellet tester commonly used by the feed industry to determine the pellet durability index (PDI). The objective of this study was to determine the effect of filter type and machine warm-up time on PDI. A corn-soybean meal-based grower diet was conditioned at 185°F for 30 sec and subsequently pelleted using a laboratory pellet mill (Model CL5 California Pellet Mill Co., Crawfordsville, IN) equipped with a 0.16- × 0.5-in die. Production rate was 120 lb/h. Once cool, pellets were analyzed for PDI using the NHP100 with a 60-sec run time. Air temperature and pressure within the NHP100 were recorded throughout the experiment. Treatments were arranged in a 3 × 8 factorial with varying filters (none, factory tissue filter, or commercial paper towel filter) and machine warm-up time (0, 3, 6, 9, 12, 15, 18, or 21 min). There were three replicates per treatment. Pellets were sifted before and after analysis for separation of fines and pellets using a U.S. #6 standard sieve. There was a filter × warm-up time interaction ($P \leq 0.05$) for air temperature. The air temperature without warm-up time (0 min) was greater with the factory filter and paper towel compared to no filter. Air temperature remained similar regardless of filter type as the warm-up time increased from 6 to 21 min There was a filter × warm-up time interaction ($P \leq 0.05$) for air pressure. At 0 min warm-up time, there were no differences in air pressure between none, factory and paper towel filters. At 3 to 21 min warm-up time, air pressure remained similar between factory and paper towel filters, while no filter was greater than the paper towel filter. There was a filter × warm-up time interaction ($P \leq 0.05$) for PDI. For no filter, increasing warm-up time from 0 to 6 min increased PDI with no further increase from 6 to 21 min. However, there were no differences in PDI with increasing warm-up time when using the factory filter or paper towel. Using the factory filter or paper towel had similar PDI, but resulted in greater PDI compared to no filter. In conclusion, warm-up time did not influence air temperature, pressure, or PDI when using a filter. Therefore, it is suggested to use a filter when conducting PDI analysis using the Holmen NHP 100.

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Introduction

Pelleting is a feed processing method shown to improve handling and transportation characteristics of feeds, while improving feed utilization in swine. Ensuring high-quality pellets helps to maximize the process' many benefits. High quality in pellets can be defined as the ability to withstand repeated handling and pressure during the transportation and delivery process with minimum fines generation or pellet breakage. Pellet quality is typically expressed on a scale of 0 to 100% pellet recovery, known as the pellet durability index (PDI). Several devices may be used to measure the pellet quality, each with its own advantages. One such piece of equipment is the Holmen NHP100 (TekPro Ltd, Norfolk, UK). Its compact size and quick results make it a desirable tool for measuring the PDI in a production setting. Because the NHP100 uses forced air to agitate the pellets and requires only a 100-g sample, results may be more sensitive to air temperature and pressure changes. Using a filter and implementing a machine warm-up time may help to stabilize the temperature and pressure in the unit and lead to more accurate PDI analysis. Though the use of a filter is recommended by the manufacturer, little information is offered as to type. Thus, the objective of this study was to determine the effect of filter type and machine warm-up time on PDI.

Procedures

A corn-soybean meal-based grower diet (Table 1) was manufactured in accordance with current Good Manufacturing Practices (cGMP) at the Kansas State University O.H. Kruse Feed Technology Innovation Center in Manhattan, KS. The diet was conditioned at 185°F for 30 sec and then pelleted using a laboratory pellet mill (Model CL5, California Pellet Mill Co., Crawfordsville, IN) equipped with a 0.16- × 0.5-in die and production rate of 120 lb/h. Pellets were cooled for 12 min using a laboratory counter-flow cooler and then stored in tri-layer paper sacks until analysis. Pellets were allowed to rest for 24 h before analysis.

All pellets were analyzed for PDI using the NHP100 with a 60-sec run time and a 100-g sample. Pellets were sifted before and after analysis for separation of fines and pellets using a U.S. #6 standard sieve. Air temperature and pressure within the NHP100 were recorded throughout the experiment.

Treatments were arranged in a 3 × 8 factorial with varying filters (none, factory filter, or commercial paper towel) and machine warm-up time (0, 3, 6, 9, 12, 15, 18, or 21 min). The factory filter (FTF), similar in appearance to a commercial tissue, was obtained from the equipment manufacturer. The commercial paper towel (CPT) was chosen based on brand availability and ease of sourcing (Bounty® 2-ply paper towel, Proctor and Gamble Co.). A new filter was used for each analysis to avoid any possible negative effects of a dirty filter. Warm-up time treatments (Time) were run in chronological order within each filter replication. There was a 60-minute cool-down time between each replicate run to ensure the machine's return to ambient temperature. Each treatment was replicated three times with results blocked by day of analysis.

Data were analyzed using the GLIMMIX procedure in SAS version 9.4 (SAS Institute Inc., Cary, NC) as a completely randomized design. Results were considered significant if $P \leq 0.05$. Linear and quadratic contrasts were used to evaluate the impact of increasing warm-up time.

Results and Discussion

There was a filter × time interaction ($P < 0.001$) for air temperature. The air temperature without warm-up time (0 min) was significantly greater with the factory filter and paper towel compared to no filter. At 3 min warm-up time, the factory filter continued to have similar air temperature to the paper towel filter, though there was no significant difference when compared to no filter. Air temperature remained similar regardless of filter type as warm-up time was increased from 6 to 21 min.

There was a filter × time interaction ($P < 0.001$) for air pressure. At 0 min warm-up time there were no differences in air pressure between none, factory and paper towel filters. At 3 to 21 min warm-up time, air pressure was significantly greater with no filter paper compared to paper towel filter. The same was true for the factory filter at 6, 9,15, and 18 min warm-up times, though pressure was similar to no filter at 3, 12, and 21 min warm-up times. Pressure remained similar when comparing the factory and the paper towel filters from 0 to 21 min warm-up times.

There was a filter × time interaction ($P < 0.001$) for PDI. For no filter, increasing warm-up time from 0 to 6 min increased PDI with no further increase from 6 to 21 min. However, there were no differences in PDI with increasing warm-up time when using the factory filter or paper towel filter. Using the factory filter or paper towel filter had similar PDI, but resulted in greater PDI compared to no filter.

Conclusion

In conclusion, greater PDI results were observed when using either filter compared to no filter, indicating a more accurate and reproduceable result. Therefore, a filter paper should be used when conducting PDI analysis with the Holmen NHP100 unit.

Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. Persons using such products assume responsibility for their use in accordance with current label directions of the manufacturer.

Table 1. Diet composition (as-is)[1]

Ingredient, %	
Corn	69.22
Soybean meal, 48%	26.48
Choice white grease	1.50
Monocalcium phosphate, 21% P	0.55
Limestone	1.13
Salt	0.35
L-Lysine-HCl	0.31
DL-Methionine	0.07
L-Threonine	0.09
Trace mineral premix	0.15
Vitamin premix	0.15
Total	100.00
Calculated analysis	
Total lysine, %	1.20
Metabolizable energy, kcal/lb	1,526
Crude protein, %	18.70
Calcium, %	0.60
Available phosphorus, %	0.31

[1]The diet was conditioned at 185°F for 30 sec and pelleted using a laboratory pellet mill (Model CL5, California Pellet Mill Co., Crawfordsville, IN) equipped with a 0.16- × 0.5-in die and production rate of 120 lb/h.

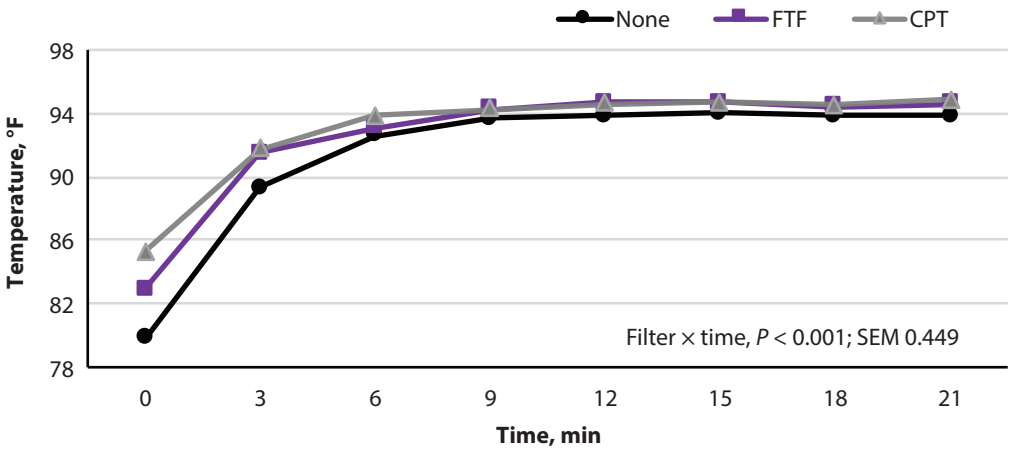

Figure 1. The interaction between filter type and warm-up time on the exhaust air temperature of the NHP100 portable pellet durability tester. None = no filter. FTF = factory tissue filter. CPT = commercial paper towel filter.

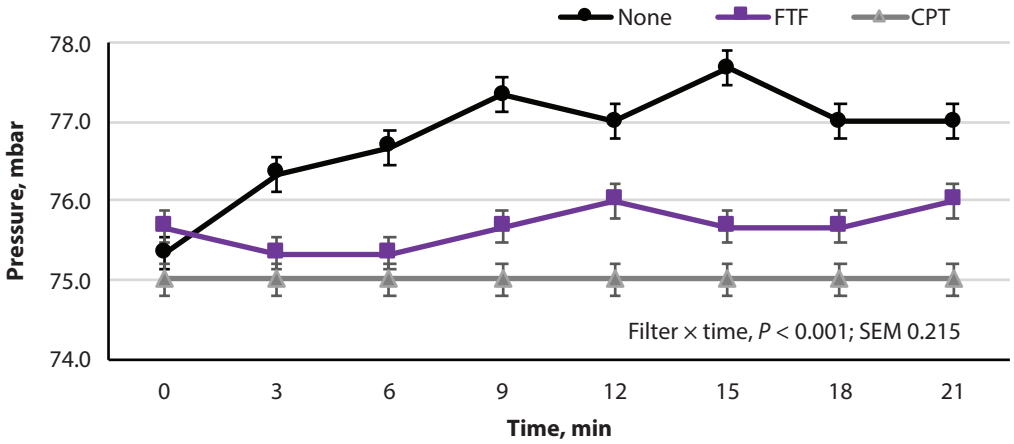

Figure 2. The interaction between filter type and warm-up time on the operating pressure of the NHP100 portable pellet durability tester. None = no filter. FTF = factory tissue filter. CPT = commercial paper towel filter.

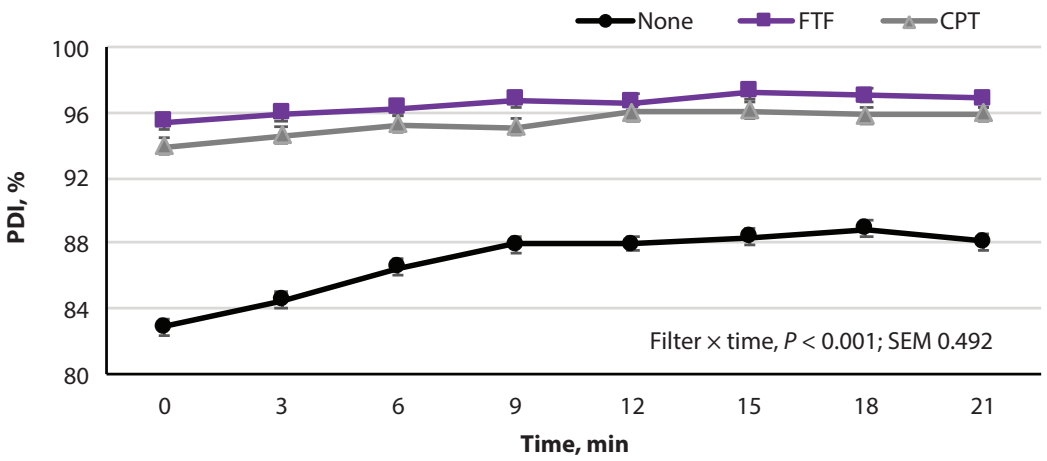

Figure 3. The interaction between filter type and warm-up time on the pellet durability index (PDI) of samples analyzed using the NHP100 portable pellet durability tester. None = no filter. FTF = factory tissue filter. CPT = commercial paper towel filter.