New insights for effective mould control

Serbian Feed Techn. Symposium

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Content the presentation

- World mould problem
- Assignment from the feed industry
- New innovation: Activated propionate
- Benchmark mould inhibitors
- Benchmark moisture optimization
- Summary
World mould problem!
Estimation: +/-22% of total feed has to high numbers of moulds

Mould contamination > max limit: 10,000 CFU/gr; Total 756 samples
Average pig feed: 15% ; Average poultry feed 28%.

Other literature: Russell et al 1991: 25.4 % samples contaminated with moulds: average 2.63*10^4
Mould growth can start easily!

High day temperature
- Warm up
  - Homogenous moisture distribution

Low night temperature
- Cool down
  - Moisture migration
    - Condensation of water vapour
The effect of mould contamination on nutritional value of stored maize is presented in table 1. The nutritive value drops after contamination by mould.

Table 1: Effect of mould contamination on the nutritional value of stored maize

<table>
<thead>
<tr>
<th></th>
<th>ME (Kcal/Kg)</th>
<th>CP (%)</th>
<th>Fat (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good corn</td>
<td>3,410</td>
<td>8.9</td>
<td>4.0</td>
</tr>
<tr>
<td>Mouldy corn</td>
<td>3,252</td>
<td>8.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Loss in nutrient</td>
<td>158</td>
<td>0.6</td>
<td>2.5</td>
</tr>
<tr>
<td>% loss in nutrient</td>
<td>4.6</td>
<td>6.7</td>
<td>62.5</td>
</tr>
</tbody>
</table>

Source: O’keeffe (2003). ME = Metabolisable energy, CP = Crude protein
Assignment from the feed industry
Assignment from the feed industry

- Cost reduction/ treated ton
- One product with multiple applications:
  - Mould control; or
  - Moisture optimalisation or
  - both
- Higher efficacy!

But

- Higher active ingredients are not possible

Innovation is NEEDED!
New innovation: Activated propiononate
Key features: Fylax, we never will change

- Non corrosive
- No evaporation
- Surfactant/
- Waterbinding
Moulds: Hard to attack!

Killing moulds: organic acids break through 2 cell layers ➞ Need for increased porosity organic acids
Innovative mould inhibition

- **New** production technology with activated propionates

Resulting in:

- Improved efficacy
  - Fylax Forte for low risk
  - Fylax Forte HC high risk
- Lower cost/ton treated material
New technology: Activated propionates form micelles

Micelles formed by activated propionates

M. O. Bachynsky; Aya Kitahara; Bressler 1999
Effect of activated propionates on moulds

1) Increased porosity of cell-wal
2) Destabilisation of cell-membrane
3) Better accessibility of organic acids
4) Decrease internal pH → inhibition growth → killing mould

Adapted from mucoses study group
Observe the difference!

Difference by activated propionates bound in micelle structure in water solution!

Pre-solution of 5% in water
Benchmark mould inhibitors
Benchmark efficacy!
1) Analysis the world moulds

Mix tested moulds
- Aspergillus
- Penicillium
- Zygomycetes
- Fusarium
The testing model: 2) Accelerated Stress test

- Incubation: 35°C & 95-99% humidity
- Increased moisture: + 3-6%
- Innoculated with log phase mix 4 mould species
- Treated with different dosages of mould inhibitor: 0.25-1.5 kg/tonne
- Record shelf life in contrast to control
Fylax new; strong efficacy improvement

Effect of mould inhibitors on shelf life extension (comp. to control)

Efficacy compared to Ammonium propionate:
Fylax forte HC: +60%
Fylax forte: +17%
Fylax Forte HC stronger mould inhibition efficacy compared to commercial competitors;
Comparison with Industrial standards

Effect of different mould inhibitors on effect of shelf life extension

- Fylax
- Fylax Forte
- Fylax Forte HC
- Amm. Propionate
- Calcium Propionate

Graph showing Relative shelf life extension compared to control vs Dosage (kg/ton):
- Fylax: $y = 0.5626x$
- Fylax Forte: $y = 0.4404x$
- Fylax Forte HC: $y = 0.4081x$
- Amm. Propionate: $y = 0.3333x$
- Calcium Propionate: $y = 0.3293x$

Dosage range: 0.5 to 1.5 kg/ton
Relative shelf life extension range: 0% to 100%
Fylax Forte higher efficacy and more cost effective compared to industrial standards (AP/CP)

Mould inhibitors comparison

- Relative anti-mould strength
- Relative cost/ton

% compared to Ammonium Propionate

- Amm. Propionate
- Fylax
- Fylax Forte
- Fylax Forte HC
Benchmark moisture optimization
Moisture optimization test trials at Nutreco research feed plant

1. Effect of Fylax Forte HC on Feedmill efficiency

2. Comparison of Fylax and / Fylax Forte HC (25% lower inclusion)

3. Comparison of Fylax Forte with commercial emulsifier
Dosing equipment: Flexible Moisture optimisation E500

- Control box
- Pressed Air
- Nozzle spray
- Mixer
- Display

- Free Water
- Water storage
- Pump
- Fylax Liquid 1000 kg
- Pump
1) Fylax Forte HC improved feedmill efficiency

<table>
<thead>
<tr>
<th></th>
<th>Moisture % before pressing</th>
<th>Moisture % after pelleting</th>
<th>Pelleting energy consumption (Watt)</th>
<th>Temp.</th>
<th>Hardness pellet</th>
<th>Free water (Aw)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>11.5</td>
<td>11.25</td>
<td>11,020</td>
<td>76.6</td>
<td>7.35</td>
<td>0.708</td>
</tr>
<tr>
<td>Fylax Forte HC</td>
<td>11.5</td>
<td>12.35</td>
<td>9,880</td>
<td>75.0</td>
<td>7.45</td>
<td>0.741</td>
</tr>
<tr>
<td>Difference</td>
<td>0%</td>
<td>+ 9%</td>
<td>-10%</td>
<td>-2.2%</td>
<td>1.4%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Premix: Fylax Forte HC = 7.5% in water; Dosage 1.5% in mixer.

Control group is without addition of water.

73% Moisture retention with Fylax Forte HC

Source: IRC research plant; March 2009
2) Forte HC; showed same moisture retention at 25% lower inclusion level!

- Piglet feed
- Addition: +/- 1.5% moisture in mixer
- Moisture retention compared to control

Source: IRC research plant; January 2010
## Fylax Forte range: Solution for every feed efficiency target

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Inclusion per ton of feed</th>
<th>Cost-Benefit Ratio *</th>
<th>Shelf life</th>
</tr>
</thead>
<tbody>
<tr>
<td>No moisture control</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Fylax Forte + 1.5% water</td>
<td>300 grams</td>
<td>1 - 4.4</td>
<td>maintained shelf life</td>
</tr>
<tr>
<td>Fylax Forte HC + 1.5% water</td>
<td>750 grams</td>
<td>1 - 4.7</td>
<td>increased shelf life</td>
</tr>
</tbody>
</table>

Choose the most cost effective solution for your target

* (* Feed price € 0.25/kg; Electricity € 0.20/ Kwh; Commercial prices for products)
Summary Fylax Forte

- New production technology resulted in activated propionates:
  - improved efficacy
  - 25% lower inclusion

- Fylax Forte HC → 10% lower cost / treated MT
- Energy saving up to 10-15%
- Pellet capacity increased 10%
- Better pellet quality
- Fylax Forte range: solution for every target
Thanks for your attention!

Don’t let moulds consume your money

NEW Fylax® Forte
More effective and cost efficient