

# **Efficacy of Tetrabasic Zinc Chloride as a Growth Promoter for Young Pigs**

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# Introduction

- Feeding pharmacological concentrations of Zn, as ZnO, is known to reduce diarrhea and improve growth performance of nursery pigs
- Increased Zn content in manure resulting from feeding high levels of Zn in nursery diets causes environmental concerns

**Analytical Grade ZnO**

**80.3% Zinc**

**Mallinckrodt**

**Feedgrade ZnO**

**78.1% Zinc**

**Hydrosulfide**

**Process (HS)**

**Feedgrade ZnO**

**69.4% Zinc**

**China**

**Process Unknown**

**Feedgrade ZnO**

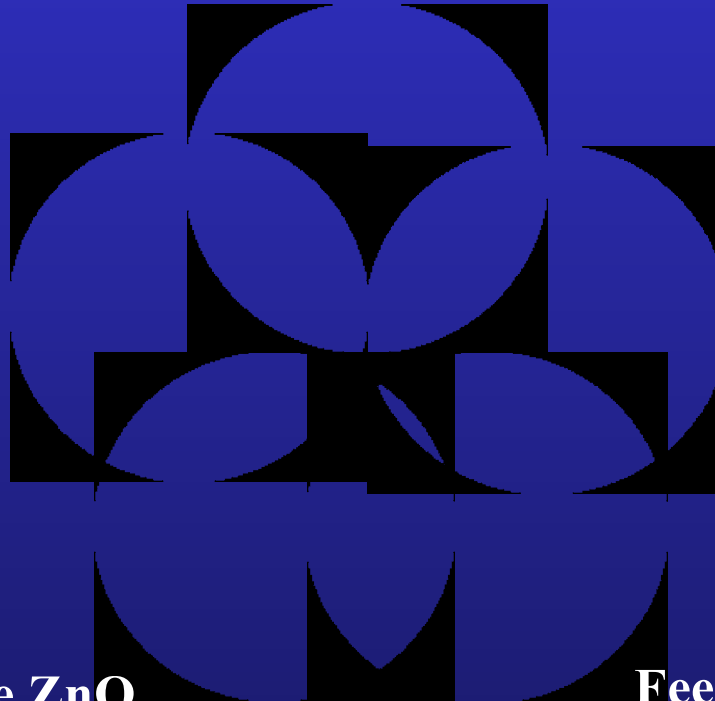
**78.0% Zinc**

**French Process (FP)**

**Feedgrade ZnO**

**74.1% Zinc**

**Waelz Process (W)**



# Tetrabasic Zinc Chloride (TBZC)



Zn = 60.2%



# Impurities (mg/kg) in Waelz ZnO and TBZC

Element	ZnO	TBZC
Iron	18,000	19
Calcium	17,000	<20
Sodium	3,800	<20
Manganese	1,900	< 1
Magnesium	1,600	<20
Aluminum	1,000	8.6
Tin	380	< 5
Copper	290	7.6
Lead	180	1.7

# Relative Zn Bioavailability in Waelz ZnO<sup>1</sup>

Suppl Zn (mg/kg)	Source	Suppl Zn intake (mg)	12-d Wt. Gain (g)	RBV (%)
0	-	0	93	
4.73	ZnSO <sub>4</sub> ·7H <sub>2</sub> O	1.41	160	<b>100</b>
9.13	ZnSO <sub>4</sub> ·7H <sub>2</sub> O	3.56	230	
8.98	ZnO (W)	2.33	132	<b>36</b>
SEM		0.07	6	

<sup>1</sup>4 pens of 4 chicks/diet

<sup>2</sup>Std curve:  $y = 97.3 + 38.1 \times (\text{SO}_4)$ ,  $r^2 = 0.97$

# Relative Zn Bioavailability in TBZC<sup>1</sup>

Suppl Zn (mg/kg)	Source	Suppl Zn intake (mg)	12-d Wt. Gain (g)	RBV (%)
0	-	0	80	
5.92	ZnSO <sub>4</sub> ·7H <sub>2</sub> O	1.80	140	<b>100</b>
10.78	ZnSO <sub>4</sub> ·7H <sub>2</sub> O	4.23	199	
5.41	Zn <sub>5</sub> Cl <sub>2</sub> (OH) <sub>8</sub>	1.71	141	
10.82	Zn <sub>5</sub> Cl <sub>2</sub> (OH) <sub>8</sub>	4.01	208	<b>111</b>
SEM		0.08	6	

<sup>1</sup>4 pens of 4 chicks/diet

<sup>2</sup>Std curve:  $y = 85.2 + 27.7 x_1 (\text{SO}_4) + 30.6 x_2$ ,  $r^2 = 0.94$

# Objectives

- To investigate the efficacy of TBZC as a growth-promoting feed additive for newly weaned pigs.
- To compare TBZC at various supplemental Zn levels as compared to Waelz-processed ZnO.

# Materials and Methods

## General:

Facilities: Environmentally-controlled nursery facility (United Feeds, Inc.); six pigs/pen

Animals: AusGene barrows and gilts (15 to 17-d of age)

## Zn Sources:

-ZnO: Zinc Nacionale, S.A. Mexico

-TBZC: Micronutrients, LCC, Indianapolis, IN

## Statistics:

-Randomized complete-block designs

-ANOVA w/ Trt and replicate as sources of variation

-Orthogonal and non-orthogonal individual degree-of-freedom contrasts for interpretation of treatment differences

# Materials and Methods (Cont.)

## Experiment 1:

- 150 weaned pigs (5 treatments x 5 pens/treatment)
- 21-d growth assay
- No antimicrobial agents included in diet

## Experiment 2:

- 144 weaned pigs (3 treatments x 8 pens/trt)
- 19-d growth assay
- Antimicrobial agents included in diet

## Experiment 3:

- 180 weaned pigs (6 treatments x 5 pens/trt)
- 21-d growth assay
- Antimicrobial agents included in diet

# Composition of Basal Diet

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## Ingredients

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Corn	to 100.00
Dehulled SBM	20.24
Edible-grade dried whey	25.00
Lactose	10.00
SD animal plasma	7.50
Animal fat/vegetable oil blend	3.00
Dicalcium P	0.63
Limestone	1.14
VTM	0.55
L-Lys & DL-Met	0.19

## Analysis

Lysine (%)	1.50
Zn (mg/kg)	119

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# Increasing Doses of Zinc from ZnO or TBZC on Growth Performance of Weaned Pigs W/O Antimicrobials (Exp. 1)<sup>1</sup>

Treatment	Weight gain (g/d) <sup>a,d,e,f</sup>	Feed intake (g/d)	Gain/feed (g/kg) <sup>a,b,c,e</sup>
1. No added Zn (control)	234	329	711
2. 1,500 mg Zn/kg - ZnO	240	341	705
3. 3,000 mg Zn/kg - ZnO	265	363	730
4. 1,500 mg Zn/kg - TBZC	263	353	745
5. 3,000 mg Zn/kg - TBZC	261	339	769
Pooled SEM	11	13	14

<sup>1</sup>Data are means of five pens of six pigs with average initial BW of 5.2 kg and an average initial age of 15 d during a 21-d feeding period.

<sup>a</sup>Control vs added Zn (P < 0.10)

<sup>b</sup>ZnO vs TBZC (P < 0.10)

<sup>c</sup>ZN Level (P < 0.10)

<sup>d</sup>ZnO linear (P < 0.10)

<sup>e</sup>TBZC linear (P < 0.10)

<sup>f</sup>TBZC quadratic (P < 0.10)

# Effects of 1,500 mg/kg Supp. Zn from ZnO or TBZC on Growth Performance of Weaned Pigs Fed Diets Containing an Antimicrobial Agent (Exp. 2)<sup>1</sup>

Treatment	Weight gain (g/d)	Feed intake (g/d)	Gain/feed (g/kg)
1. No added Zn (control)	282	388	725
2. 1,500 mg Zn/kg - ZnO	280	392	718
3. 1,500 mg Zn/kg - TBZC	295	383	769
Pooled SEM	10	13	11
<i><u>Contrasts, P-value<sup>x</sup></u></i>			
Control vs Zn (T <sub>1</sub> vs T <sub>2&amp;3</sub> )	NS	NS	NS
ZnO vs TBZC (T <sub>2</sub> vs T <sub>3</sub> )	NS	NS	0.01

<sup>1</sup>Data are means of five pens of six pigs with average initial BW of 5.2 kg and an average initial age of 15 d during a 21-d feeding period.

<sup>x</sup>NS = not significant (P >0.10)

# Increasing Doses of Zinc from TBZC on Growth Performance of Weaned Pigs Fed Diets Containing an Antimicrobial Agent (Exp. 3)<sup>1</sup>

Treatment	Weight gain (g/d) <sup>a,b,c,d</sup>	Feed intake (g/d) <sup>a,c</sup>	Gain/feed (g/kg) <sup>a,b,c,d</sup>
1. No added Zn (control)	229	329	694
2. 3,000 mg Zn/kg - ZnO	280	374	749
3. 750 mg Zn/kg - TBZC	235	316	745
4. 1,500 mg Zn/kg - TBZC	279	361	774
5. 2,250 mg Zn/kg -TBZC	294	384	765
6. 3,000 mg Zn/kg - TBZC	285	370	769
Pooled SEM	15	17	19

<sup>1</sup>Data are means of five pens of six pigs with average initial BW of 4.5 kg and an average initial age of 15 d during a 21-d feeding period.

<sup>a</sup>Control vs ZnO (P < 0.10)

<sup>b</sup>Control vs TBZC (P < 0.10)

<sup>c</sup>TBZC linear (P < 0.10)

<sup>d</sup>TBZC quadratic (P < 0.10)

# Conclusions

- TBZC, with its high relative Zn bioavailability, is a better growth promoter than Waelz-processed ZnO when the supplemental dose is limited to 1,500 mg Zn/kg
- TBZC, when provided at 1,500 mg Zn/kg, is an effective source of Zn for enhancing growth performance of newly weaned pigs fed diets with or without an added antimicrobial compound.