A new choice for using copper in pig feeds – Part I

When selecting the source of minerals, all premix and feed formulations are familiar with oxides. They use or may use zinc oxide, manganese oxide, but why is copper oxide not a popular source of copper in pig nutrition?

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This article, in two parts, will give some reasons and will explain why the situation recently changed with the authorisation of the monovalent form of copper oxide.

More restrictive usage of copper in animal feeds

For decades the EU authorities have initiated a policy to reduce copper levels in animal diets, especially in pig feeds. Back in 1982, the Scientific Committee for Animal Nutrition (SCAN) concluded that maximal level in total dietary copper should not exceed 125mg/kg in complete feeds for piglets and pigs. In another Opinion from 1983, SCAN expressed the concern of higher selection of E. coli strains resistant to one antibiotic (chloramphenicol) with higher dietary copper. They suggested to reduce the authorised level of 175mg/kg up to 10 weeks of life instead of four months.

The SCAN Opinion from 2003 proposed a compromise to reduce the copper burden without affecting the performance of farm animals, especially when its use as a growth promoter is well documented. They suggested to reduce the authorised level of 175mg/kg up to 10 weeks of life instead of four months.

Fig. 1 summarises the literature reviewed at that time, showing that the younger the pig, the more significant the growth promoting effect of copper at high supplementation levels.

On the risk of microbial resistance, SCAN communicated that a plasmid from a gut bacteria could contain both a gene encoding resistance to copper and antibiotic resistance genes. Following SCAN Opinion, Regulation 1334/2003 of 25th July 2003 defined new maximum copper levels in pig feeds:

- Piglets up to 12 weeks: 170 (total) mg/kg.
- Other pigs: 25 (total) mg/kg.

In 2016, on the request of the European Food Safety Agency (EFSA), two high quality literature reviews were published. Initiated in 2012, an updated report on the influence of copper on antibiotic resistance of gut microbiota in pigs, including piglets, was supervised by Ghent University.

Of a total of 901 references, only 33 were found eligible. Authors concluded that they could not exclude the possibility of a positive correlation between copper supplementation above requirements and development of antibiotic resistance.

Another systematic literature review focused on the effects of copper intake levels in the gut microbiota profile of target animals. Authors concluded that copper, even at low concentrations (<50mg/kg in complete feed), may affect the microbiota in the gastrointestinal tract. From these reports, EFSA published a 100 page Opinion in 2016 for the revision of maximum contents of dietary copper.

The suggestion with the highest impact on animal performance was to reduce the Cu concentration from 170 to 25mg/kg in piglet feeds, thus suppressing its growth promoting effect. It created a strong reaction from the pig industry in the EU. Table 1 shows that all piglet feeds which were collected and analysed, reach the highest permitted level, as the effect on weight gain and faecal score is well known.

Regulatory authorities want to restrict safety margins in copper supplementation. They have to choose solutions which maximise animal performance, while minimising the impact on the environment. A new tool is now available to simulate the impact of copper in the feeding program of the pig, from weaning until slaughter.

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Fig. 1. Effect of copper level on body weight gain. Left, in the post weaning phase and, right, in the growing phase (20-50kg).
Table 1. Copper concentration in feed, control data submitted by 14 EU countries.

<table>
<thead>
<tr>
<th>N</th>
<th>Cu (mg/kg complete feed)</th>
<th>Copper concentration (%)</th>
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<tbody>
<tr>
<td></td>
<td>Median</td>
<td>10%</td>
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<tr>
<td>Piglets</td>
<td>1,420</td>
<td>136</td>
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<tr>
<td>Fattening pigs</td>
<td>2,034</td>
<td>18</td>
</tr>
<tr>
<td>Sows</td>
<td>546</td>
<td>20</td>
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Table 2. Copper concentration in feed grade copper sources in the EU.

Two forms of copper oxide; left, Cupric oxide (CuO) copper(II) oxide, right, Cuprous oxide (Cu2O) Copper(I) oxide.

References are available from the author on request.