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Homogeneity of an oxytetracycline solution administered with a dosing pump

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Introduction

On pig farms, collective treatments can be achieved by oral administration of medicines through drinking water with dosing pumps. Homogeneity of the medicated solution at the drinkers is a key factor for therapeutic success, respect of the maximum residue limits (MRL) in meat and prevention of antimicrobial resistance. The aim of this study was to assess homogeneity of an oxytetracycline (OTC) solution, according to type of stock solution tanks and to solubility of OTC.

Materials and Methods

Homogeneity in the stock solution tank

Three types of tanks commonly used on farms (1) were tested:
- One flat-bottomed tank without stirrer,
- One flat-bottomed tank with a motorized propeller,
- One conic-bottomed tank with a pump mixing the solution.

Each tank was filled up with a well-dissolved OTC solution. Sixty samples were taken 3, 5, 7 and 24 hours after the solution had been prepared at 3 heights of the tank (top, middle and bottom).

Homogeneity at the drinker

Tests were conducted on an experimental pipe, simulating on-farm conditions. An OTC solution prepared in a mixing tank with (solution A) or without solvent (solution B) was administered by a hydraulic pump to the drinkers. Fifty or 60 samples of 50 ml were taken at the drinker continuously or after a break, with 4 combinations of water flows and pressures.

Concentrations of OTC were assessed by colorimetric analysis.

Results and Discussion

Homogeneity in the stock solution tank

For the 3 tanks and at a given time, all the coefficients of variation (CV) in the 3 heights and in the entire tank were below 5%. We concluded there was no concentration gradient in tanks at any given time, with or without a stirrer. These results completed those obtained during a test comparing the homogeneity of low or highly soluble preparations of amoxicillin (2).

Homogeneity at the drinker

With solution B, samples taken after each break showed increases and drops of concentrations (figure1), certainly matching settling and releasing of OTC in the pipe. This didn't occur with continuous sampling but in both cases, CV were up to 5% for the 4 combinations of flows and pressures (Figure1). So, without any solvent, the solution wasn't homogeneous at the drinker.

ÁWith continuous sampling of solution A, CV were below 5% and average concentrations were between 104 and 109% of the expected concentration (1g/l) (Table 1). This met the quality requirements of an industrial medicated feed.

Figure 1: *Discontinuous sampling of solution B at a drinker: variation of OTC concentrations*

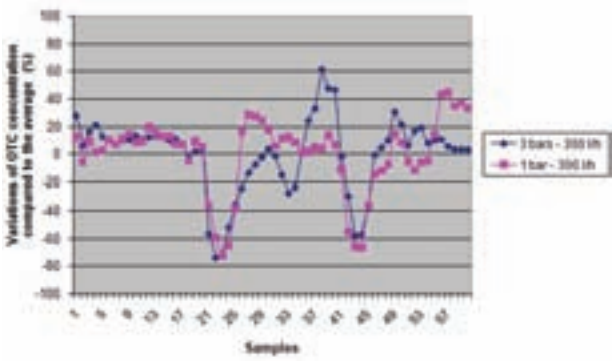

Table 1: *Homogeneity of an OTC solution at drinker*

Without any solvent (solution B)	Without any solvent (solution B)	Without any solvent (solution B)
Water flow - pressure	CV (%) of OTC concentrations	CV (%) of OTC concentrations
Water flow - pressure	Continuous sampling	Discontinuous sampling
30 l/h - 0.5 bars	14.0	85.6
30 l/h - 3 bars	10.4	53.6
300 l/h - 1 bars	11.7	27.0
300 l/h - 3 bars	7.0	27.5
With a solvent (solution A)	**With a solvent (solution A)**	**With a solvent (solution A)**
Water flow - pressure	CV (%)	Ratio avg. /expected OTC concentrations (%)
30 l/h-0.5 bars	1.4	109
30 l/h-3 bars	3	108
300 l/h-1.5 bars	1.6	104
600 l/h-3 bars	1.4	106

After a 12 hour break of solution A, the first samples showed concentration levels between 1.2 and 2.5 times higher than the average levels of the next samples. The involved volume (400 ml), corresponding to the pipe coming down towards the drinker, might globally match the first morning-time drinking of one pig weighting 70 kg (less than 6% of its daily water intake). So, this doesn't question the respect of the MRL.

Conclusion

Our results demonstrate that a well-dissolved medicated solution guarantees a correct homogeneity in the stock solution tank even without a stirrer. At the drinker, the homogeneity of such a solution meets the quality requirements of an industrial medicated feed.

References

1. Correge I., et al. (2008). Techniporc, 31, 17-21.
2. Hawkins P., et al. (2009). AASV, 223-229.