Biomass production potential of antibiotic solutions intended for application in animal drinking water

Dechra
Veterinary Products

The philosophy of the Dechra Water-Soluble Powders (WSP)

Dechra's WSP's are carefully formulated to guarantee:

- A high solubility
- An maximum stability
- A limited effect on biofilm growth
- An optimal efficacy

Effects on biofilm growth of antimicrobial powders

In theoretical calculations

The microbial growth potential of tartaric acid compared to citric acid and citric acid/lactose mixture is calculated in scientific reviews[1]

- the bacterial yield on lactose is ~ 2 times higher than on tartaric acid.
- the bacterial yield on citric acid is ~1,4 times higher than on tartaric acid.

In a well-validated test

Dechra has approached a well-known water-research institute to carry out a validated test* to review 3 doxycycline-containing, water-soluble powders on their individual effects on the (re)growth of microorganisms in drinking water systems. These powders, in particular, differ in the composition of their buffers and fillers.

Testing Method

A currently often used and well validated method for measuring this (re)growth in vitro is the experimental determination of the biomass production potential in a so-called BPP-test. *(see 'additional information')*

TABLE 1. **Selected solutions for the BPP test**

Label	*Antibiotic	*Additive
Soludox	**Doxycycline (500 mg)	Tartaric acid (500 mg)
Product 2	**Doxycycline (580 mg)	Citric acid & Lactose (420 mg)***
Product 3	**Doxycycline (580 mg)	Citric acid (420 mg)***
Blanco	none	none

* *per 1gram of the commercial product (in a powder form);*
** *as doxycycline hyclate;*
*** *in an unknown ratio.*

* Test report available on demand

ADDITIONAL INFORMATION:

Biomass Production Potential (BPP) Test

During the biomass production potential (BPP) test, the solution to be tested is incubated for 14 days at 25 °C and at regular intervals, the growth of bacteria is monitored by the adenosine triphosphate (ATP) content of the solution.

ATP is an energy-rich compound which is present in all living organisms, and can be used as a dimension for measuring the amount of active biomass of microorganisms.

Results

The maximum ATP concentration during the first seven days (BP7) is determined, which is used as an indication for the concentration of easily assimilable organic carbon (AOC). Furthermore, the cumulative biomass production over 14 days (BPC14) is determined as well. The BPC14 is a measure for the amount of easily and difficult degradable organic carbon in the water sample.

TABLE 2. **The average BP7 and BPC14 (± sd)**

Sample	BP7 (ng ATP L^{-1})	BPC14 (ng ATP L^{-1})
Blanco (600 mL tap water)	4,9 ± 0,1	61,9 ± 12,1
Soludox (600 mL tap water + 0,12 mg *Doxycycline/0,12 mg Tartaric acid)	16,9 ± 0,4	132,6 ± 3,7
Product 2 (600 mL tap water + 0,12 mg *Doxycycline/0,09 mg Citric acid & Lactose)	33,2 ± 12,3	233,8 ± 54,5
Product 3 (600 mL tap water + 0,12 mg *Doxycycline/0,09 mg Citric acid)	25,5 ± 1,9	233,0 ± 27,6

Table 2 - ***The average BP7 and BPC14 (± sd), for the tap water of Nieuwegein*** *(Blanco) and the low concentrations of Soludox (Dechra), Product 2 and Product 3 in tap water from Nieuwegein (600 mL).*

FIGURE 1. **Progression of ATP value during the BPP tests**

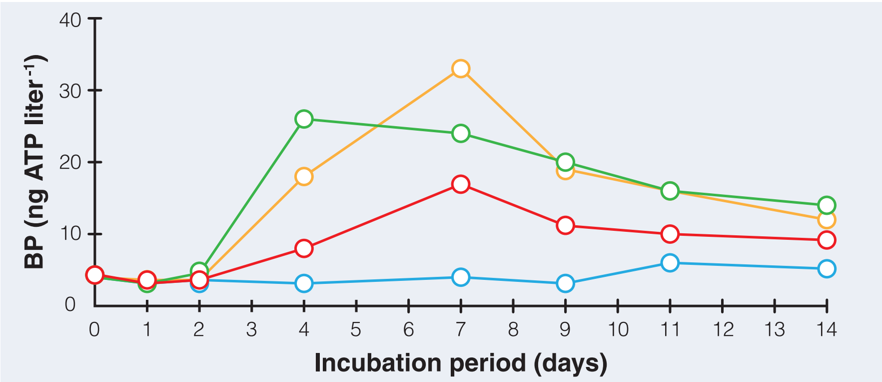

Figure 1 - ***The progression of ATP value during the (in duplo performed) BPP tests*** *with the tap water from Nieuwegein (600 mL) and* ***Soludox, Product 2, Product 3*** *and* ***Blanco****.*

FIGURE 2. **Cumulative biomass production over 14 days (BPC14)**

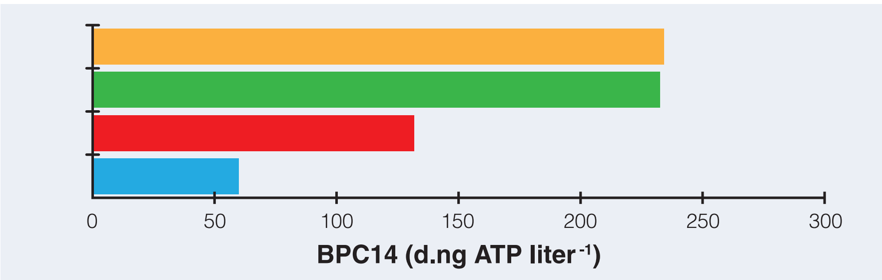

Figure 2 - ***The BPC14 value of the Blanco*** *(600 mL of the tap water from Nieuwegein) and* ***Soludox, Product 2, Product 3*** *and* ***Blanco****.*

Conclusion

Under the conditions of the BPP test, the microbial growth potential for all three products (in low concentrations) was considerably higher than for the blanco. However, Soludox has an almost two times lower growth potential than both competitive products, compared in the test (Fig. 2).

The results found in this test align with values found in literature for the bacterial yield of tartaric acid, citric acid and glucose (lactose). These data support our estimate that Soludox contributes far less to the formation of biofilms in drinking water systems as comparable products.

"Soludox has an almost two times lower growth potential than both competitive products, compared in the test!"

The biofilm is like a living tissue on the inner wall of a water pipe

It is a complex form of cooperation among several micro-organisms.

Every drinking water system is contaminated with microorganisms and dust particles, coming from the environment. In this humid environment micro-organisms can multiply, depending on temperature, available nutrients and inhibiting factors. Multiplication of micro-organisms can lead to formation of an mucous substance, called a biofilm.

Biofilms are ubiquitous. Nearly every species of micro-organism has mechanisms by which they can adhere to surfaces and to each other.
In drinking water system, biofilms can result in obstructed drinking nozzles. Adding antibiotics to drinking water will select microorganisms, in favor of resistant and not targeted micro-organisms such as yeasts and moulds.

Bacteria living in a biofilm show increased resistance to detergents and antibiotics.

Soludox® Contains no lactose and is buffered with tartaric acid instead of citric acid

Soludox®

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