

Monitoring of environmental conditions in Tecniplast Emerald EM500 Individually Ventilated Cages.

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Abstract

Objectives

The objective of the trial was the monitoring of intra-cage environmental parameters, namely the levels of ammonia, oxygen, temperature and relative humidity. Secondary objectives included the growth curves of mice and their consumption of water and feed.

Methods

The levels of ammonia, oxygen, temperature and relative humidity were measured in six Emerald (EM500) cages on a 6 column and 12-level rack (HD Rack). The growth curves of mice and their consumption of water and feed were measured in twenty seven C57Bl/6J male mice > 10 weeks old.

Results

The stability of Oxygen value and the low concentration of CO₂ recorded during the 14 days of the trial are, in combination with the good health condition of the mice in the cages (Ammonia concentrations remained below 25 ppm up to day 7 and gradually increased from the ninth to the fourteenth day), indicators of more than acceptable environmental condition. Feed and water intake were absolutely in agreement with those expected in that strain/gender/age. Intra-cage Temperature and relative humidity were always within the acceptable range of 40 to 70% for Individually Ventilated Cages confirming the high efficiency of ventilation.

Conclusions

Emerald cages were monitored for a period of two weeks in order to describe the environmental conditions in terms of residual pollutants following the metabolic activity of the mice housed, and the contribution to the pollutants removal due to the ventilation. The positive output of these experiments showed how the new Emerald system is maintaining an absolutely healthy environment without affecting the animals' physiological parameters and behavior.



EM500
EMERALD IVC

INTRODUCTION

The welfare of the animals used in research has always been a key point in the choice of the housing solution.

There are different parameters used to define the welfare, each contributing to the definition of the physical and psychological health status.

The levels of NH₃, O₂ and CO₂, in the micro-environment of the cage, in combination with the stability of the Temperature and Relative Humidity play a crucial role in defining the threshold of welfare.

It is well known that high levels of ammonia can cause various respiratory problems, nevertheless a low oxygen level can affect mice red blood cells count and behavior.

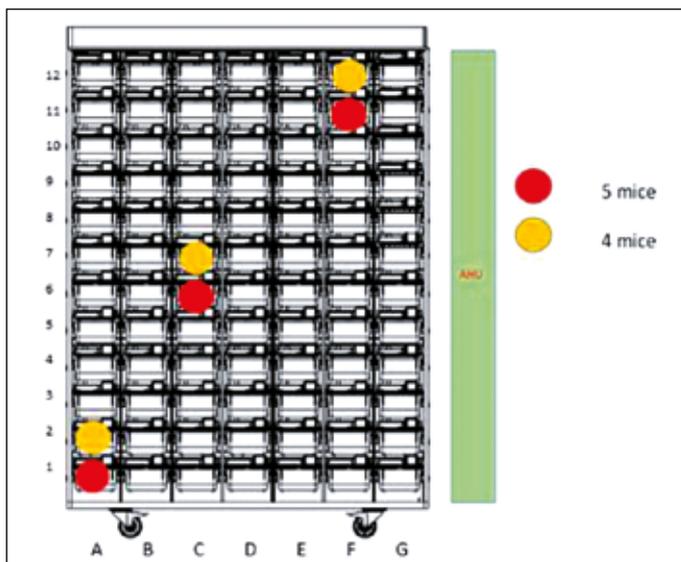
A good ventilation combined with the cage design, have a strong impact on the removal of pollutants and the maintenance of acceptable O₂ concentration.

MATERIALS AND METHODS

The Emerald cages with mice were placed on the rack according to the scheme described below.

All cages involved in the trial were with the In-Richment, an elevated surface embedded in the cage base.

The remaining positions on the rack were filled with empty cages.



Each group of cages was populated with at least one cage housing 4/5 mice and maintained in position for two weeks.

Rack and cages.

Eighty-four Emerald (EM500) cages on a 12-level rack. Cages are Ventilated through a Smart Flow Air Handling Unit in positive mode.

Mice.

Twenty seven C57Bl/6J male mice > 10 weeks old.

Diet and water.

Rodents breeding and maintenance, Harlan Teklad Global Diet, autoclaved. Water: filtered and autoclaved in bottles.

Bedding.

¾ Fasern Rettenmaier, autoclaved. 70 g to a cage.

Data loggers.

TESTO 174-H - Mini-Data logger for Temperature and Relative Humidity. Recording frequency every 30 minutes. Positioned on the food hopper, aligned with the exhaust valve of the cage.

Gas recording Instrument.

Drager X-am 7000. The air is sampled from the cage introducing the probe through the flap for the water bottle sipper tube and down to a height of approx. 3 cm from the bedding surface. Each sampling procedure lasts 5 minutes.

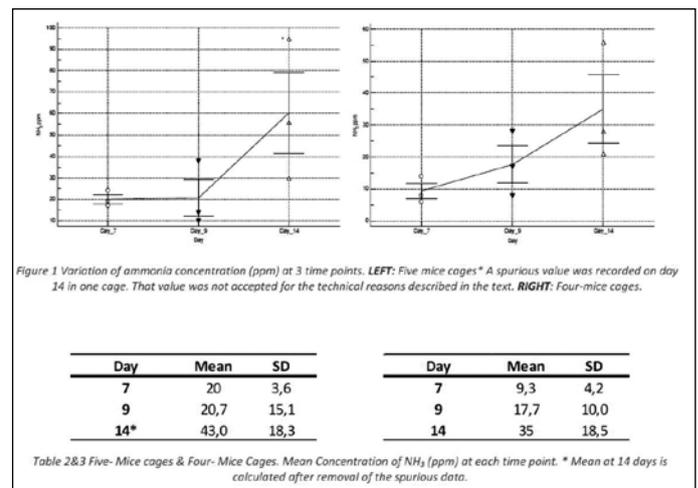
RESULTS

· Body Weight, feed and water intake:

	Beginning of trial	End of trial
Body weight	27,2 g	28,9 g
Water Consumption (mean/mouse/day)	-	3,8 g
Feed consumption (mean/mouse/day)	-	3,9 g

Table 1 Variation of Body weight during the weeks of trial. Feed and water consumption per mouse on a daily basis.

· Ammonia, Oxygen and CO₂:



In one of the cages with five mice a spurious value of ammonia concentration was detected on day 14 (95ppm).

This value was due to mice activity of "bedding pushing" against the sampling probe. The probe was constantly submerged by dirty bedding and despite repeated attempts it was not possible to record a true value from the air in that cage. For this reason that value was discarded from our analysis. Oxygen was stable at 20,9% throughout the trial at the three time points and CO₂ never exceeded a concentration above 0,12 %.

· Temperature and Relative Humidity:

Cage	Temp °C	rH%
A1	24,1(0,60)	54,4(1,85)
A2	23,3(0,72)	52,2(4,87)
C6	23,9(0,69)	49,0(2,56)
C7	23,3(0,69)	49,6(3,43)
F11	24,2(0,58)	47,0(1,55)
F12	24,5(0,60)	51,0(2,68)
Room	21,7(0,34)	43,7(1,17)

Table 4 Two weeks recording of Temperature and Relative Humidity. Data are described as Mean (Std. Dev.)

COMMENT AND CONCLUSION

The new Emerald cage has shown low levels of ammonia (below 25 ppm up to day 7 and gradually increased from the ninth to the fourteenth day) and CO₂, and stability of the Oxygen value during the 14 days of the trial.

This, in combination with the good health condition of the mice in the cages (food and water intake were absolutely normal), are indicators of more than acceptable environmental conditions.

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