Effect of Caging System and Bedding Sterilization on Intra cage Ammonia accumulation with time. 

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### Introduction

Cages holding rodents accumulate ammonia and faces over time and need to be periodically changed and washed. Cage changing, however, can cause distress to the rodents and expose the lab personnel to allergens and/or infectious agents. Cage washing, furthermore, is expensive and resource intense. Less frequent cage changes and/or cage washing, furthermore, is expensive and resource intense. Cage changing, however, can cause distress to the rodents and expose the lab personnel to allergens and/or infectious agents. Cage changing, however, can cause distress to the rodents and expose the lab personnel to allergens and/or infectious agents. Cage changing, however, can cause distress to the rodents and expose the lab personnel to allergens and/or infectious agents. Cage changing, however, can cause distress to the rodents and expose the lab personnel to allergens and/or infectious agents.

Using IVCs is helpful: their air supply is continuously renewed and this helps maintain their levels of moisture and noxious gases (i.e. ammonia). Work with IVCs, however, has mainly centered on the frequency of cage air changes. Less attention has been given to how the pattern of air movement within the cage, or other cage design characteristics, affect gas accumulation.

Using the proper bedding is also important: much research has documented differences among bedding materials, as well as the effects of their treatment (i.e. sterilization), on cage changing frequency. The present study sought to: a) Compare the ammonia removal efficiency of two ventilated cage systems in which the air injection and exhaust ports were either horizontal (CH) or vertical (CV), and b) Determine if using autoclaved bedding (AB) resulted in different intra-cage ammonia concentrations than using non-autoclaved bedding (NAB).

### Procedures

Double sided racks were used in each caging system. 5 cages were placed on each rack side in an X pattern: Top Left, Top Right, Center, Bottom Left and Bottom Right. The mice were weighed individually at the start and end of the study; average daily gains were calculated from these weights. The feed provided, and the feed leftovers at each feeding and at the end of the study, were weighed and used to calculate daily feed disappearance. Water was provided in 400 ml (CH) or 300 ml (CV) bottles. The bottles were weighed every morning to measure daily water disappearance. Bedding was weighed at the start (220g) and end of study for each cage. End of study bedding samples were taken and frozen for analysis.

Intra-cage ammonia concentration was used as the criteria of cage environmental quality. Ammonia was measured daily (between 09:30 and 11:30 hours) with a Drager X – am 7000 unit equipped with an sensor calibrated to read from 0 to 200 ppm of ammonia. To measure the ammonia, a 2 minute air sample was drawn from each cage through a brass fitting port in the front of the cage, at about 1" from its bottom. Intra-cage ammonia concentration was used as the criteria of cage environmental quality. Ammonia was measured daily (between 09:30 and 11:30 hours) with a Drager X – am 7000 unit equipped with an sensor calibrated to read from 0 to 200 ppm of ammonia. To measure the ammonia, a 2 minute air sample was drawn from each cage through a brass fitting port in the front of the cage, at about 1" from its bottom. Intra-cage ammonia concentration was used as the criteria of cage environmental quality. Ammonia was measured daily (between 09:30 and 11:30 hours) with a Drager X – am 7000 unit equipped with an sensor calibrated to read from 0 to 200 ppm of ammonia. To measure the ammonia, a 2 minute air sample was drawn from each cage through a brass fitting port in the front of the cage, at about 1" from its bottom. Intra-cage ammonia concentration was used as the criteria of cage environmental quality. Ammonia was measured daily (between 09:30 and 11:30 hours) with a Drager X – am 7000 unit equipped with an sensor calibrated to read from 0 to 200 ppm of ammonia. To measure the ammonia, a 2 minute air sample was drawn from each cage through a brass fitting port in the front of the cage, at about 1" from its bottom. Intra-cage ammonia concentration was used as the criteria of cage environmental quality. Ammonia was measured daily (between 09:30 and 11:30 hours) with a Drager X – am 7000 unit equipped with an sensor calibrated to read from 0 to 200 ppm of ammonia. To measure the ammonia, a 2 minute air sample was drawn from each cage through a brass fitting port in the front of the cage, at about 1" from its bottom.

The study ended for a given cage on the day its ammonia concentration reached (or surpassed) 50 ppm. The end point for cages not yet reaching 50 ppm was when their cage’s useful life, or when their bedding accumulation, in the view of the veterinary staff, could hinder animal mobility within the cage.

### Results

Statistical analysis indicated that the cage ammonia levels were closely related to the rate of water disappearance from the cages. Water disappeared to a much lesser extent from CV cages bottles than from CH cage bottles. See Table 1.

### Materials

Twenty mouse cages, each containing five CD1 female mice weighing 28-30 g, were allocated to one of four combinations of caging systems and bedding: CHAB, CVNAB, CHAB and CHNAB, where:

- AB: autoclaved 1/4 Bed-O-Cob bedding  
- NAB: non-autoclaved 1/4 Bed-O-Cob bedding

CV, pictured below, a caging system where both the air injection and exhaust ports are at the top of the cage and the feeder is in the middle of the cage, between the ports; a built in space for a vertically mounted 300 ml water bottle is located at the cage top near the front.

CH, pictured next column, is a caging system where the air injection and exhaust ports are located near the left and right corners of the rear of the cage lid and the feeder is located under the air ports; a built in space for a diagonally mounted 400 ml water bottle is located at the cage front.