

Anthroponics Experiment

Progress Report

By Henrique Sánchez, 11/06/2015

1. Ammonia Volatilization from Urea

The first results from ageing urine have given us an approximate time of 4-5 weeks to have 100mL of fresh urine reach a pH of 9, thus sterilizing it while also having converted all the urea to ammonia.

Table 1 – 1st batch results after 2 and 3 weeks of ageing.

1st batch (test)	Control	Jar 1 (100mL)	Jar 2 (100mL)	Jar 3 (100mL)
Enclosure date (13:00)	-	18-03-2015	18-03-2015	18-03-2015
Opening date	-	25-03-2015	01-04-2015	08-04-2015
pH enclosure	-	-	-	-
pH opening	-	-	8,4	8,5

Table 2 – 1st batch results after 4 weeks of ageing.

	Jar 1 (100mL)	Jar 2 (100mL)	Jar 3 (100mL)
4th week results	15-04-2015	15-04-2015	15-04-2015
pH	9,1	8,8	8,7

This first batch was measured so as to get an idea of the timeframe as the baseline for next measurements. The first batch urine was used to cycle the anthroponics experiment units, and further batches will be created not only to dose the experiment units but also to gain statistical data on the average and median time of volatilization.

2. Construction of Anthroponic experiment units

Three anthroponic experiment units were built during the period of almost 2 months (03/03/2015 – 28/04/15). This excessive time (for the size of the experiment) was due to other organization activities occurring at the same time and our dedication to getting the correct materials and equipment. In the next page you will find several pictures of the materials used and the construction process.



Figure 1: From left to right: The three container units with the plumbing tubes, the three light fixtures, and the three pumps, connectors, standpipes, and bulkhead fittings.



Figure 2: From left to right: Adding the bulkhead fitting + standpipe to the grow bed component, drilling the bulkhead fitting hole and pump hose in the support lid of the grow bed and a close-up of the bulkhead fitting being inserted in the lid hole.

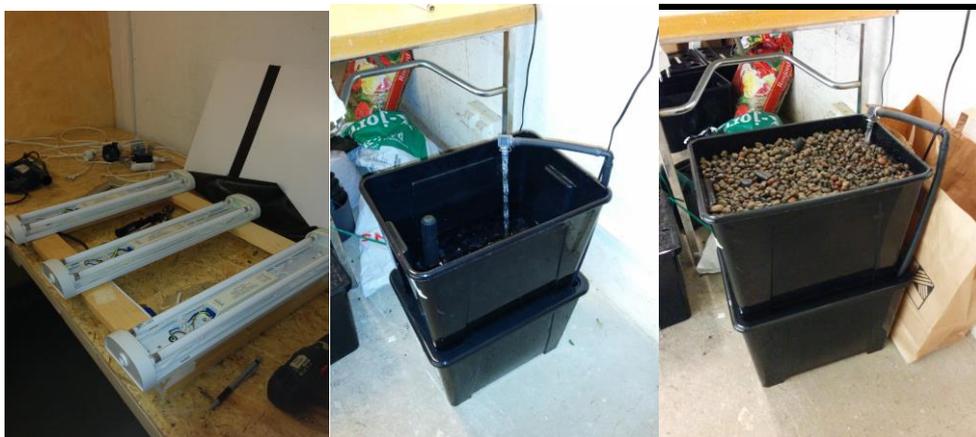


Figure 3: From left to right: Constructing the wood support for the light fixtures, testing the water flow in one of the experiment units, testing the water flow in the same unit with the grow media (leca/hydroton/hydrocorn).

3. Cycling of Anthroponic experiment units

The amount of aged urine calculated for aging was based on Sylvia Bernstein's *Aquaponic Gardening* guidelines as well as information available on the concentration and composition of urine ([Putnam, 1971](#)).

According to the information on the composition of urine, it is possible to estimate that the urea is in a concentration of 0,93% (per 1L of urine). Assuming that all the urea is converted to ammonia during the volatilization process, then the solution will have 0,93% of ammonia.

The recommended dosage per day (Bernstein, 2013) is of 24,65mL for every 378,54L of fish tank volume with 10% ammonia. As our units have a total volume of 22L, then the amount of ammonia needed would be:

$$\frac{22000 \text{ mL} \times 24,54 \text{ mL}}{378540 \text{ mL}} = 1,43 \text{ mL of } 10\% \text{ ammonia}$$

However, since the available solution has a perceived percentage of ammonia of 0,93%, then:

$$\frac{1,43 \text{ mL} \times 0,1}{0,0093} = 15,4 \text{ mL of } 0,93\% \text{ ammonia per day}$$

As we only went to the testing site bi-weekly, we calculated the dosage amount on ~100mL (15,4 mL x 7), but divided it by half as a precaution to not overrun the system. Thus, 50mL of aged urine was added to all systems.



Figure 4: 50mL of aged urine, added to all three systems.

After adding the aged urine, all systems were tested for Ammonia (NH₄), Nitrite (NO₂) and Nitrate (NO₃) as a way to monitor the cycling process and the build-up of the nitrifying bacteria community.

Table 3 – Cycling measurements of Ammonia, Nitrite and Nitrate

Date	System	NH ₄	NO ₂	NO ₃	Comments
06-05-2015	1	-	-	-	added 50mL urine
06-05-2015	2	-	-	-	added 50mL urine
06-05-2015	3	-	-	-	added 50mL urine
12-05-2015	1	<0,05	>1	-	Pump was dry, added 8L + 25mL urine
12-05-2015	2	<0,05	0,05-0,1	-	added 8L water + 25mL urine
12-05-2015	3	<0,05	0,05	-	added 8L water + 25mL urine
19-05-2015	1	<0,05	0,025	80-160	Added 2L water + seedlings
19-05-2015	2	<0,05	0,025	80	Added 2L water + seedlings
19-05-2015	3	<0,05	0,025	80	Added 2L water + seedlings

The cycling process took an unusually short time compared to reports of other aquaponic practitioners. This may have been since the media selected had been used for other hydroponic systems previously, and despite having been washed thoroughly some existing nitrifying bacteria may have survived and thrived in this new ammonia-rich environment.

After the first week of cycling, given that we recorded effective ammonia to nitrite conversion, we decided to lower the dosage by half (from 50mL to 25mL) to not overrun the system with eventual nitrates as there were still no plants inserted for uptaking them.

At the 2nd week, we recorded high nitrate values, indicating a successful cycling process and running system. The seedlings were then added, with each system having the same 4 different subtypes of lettuce: 1 green lattuga, 1 american brown lettuce, 1 battaria salad lettuce and 1 australian gule.



Figure 5: Image of the seedlings being started in hydroponic nutrient solution and rootit cubes (6th May 2015) and the same seedlings being added on the anthroponic experiment units (19th May 2015).

4. Preparation for the dosage experiment

While we are ageing the urine for the dosage experiment, we have been measuring Nitrate, EC and pH levels of all three experiment units in order to see how the systems are evolving and how long they are taking to consume the original aged urine added during the cycling.

Table 4 – Nitrate, EC and pH measurement in preparation for the dosage experiment

Date	System	NO ₃	EC	pH	Comments
02-06-2015	1	40-80	0,78	7,88	Added 4L water
02-06-2015	2	20-40	0,81	7,87	Added 4L water
02-06-2015	3	40	0,61	7,91	Added 4L water
10-06-2015	1	10-20	0,97	8,2	Added 8L water
10-06-2015	2	5-10	0,7	8,07	-
10-06-2015	3	5	0,56	8,14	-

It is visible that the system has been taking a while to absorb all the nitrates, which can indicate a young system but also might be a warning that the dosage values we have calculated and will perform might be too much. In the meantime, the plants have grown normally and in good color, though some plants appear pale and might be lacking some micronutrients.



Figure 6: Image of the evolution of the lettuce in the anthroponic experiment units using the aged urine from the cycling process. From left to right, the dates are: 20th May 2015, 2nd June 2015 and 10th June 2015.