

# Effects of Substituting Activated Carbon with Titanium Dioxide Coated Cenospheres in Conventional Aquarium Filters

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## Step-by-Step Procedure for Ammonia Assay

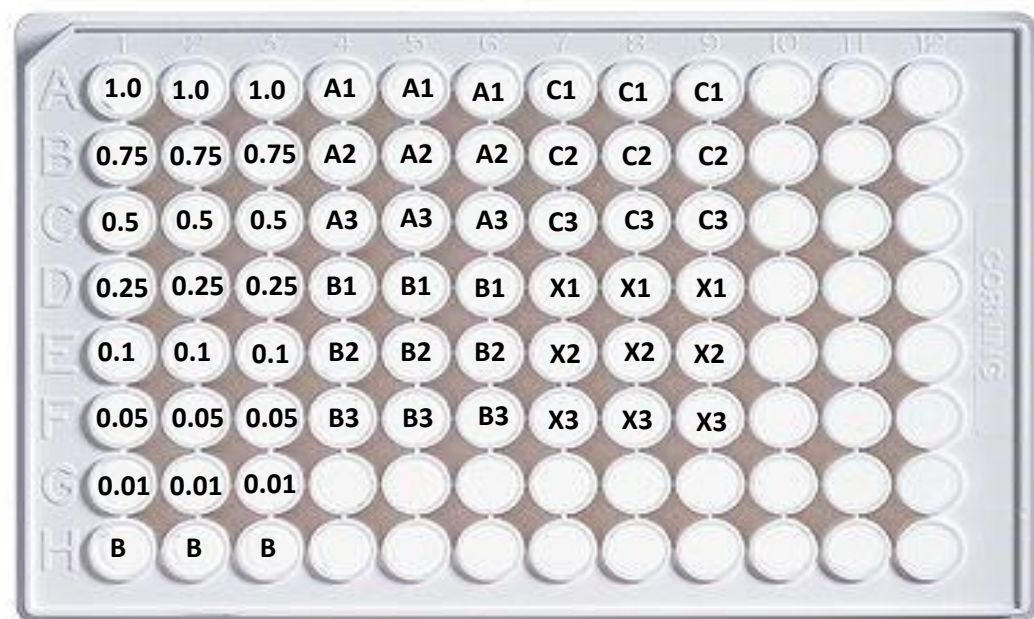
1. Prepared a range of ammonium chloride standards in 20mL scintillation vials, used serial dilutions:

| Standard | Concentration (ppm) | Volume of higher concentration (mL) | Volume of water (mL) |
|----------|---------------------|-------------------------------------|----------------------|
| 1        | 1.0                 | 4 (of 5ppm)                         | 16                   |
| 2        | 0.75                | 11.5                                | 3.75                 |
| 3        | 0.5                 | 6.667                               | 3.333                |
| 4        | 0.25                | 5                                   | 5                    |
| 5        | 0.1                 | 4                                   | 6                    |
| 6        | 0.05                | 5                                   | 5                    |
| 7        | 0.01                | 2                                   | 8                    |

2. Pipetted out 5mL of all standards in new, labelled 20mL scintillation vials
3. Pipetted out 5mL of milliQ water in 20mL scintillation vial, labelled blank
4. Pipetted out 5mL of all water samples collected from tanks in labelled 20mL scintillation vials

*To 5mL of samples, standards and blank added the following*

5. 200uL of Reagent E (Phenol reagent)
6. 200uL of Reagent D (Nitroprusside reagent)
7. 500uL of Reagent C (Oxidizing reagent)
8. Mixed all the vials and covered with aluminum foil and left for an hour.
9. Standards and reagents were plated in 96-well clear bottom plates as following:



The plate was read at the wavelength 640nm, using absorbance endpoint

Sample of the fish images are shown in Figure S1. Sample of experimental setup of the cenospheres is shown in Figure S2.



Figure S1. Images of the fish in their tanks.

## Experiment

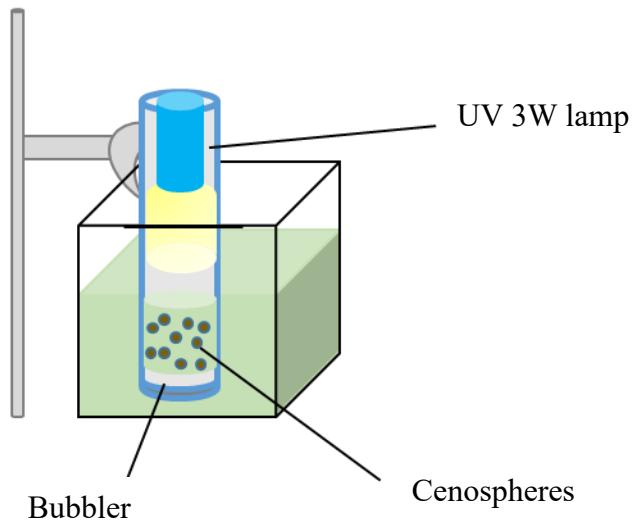


Figure S2. Experimental setup showing how the cenospheres were contained in the tank.

The experimental setup of the tanks and exposure of the fish is demonstrated in Figure S3.

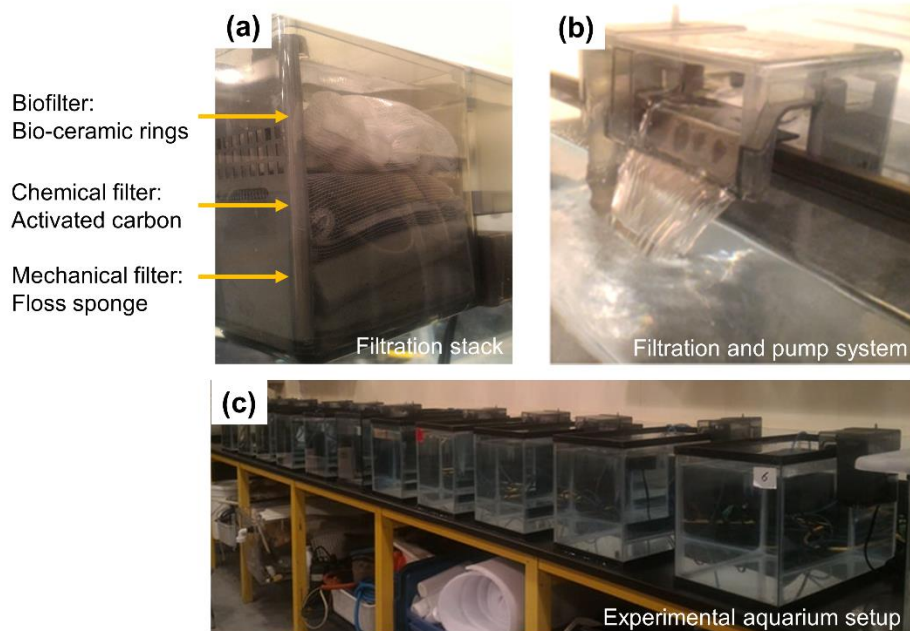


Figure S3 a) the setup of the filter is broken down into its three components. The bio filter and bio rings are placed at the top, superimposed on the chemical filter with activated carbon. The mechanical filter resides on the bottom, b) view of the functioning filter in the fish tank filtering the water. c) Side view of the 9-tanks setup for experimentation. The order of the tanks is as represented in the main manuscript in Figure 1.

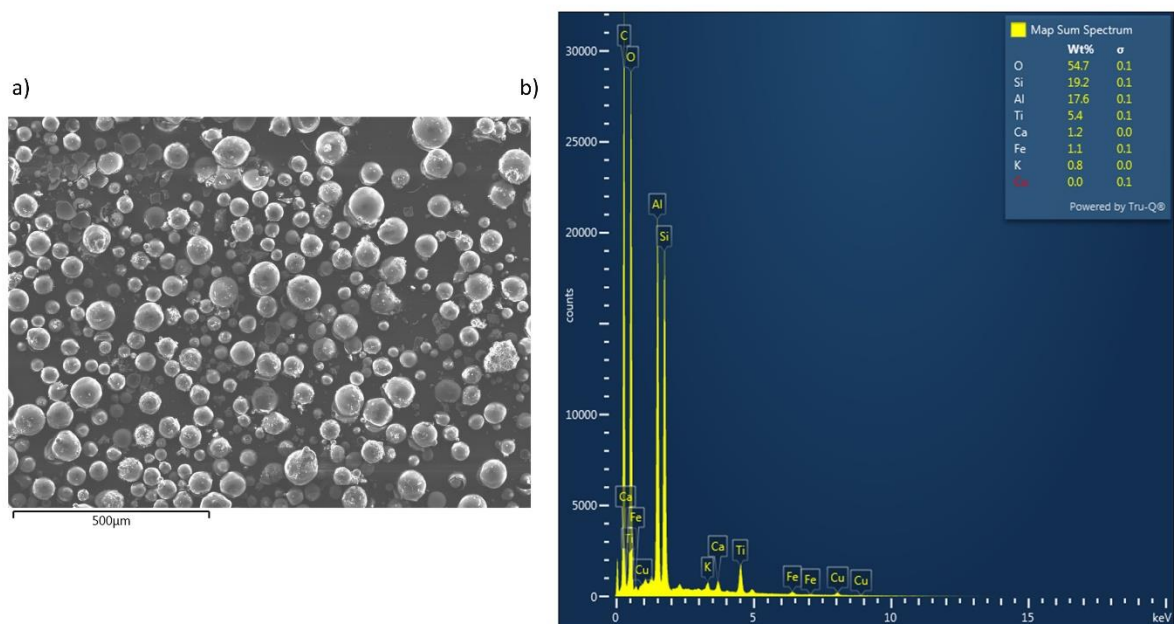


Figure S4. a) Coated  $\text{TiO}_2$  Cenospheres SEM at 500  $\mu\text{m}$  with corresponding b) EDS.

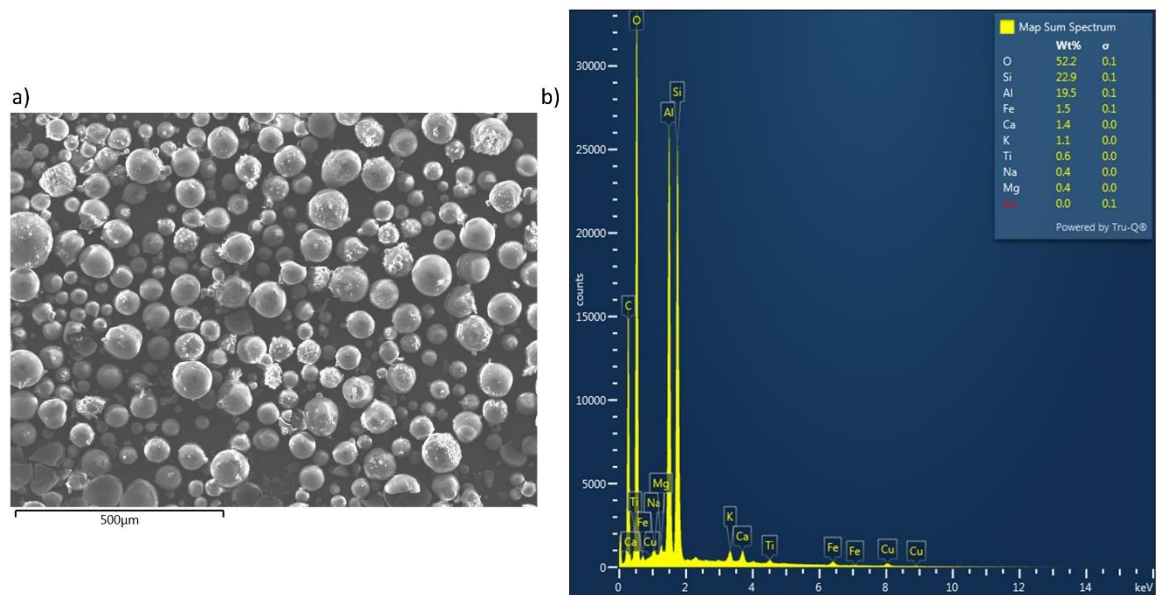


Figure S5. a) Uncoated  $\text{TiO}_2$  Cenospheres SEM at 500  $\mu\text{m}$  with corresponding b) EDS.