



Efficacy of Growstone[®] as a Filter Medium in Aquaculture Applications

Tekie Anday & Kaolin Young
SWES Department
University of Arizona

Introduction

- Re-circulating aquaculture systems require physical & biological filtration.
- Filter media helps to remove solids, dissolved organic matter & ammonia.
- Growstone is proposed as a new filter medium due to its non-toxic nature, large surface area to volume ratio & made of recycled glass.

Introduction...

- Experiment results, from trials on the performance of Growstone against the commercially recognized bio-filter media, can help to examine the practical advantages of using it in aquaculture business.
- Water quality parameters : ammonia ($\text{NH}_3\text{-N}$), nitrate ($\text{NO}_3\text{-N}$), total suspended solid (TSS), dissolved oxygen (DO), PH and temperature are the most crucial factors that affect fish growth in a closed system aquaculture.

Objectives

- To determine & compare the efficacy of Growstone as a filter medium by testing the material in replicated trials against two other commonly used filter media as control over 8 weeks.
- Trial-1 tested Growstone against plastic Bio-balls, and trial-2 tested Growstone against plastic Bio-beads.



Materials and Methods

- The experimental setup for Trial-1 consisted of nine systems of three replicates of the three treatments: 100% Growstone, 100% Bio-balls & 50-50% Mix.
- The experimental set up for Trial-2 was the same as the first trial except the Bio-beads were replaced for Bio-balls.
- Each system consisted of one cubic meter production tank stocked with five Kilograms of tilapia, and two 190 liter drums.

Materials & Methods...

- One drum was used to house the cylinder of filter media and the other for the pump that drives water circulation. Total of nine pumps were applied.
- Each system used 32 liters of filter media contained in bags of plastic mesh.
- Water samples were taken every week from production tanks, and analyzed in a lab.



Results and Conclusion

Trial-1

Table-1. Mean & standard deviation per treatment for NO₃-N, NH₃-N, TSS and growth rate of fish.

	Growstone		Bio-balls		Mix	
Parameter	Ave	STD	Ave	STD	Ave	STD
NO ₃ -N (mg/L)	7.675	4.766	10.117	5.931	7.821	6.253
NH ₃ -N (mg/L)	2.833	3.852	2.667	2.761	2.917	2.339
TSS(mg/L)	9.667	18.544	15.683	15.971	6.417	4.452
Growth (Kg)	2.143	0.113	1.992	0.511	1.652	0.693

Trial-1...

Table-2. P-values Generated Using ANOVA

Parameter	Growstone Vs Bio-balls	Bio-balls Vs Mix	Growstone Vs Mix
NO ₃ -N (mg/L)	0.0175	0.1264	0.9091
NH ₃ -N (mg/L)	0.8467	0.6791	0.9219
TSS(mg/L)	0.2406	0.0185	0.3925
Growth (Kg)	0.6349	0.3555	0.3679

Trial-1...

- In Trial-1 there were two statistically significant differences between treatments.
- The mean nitrate level for bio-balls Vs that of Growstone, and the mean TSS level for bio-balls Vs that of the mix, were significantly different.
- Among the rest of the comparisons there were no statistically significant differences.

Fig.1. Nitrate nitrogen (NO₃-N) levels

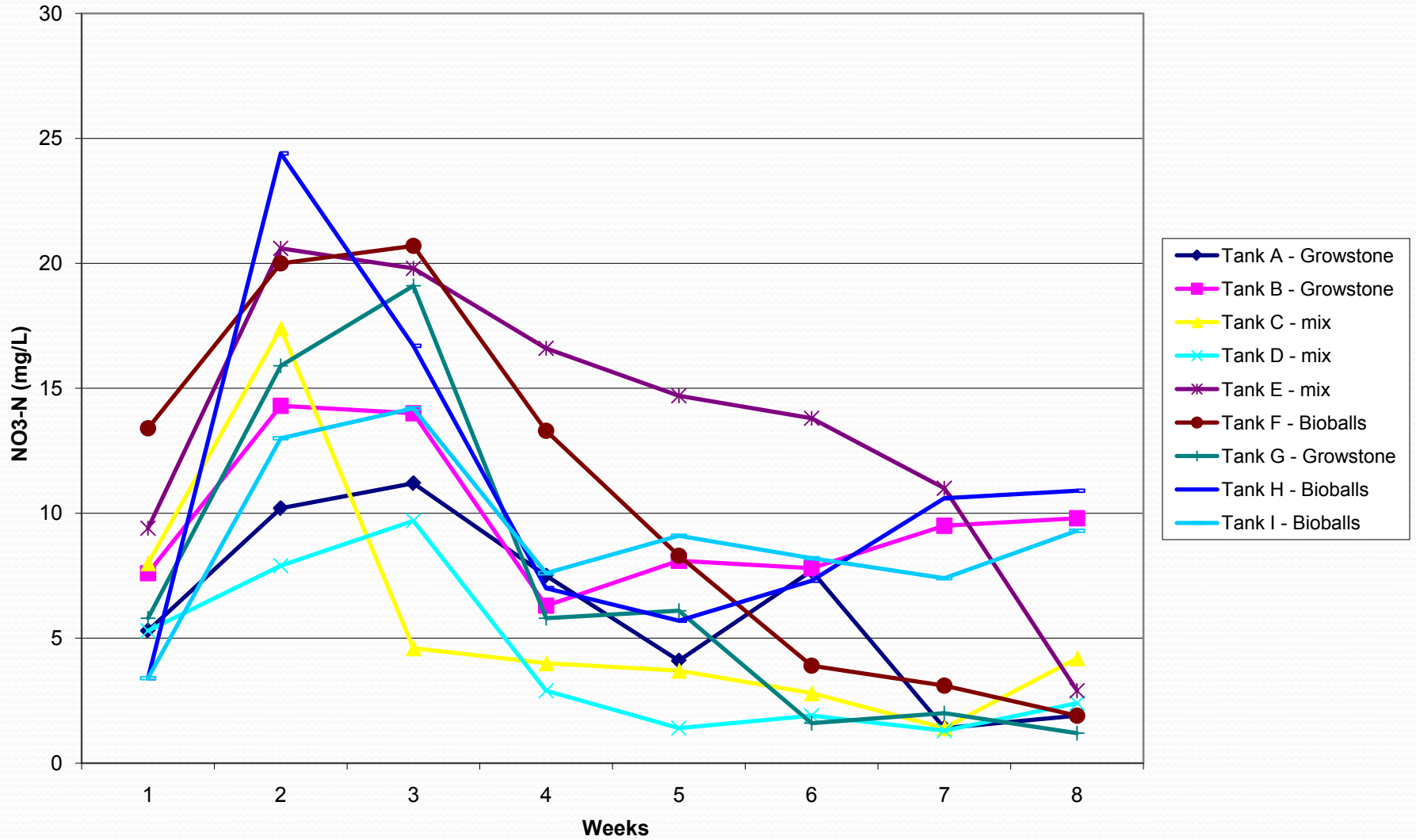


Fig.2. Total ammonia nitrogen (NH3-N) levels

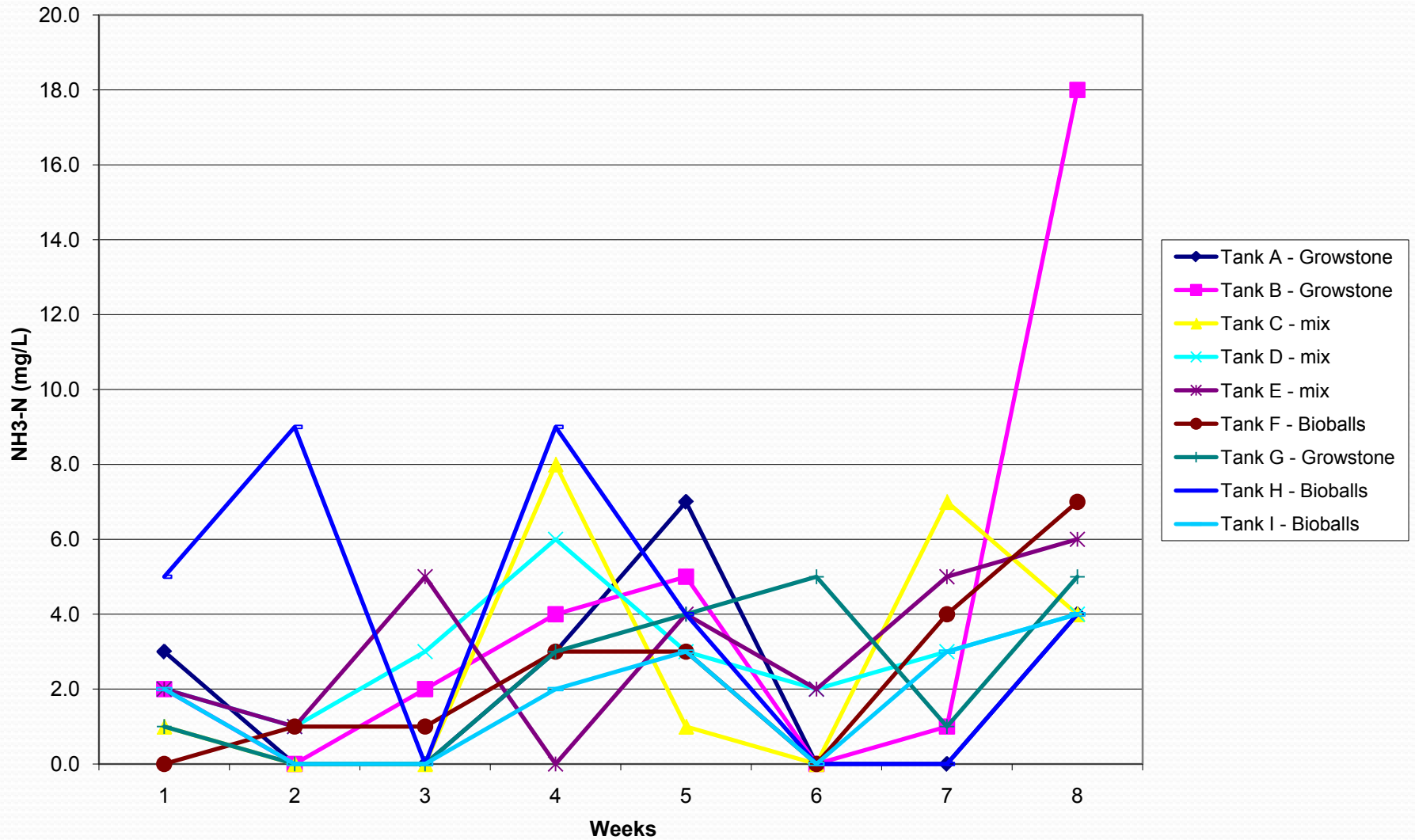
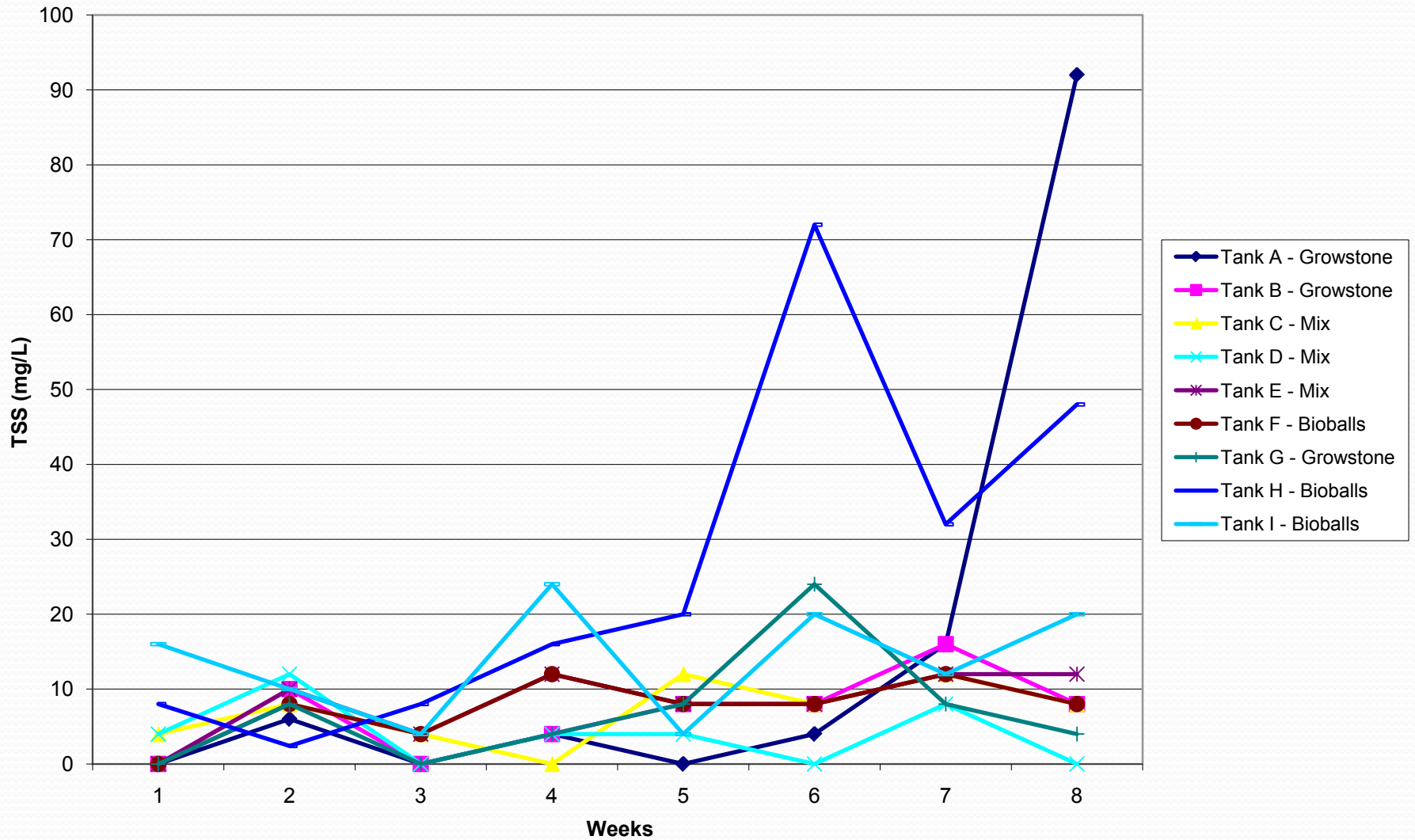


Fig.3. Total Suspended Solids (TSS, mg/L)



Trial-2

Table-3. Mean & standard deviation per treatment for NO₃-N, NH₃-N, TSS and growth rate of fish.

Parameter	Growstone		Bio-beads		Mix	
	Ave	STD	Ave	STD	Ave	STD
NO ₃ -N (mg/L)	7.163	4.35	8.33	5.102	7.838	4.262
NH ₃ -N (mg/L)	3.000	2.13	4.08	5.332	4.000	3.190
TSS (mg/L)	4.967	4.67	57.52	191.498	9.967	15.552
Growth (Kg)	5.000	1.32	4.47	0.764	4.31	0.866

Trial-2...

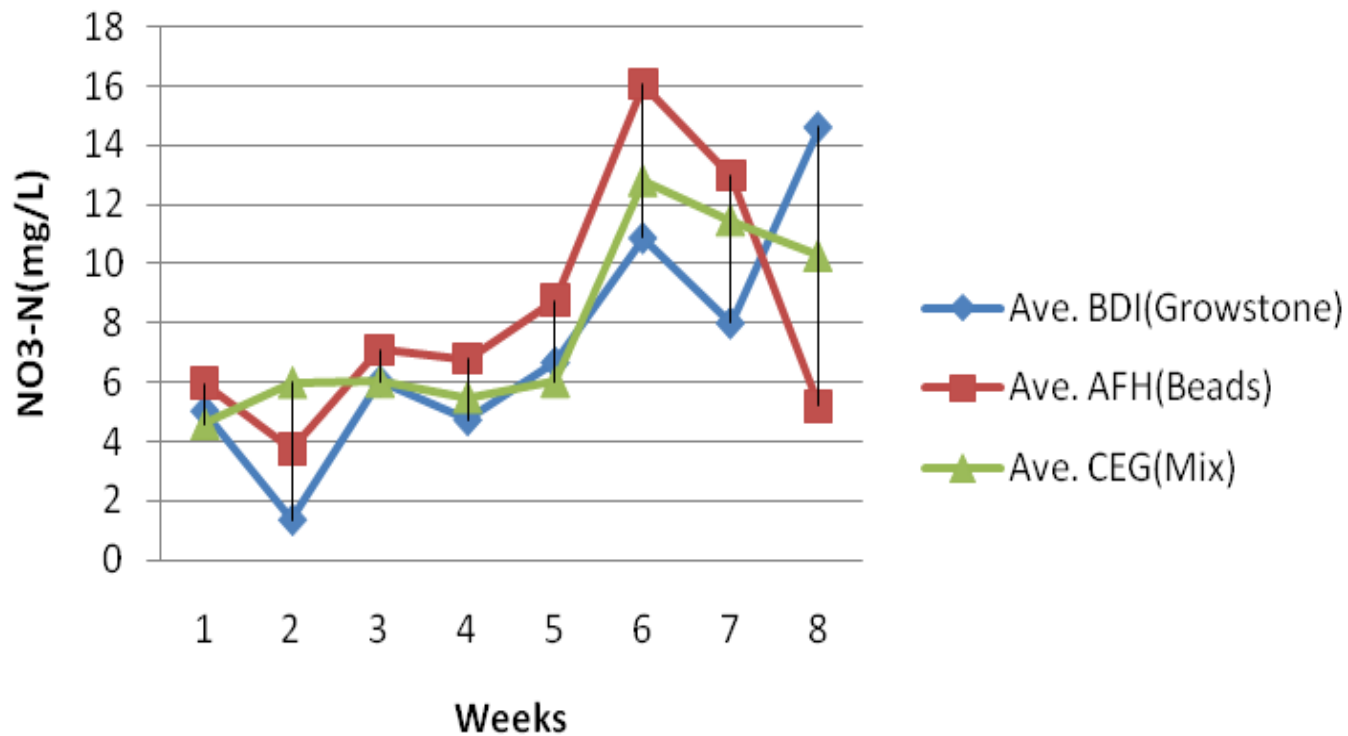
Table-4. P-values Generated Using ANOVA

Parameter	Growstone Vs Biobeads	Bio-beads Vs Mix	Growstone Vs Mix
NO ₃ -N (mg/L)	0.399	0.719	0.590
NH ₃ -N (mg/L)	0.360	0.948	0.208
TSS(mg/L)	0.186	0.232	0.138
Growth (Kg)	0.256	0.643	0.176

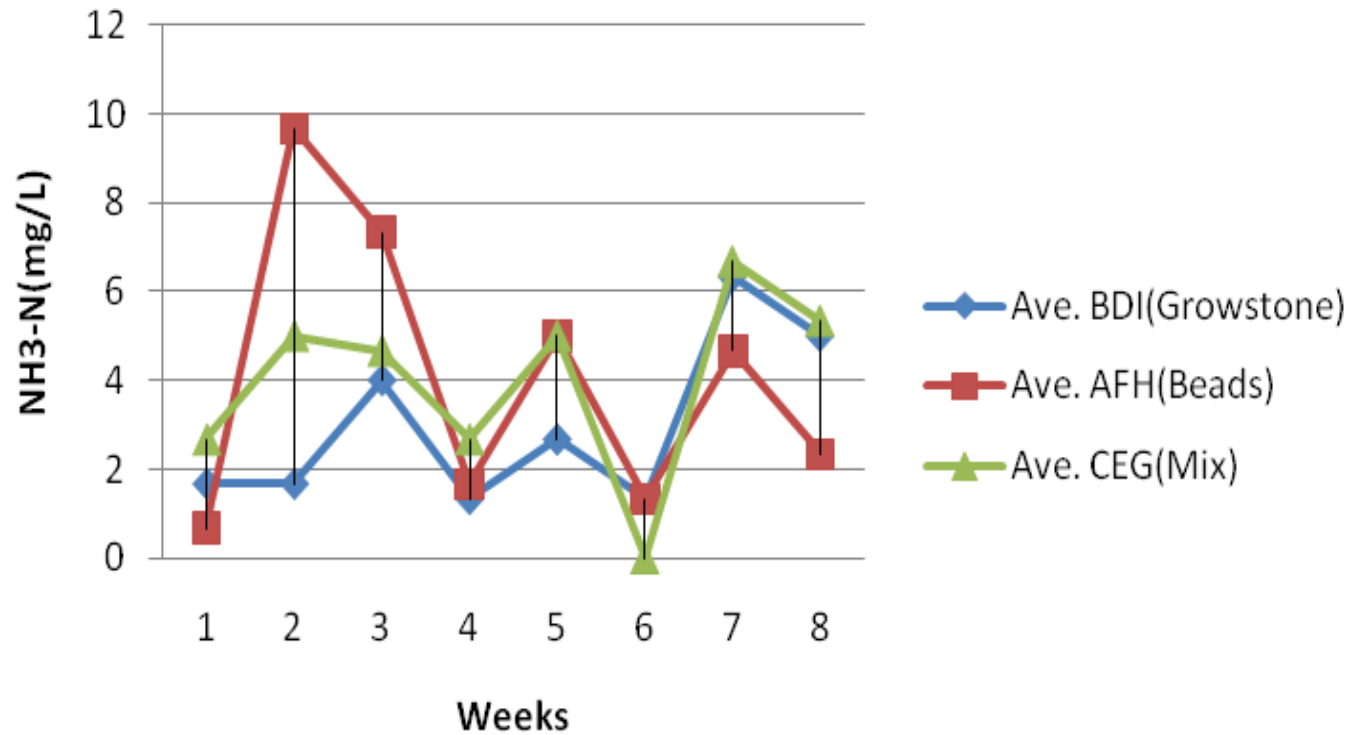
Trial-2...

- In trial-2 there were no statistically significant differences among treatments.
- On average NO₃, NH₄ and TSS levels for the tanks that were treated with Bio-beads filters have shown higher than those treated with Growstone and the Mix, but all differences for all parameters were statistically insignificant.

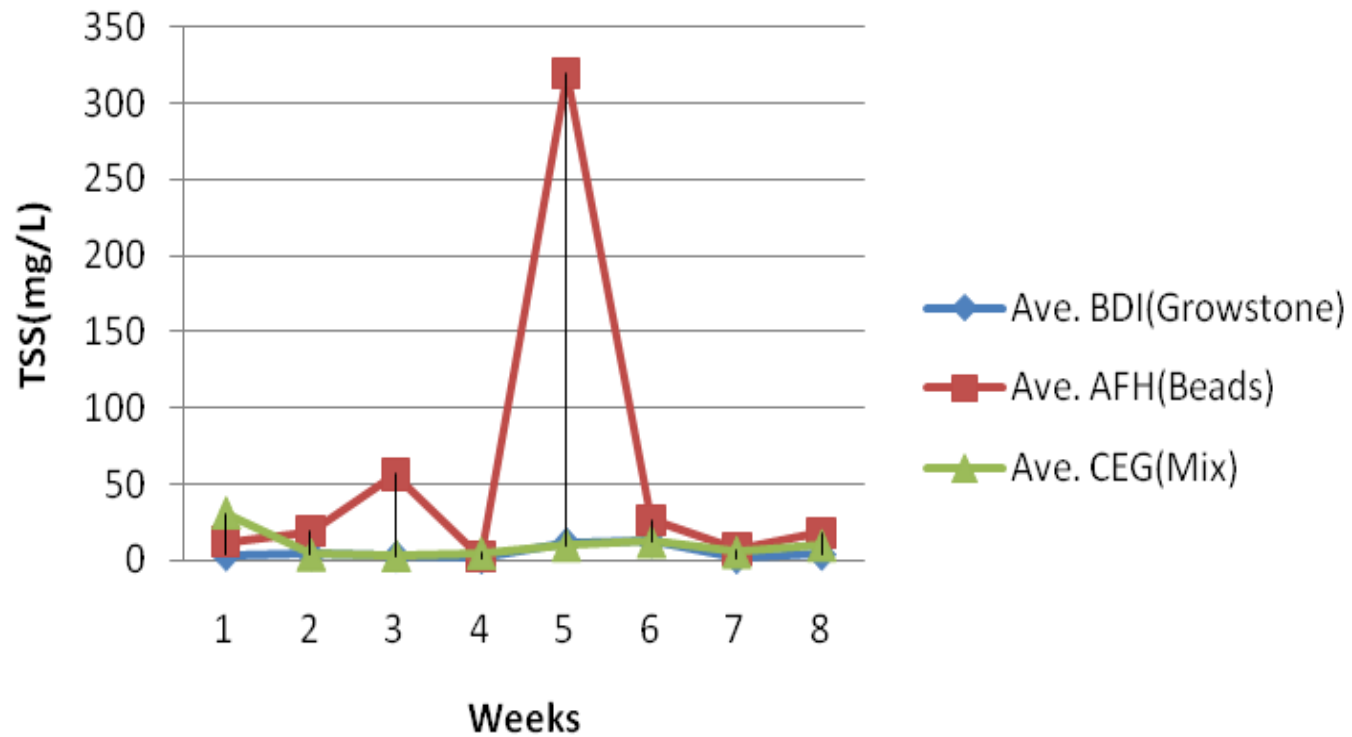
Nitrate levels of treatments



Ammonia levels of treatments



Levels of TSS for treatments



Conclusion

- From the results of this experiments, it can be concluded that Growstone can be used as equally reliable bio-filter as Bio-balls & Bio-beads.
- Based on the performance of Growstone as a bio-filter media, it is highly recommended for wide use of the product in aquaculture activities.
- Considering the fact that it is made from recycled glass and due to its large surface area to volume ratio, Growstone is relatively a better option compared to other bio-filers.

THANK YOU