Efficacy of Growstone® as a Filter Medium in Aquaculture Applications

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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 (NH3-N), nitrate (NO3-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**
NO3-N (mg/L)	**7.675**	**4.766**	**10.117**	**5.931**	**7.821**	**6.253**
NH3-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

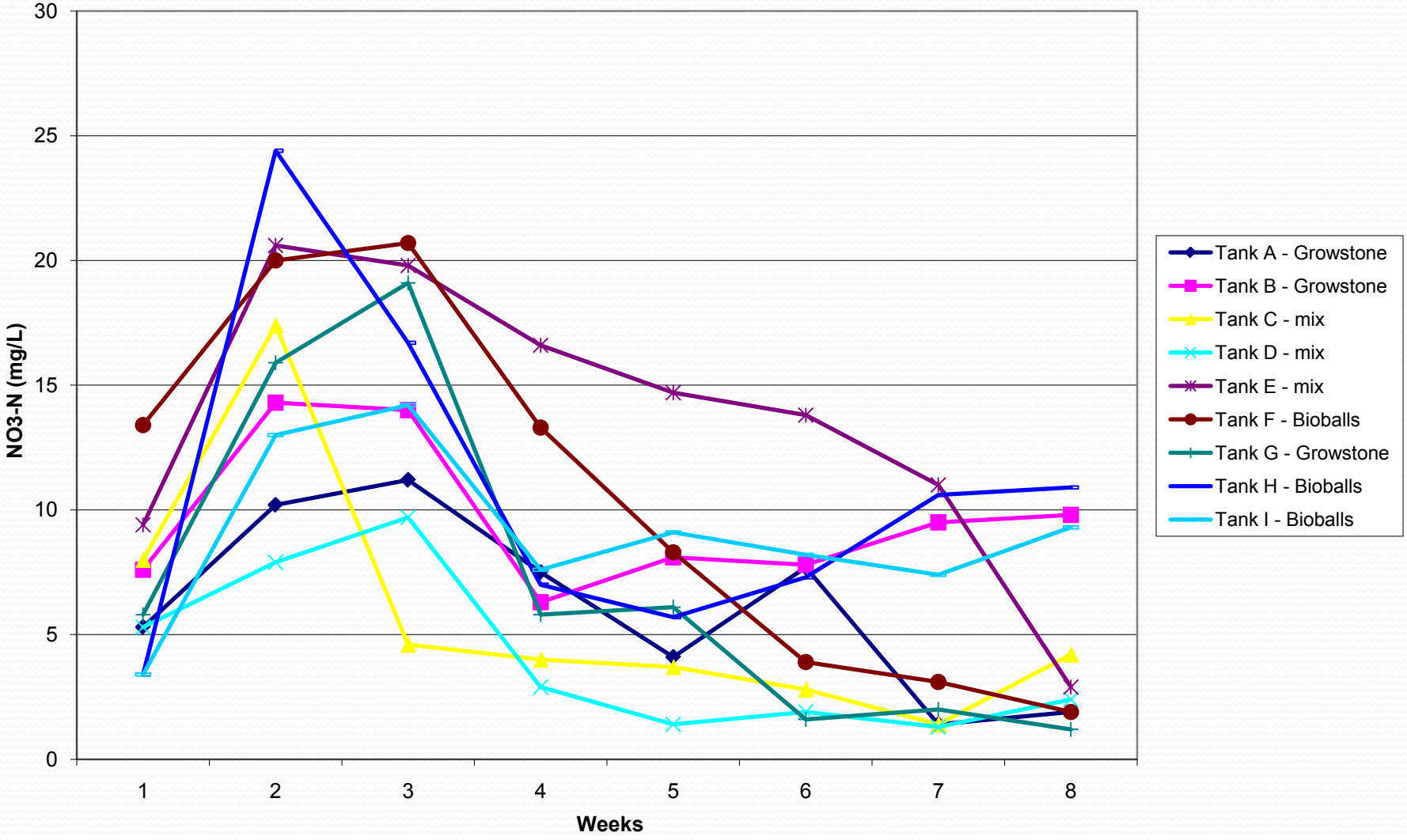


Fig.2. Total ammonia nitrogen (NH3-N) levels

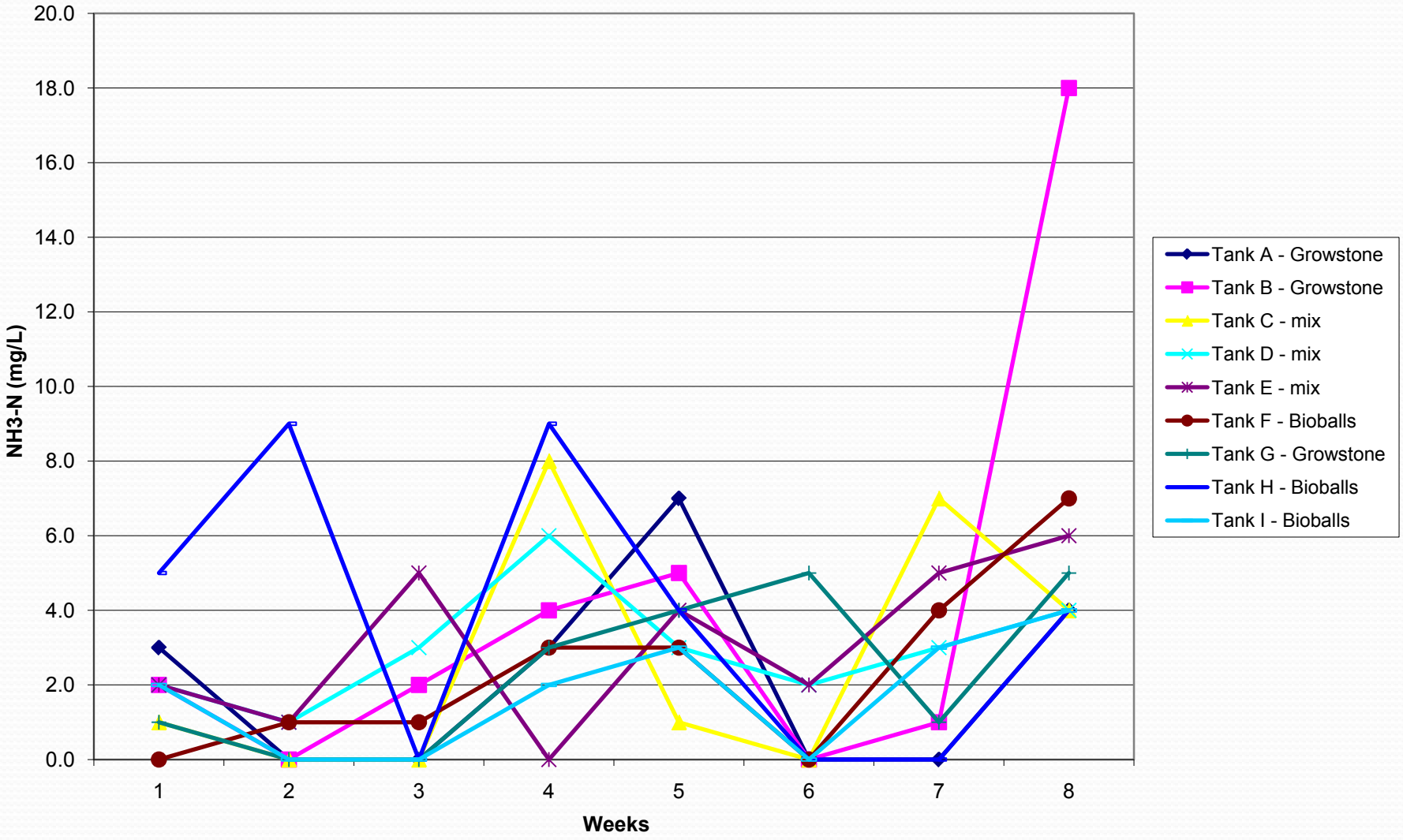
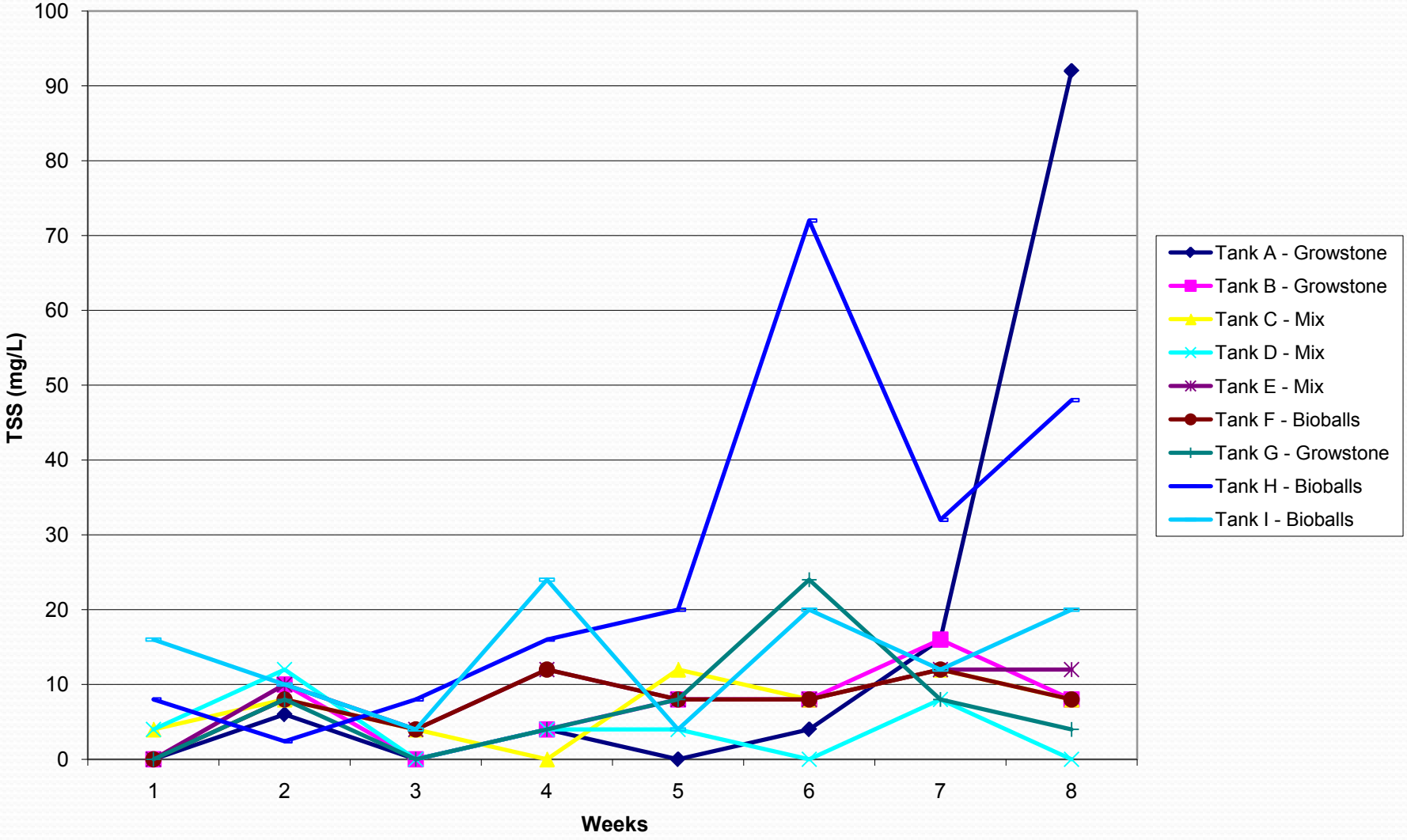


Fig.3. Total Suspended Solids (TSS, mg/L)



Trial-2

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

	Growstone		Bio-beads		Mix	
Parameter	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

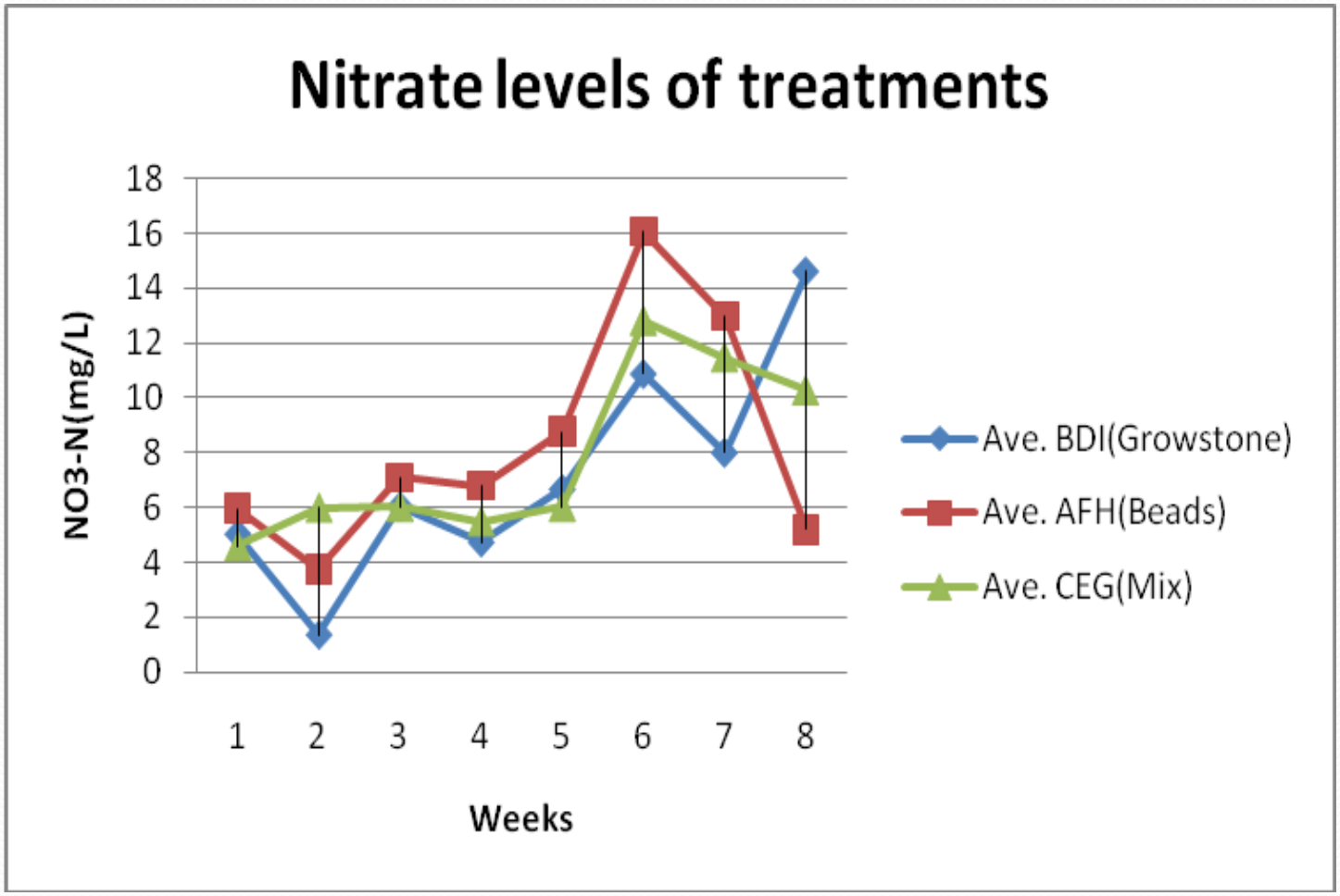
Trial-2…

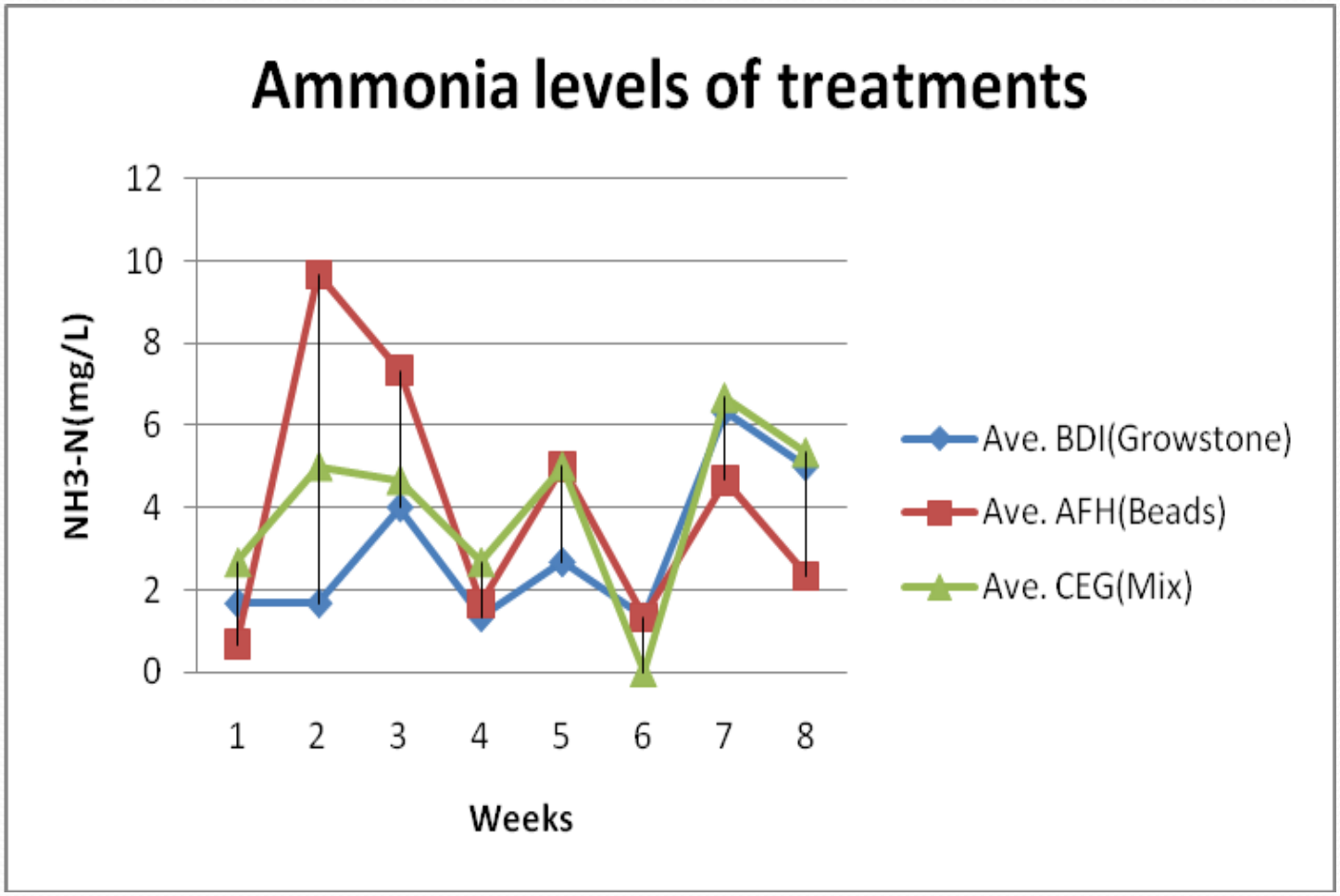
Table-4. P-values Generated Using ANOVA

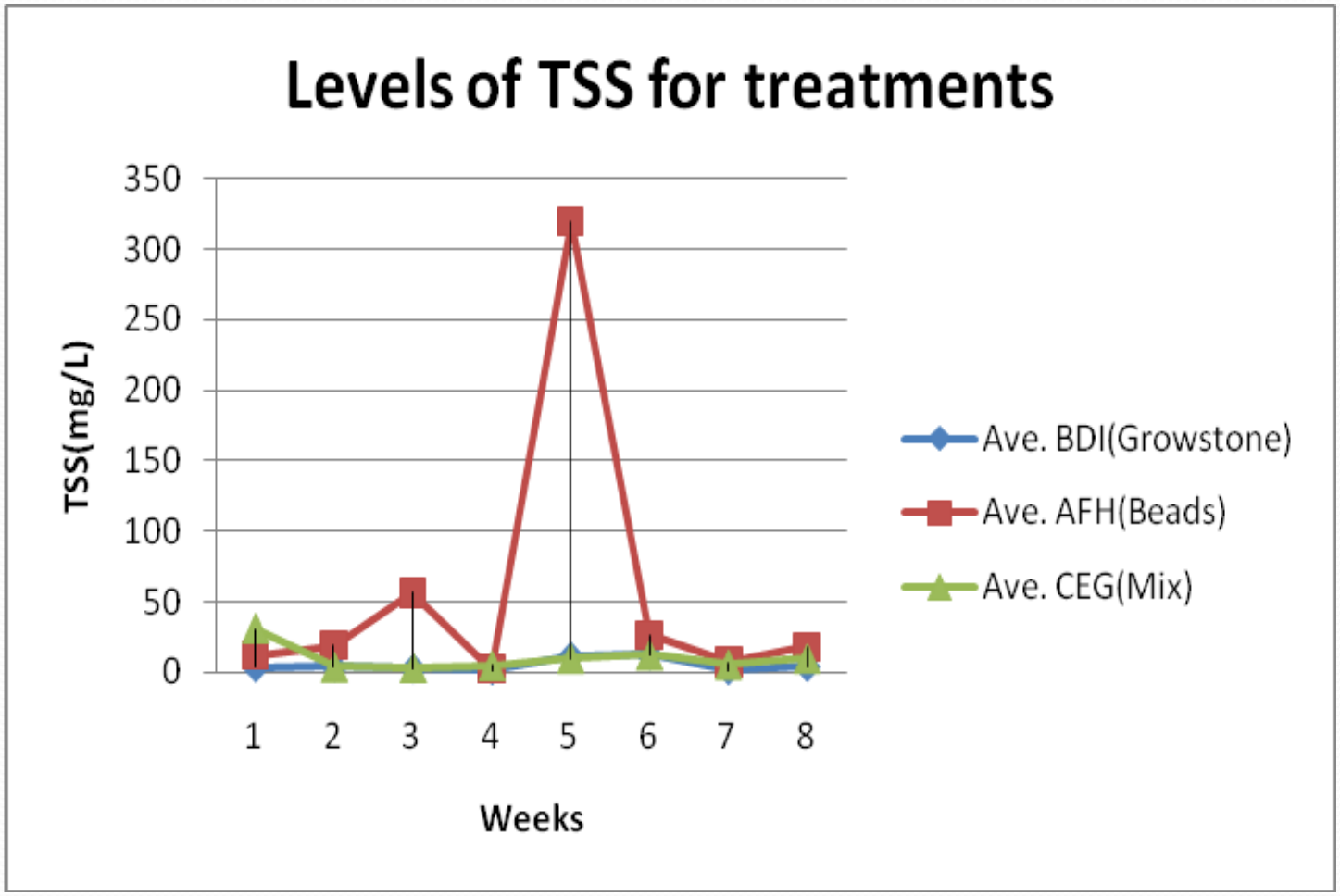
Parameter	Growstone Vs Biobeads	Bio-beads Vs Mix	Growstone Vs Mix
NO_3-N (mg/L)	0.399	0.719	0.590
NH_3-N (mg/L)	0.360	0.948	0.208
TSS(mg/L)	0.186	0.232	0.138
Growth (Kg)	0.256	0.643	0.176

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
NO3-N(mg/L)
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
Weeks
Ave. BDI(Growstone)
Ave. AFH(Beads)
Ave. CEG(Mix)


Ammonia levels of treatments
NH3-N(mg/L)
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
Weeks
Ave. BDI(Growstone)
Ave. AFH(Beads)
Ave. CEG(Mix)


Levels of TSS for treatments
TSS(mg/L)
350
300
250
200
150
100
50
0
1
2
3
4
5
6
7
8
Weeks
Ave. BDI(Growstone)
Ave. AFH(Beads)
Ave. CEG(Mix)

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