Increased salinity in fresh water and its influence on the floatation of suspended objects.

[1]Asuka Imai, [2]Yohei Takahashi., [3]Cosmas Ugwu

Key words: **salinity, salt water, HI96821, Refractometer, Floatation, aquaculture, hydroponics**

Introduction:

The major difference between sea and fresh water is based on their ionic strength. Sea water has a higher ionic strength compared to fresh water which makes floatation easier in them. But what is the reason behind this?

Many researches have been done to investigate the impact of high ionic strength on floatation of living organisms / organic matter. Salinity plays a major role in the buoyancy and the overall condition living organisms' water, so it is very important to determine the salinity of both natural and artificial water. Maintaining a proper salinity level in the biosystems (for example reef tanks) allows the organisms more time to grow properly without having to adjust to the regularly changing salinity levels.

In this study, we investigated the effect of increasing the salinity of a system by looking at the changes in floatation /or buoyancy of selected food product when salt concentration was increased. Although there are other contributing factors that influences buoyancy in salt water such as temperature, in this study we focused on investigating the amount salt needed to induce floatation of objects in water.

Materials and method

2-liter tap water was added to a 4-liter capacity plastic container and four different items of varying weight and densities were suspended in it as follows;

Potato – 195g, Carrot- 275g, Onion -105g, Tomato – 75g, Radish- 105g.

The floatation effect on the bowl when salts of different concentrations were added were then observed using a salinity meter. The initial salinity of the water was measured to ensure there wasn't a Preexisting salt content in the water.

The amount of salt added to the bowl (table salt, NaCl) were measured in g/L using an analytical balance.

Salt was then gradually added to the bowl, and the salinity of the resulting solution was measured in (ppt/g/L) using the Hanna salinity tester (**HI-98319).**

30g of solute (NaCl) was first added in the bowl and the resulting solution measured. Additional **20g, 10g, 15g, 5 g to a total of 370g**/L salt were added, and the floatation of the items were physically observed. The solution was properly stirred with a table spoon to ensure that the solutes were dissolved properly in the water.

Highly concentrated salt additions were also a diluted properly according to the measurement range of the salinity tester (~70 g/L).

Salt in grams (g)	Salt content in g/L solution
30	14.5
50	24
60	29
75	35.5
90	42.2
105	47.4
120	52.7
140	59.8
160	65.9
170	68.8
370	126.4

Results and discussion

The more salt that was added to the beaker, the higher the object rose which implies that higher salinity increases buoyancy of objects. Objects with lower density were observed to float faster compared to the higher density ones.

The major reason why object floats more in salt water than fresh water can be attributed to density. If an object is denser than water, it will sink when placed on water, but when less, it will float. Adding salt to the water significantly increased the water density, hence the suspended objects floated.

It is harder for objects to float in low density water and considerably easier in salty water.

Adding salt to fresh water increases the density by changing the mass (without changing the volume), hence improves buoyancy and floatation of objects.

As expected, the lighter and less dense object, tomato (75g) floated first, followed by radish, onion (105g). Radish floated before radish although they share the same weight in grams. This could be attributed to the difference in their densities. Potato (195g) was observed to float when the salinity of the solution was 68.8 PSU; g/L (approximately 170g solute).

The heaviest of the samples (carrot; 275g) with a considerably higher density was the last to float. Floatation was observed when 370g salt was added to the bowl (126.6 g/L, psu concentration).

POTENTIAL APPLICATIONS:

Pool /Spas: The salinity effect on floatation could be applied in spas and pools. Apart from the effect of salinity on skin, floatation effect can be controlled by monitoring the salt content.

Aquaculture: We can apply this idea in controlling the salinity of coral reef tanks to ensure that the fish grows properly in a suitable condition. Unstable salinity in reef tanks causes retarded growth and sometimes death of fish, therefore it is pertinent to monitor how much dissolved salt are in the system.

Hydroponics: Salinity stress limits the productivity of agricultural crops, with adverse effects on germination, plant strength, and crop production. Hydroponic plants such as tomato plants exposed to high concentrations of salt in their root zone cause the reduction of growth, fruit size and fruit yield. It is therefore important to apply the salinity effect on hydroponics culture.

*** Brief summary:

This research helps us to understand that different salt content can affect the environment that surrounds it such as fish, plants, reefs. This also can be applied in understanding water quality in Agriculture, and aquaculture, and even hydroponics. This knowledge is useful in exploring various areas where Hanna salinity meters can be used.