The East River –The Melting Pot of New York City

Nashley Brown, Chanelle Marshall, Danielle Soyoung Park, Mariam Traore
SCB 201 *instructed by Dr. A. Lucia Fuentes*
LaGuardia Community College

Abstract

Salinity is an important factor in water because of its role in determining types of organisms living in the water and density of the water which affects the amount of dissolved oxygen (DO) and carbon dioxide (CO2). DO and CO2 play key roles in an organism's metabolic processes, thus directly impacting the aquatic ecosystem. Oxygen is essential for many different aquatic organisms that require aerobic respiration. CO2 is required for photosynthesis; increases in this gas, on the other hand, cause a rise in the acidity of the water, disrupting the availability or CaCO3 necessary for the building of exoskeletons of many aquatic organisms. In this report, we present the results of several experiments showing the salinity, DO and CO2 level in a water sample from deep level of Long Island City side of the East River, NY (LICD), and discuss how these factors may be affecting aquatic organisms in this waterway.

Introduction

The East River is a tidal estuary connecting two oceans, New York Bay and Long Island Sound and carries brackish water; It has a higher concentration of salt than fresh water but not as high as sea waters do (Gilbert, n.d.) –average of 3,000-10,000 Mg/L (Godsey, n.d.). The amount of total dissolved salt in water (TDS), affects osmosis, a movement of water from higher to lower solute concentration, and cells lose or retain water depending on the TDS around them (Freeman, 2017). For that reason, it is essential for organisms in the brackish water to adapt quickly to salinity changes; salinity has key role in determining ecosystem in the water body) (NOAA, 2017). Salinity also affects the amounts of DO and CO_2 in the water (NOAA, 2017). Dissolved oxygen is vital to aerobic organisms living in the water (Addy, 1997). Even bacteria groups are affected by DO; studies showed higher oxygen levels are associated with higher rates of survival of aerobic bacteria (Drury, 1975). Typically, aquatic organisms need minimum of 4.0mg/l (Abowei, 2010). The majority of DO comes from the atmosphere, or as a by-product of photosynthesis (Abowei, 2010) A water body with high TDS levels, allow for less oxygen to dissolve in the water (Pawlowicz, 2013). CO_2 can also enter from atmosphere and be used up as source of photosynthesis by all photosynthesizing organisms or form carbonic acid resulting in acidity increase (EPA, 2016), the latter affecting many shellfish (CAS,2014). r. Different bacteria groups inhabit water bodies and can serve as indicators of water quality (Long, 2016). Although other factors such as temperature and pH level affect aquatic life in water body (Addy, 1997), our experiments were focused on salinity, DO and CO_2 level in the LICD water sample and their effects on cells.

Materials and Methods

1. TDS of LICD sample was measured directly by evaporating 10 ml of the water sample and weighing the solids. NaCl was also measured indirectly by creating a standard curve, measuring the percent change in mass of dialysis bags containing solutions with different salt concentrations, after dialyzing against distilled water for 45 min.
2. Onion cells in different salinity were observed under a microscope which showed the effects of salinity on cells.
3. To determine the CO2 level, de-gassed leaves were placed in various bicarbonate solutions for photosynthesis rate of leaves in different bicarbonate concentration. Each experiment was conducted with LICD water sample and was compared with other samples. The DO level was measured titration kit that uses the azide modification of the Wrinkler method. CO_2 level in LICD water sample was tested using a titration kit that measures bicarbonates, carbonates and hydroxide in water.

Results

Osmosis / Salinity

Total Dissolved Salt =29740mg/l

Table 1. TDS level

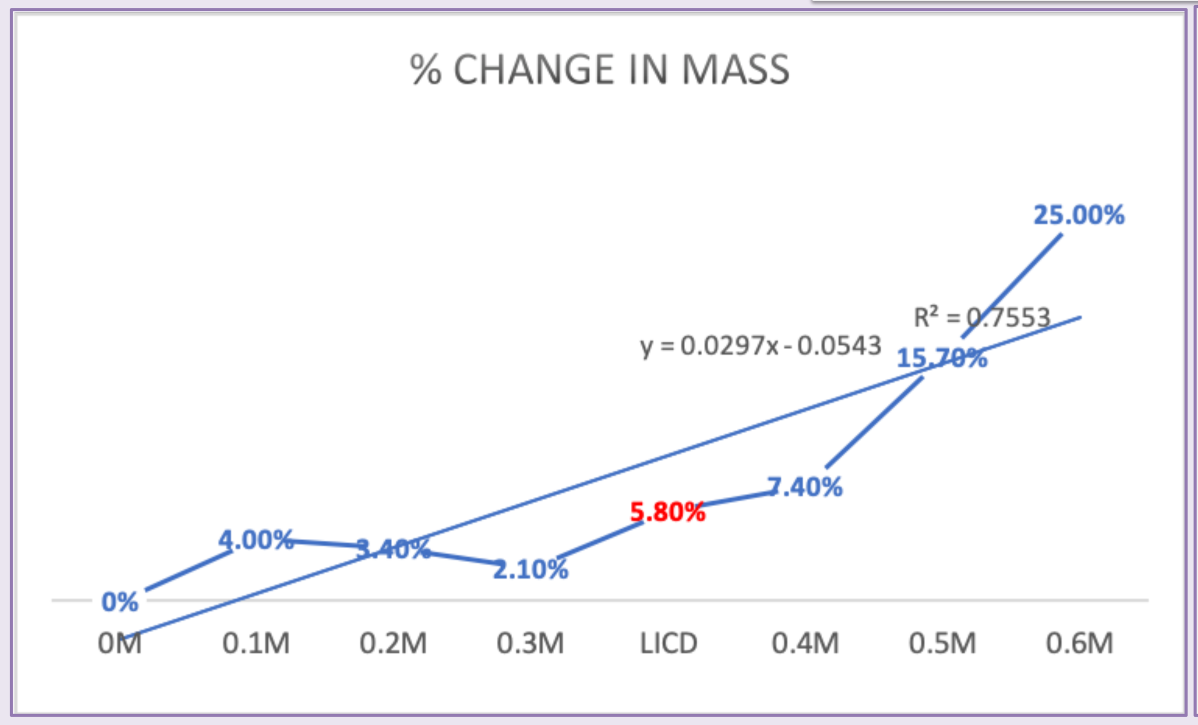

Fig 1. Mass change % in dialysis bag placed in distilled water after 45 min.

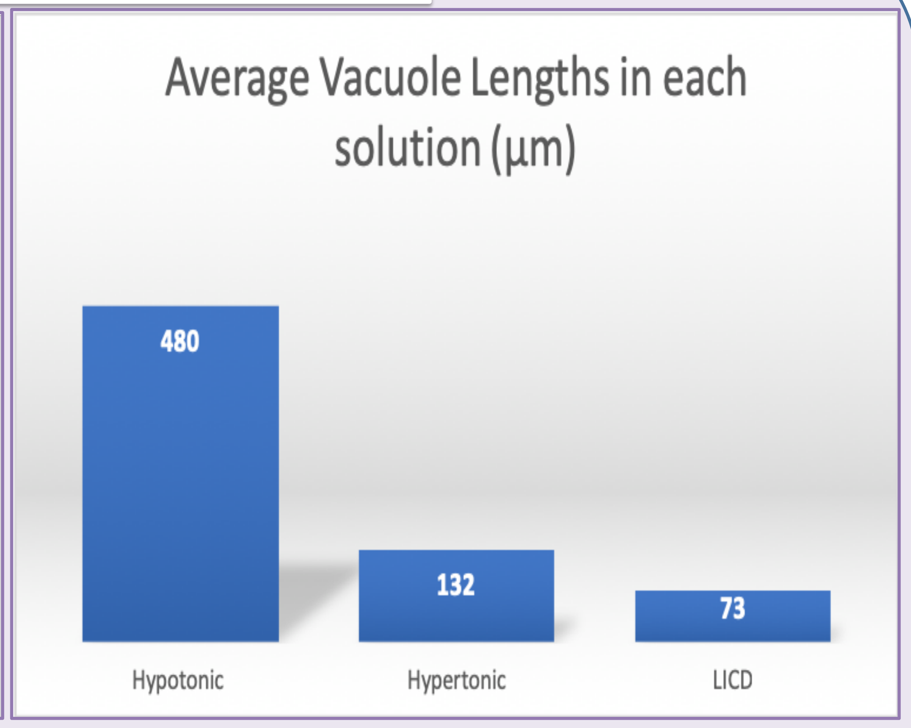

Fig 2. Average Vacuole Lengths of Onion Cells in Each Solutions

Enzyme Reactions

Solution	Time of Enzyme Reaction (Sec)
Catalase + LICD Water Sample	8.5
Catalase + Buffer	4.9

Table 2. Catalase Reaction Rate Comparison

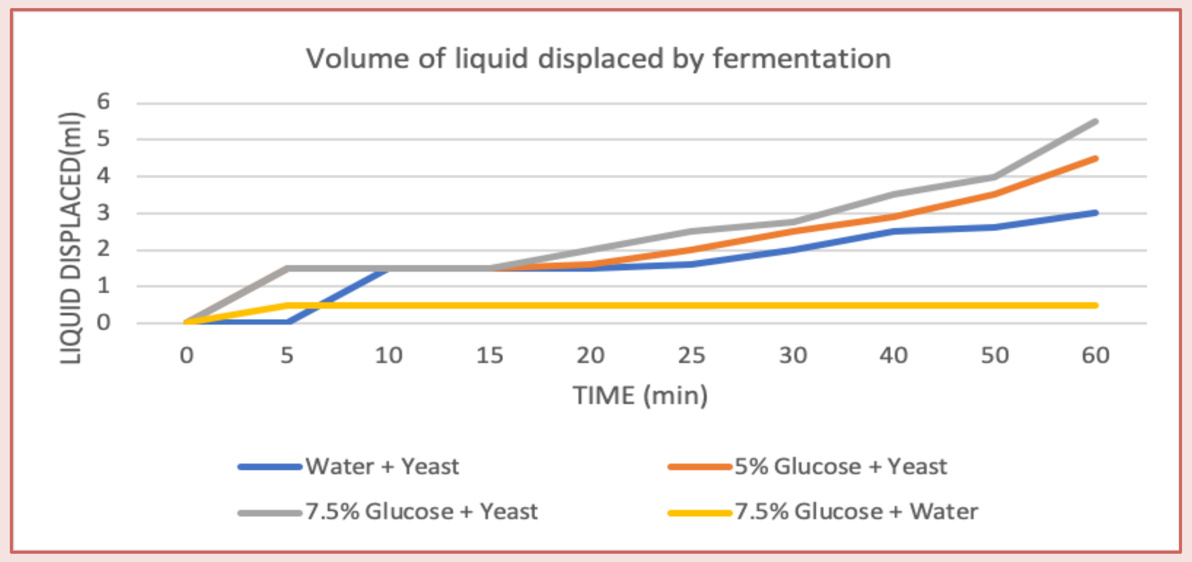

Fig 3. Fermentation Rate with Different Glucose Concentration

Bacteria Inoculated

Water Sample	Turbidity
LICD	Turbid ++
Distilled water	Not turbid

Table 3. Inoculated bacteria in water sample (Collected 10/15/18)and turbidity (Not turbid -, Less turbid +, Turbid ++, Very turbid +++)

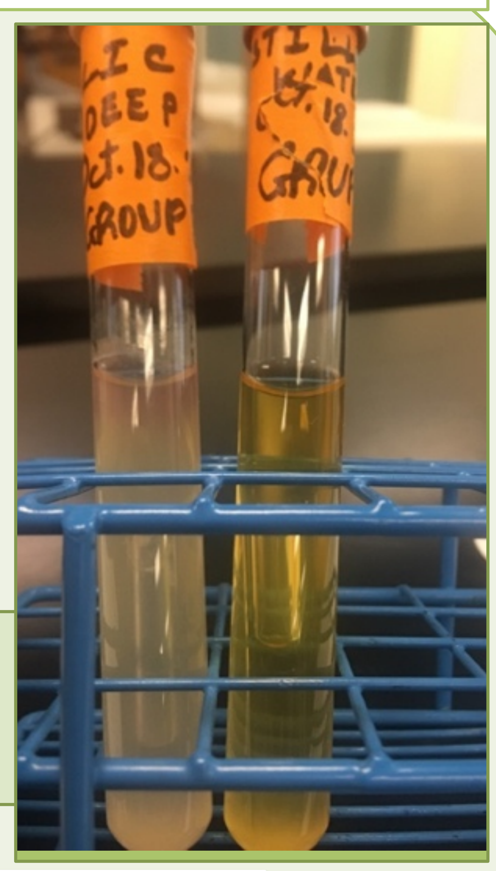

Fig 4. Coliform inoculated in LICD sample collected on 10/18/18 Yellow color and bubble indicate presence of Coliform.

Oxygen Titration Level: 4.8ppm

Table 4. Oxygen Titration Level

Carbon Dioxide Level

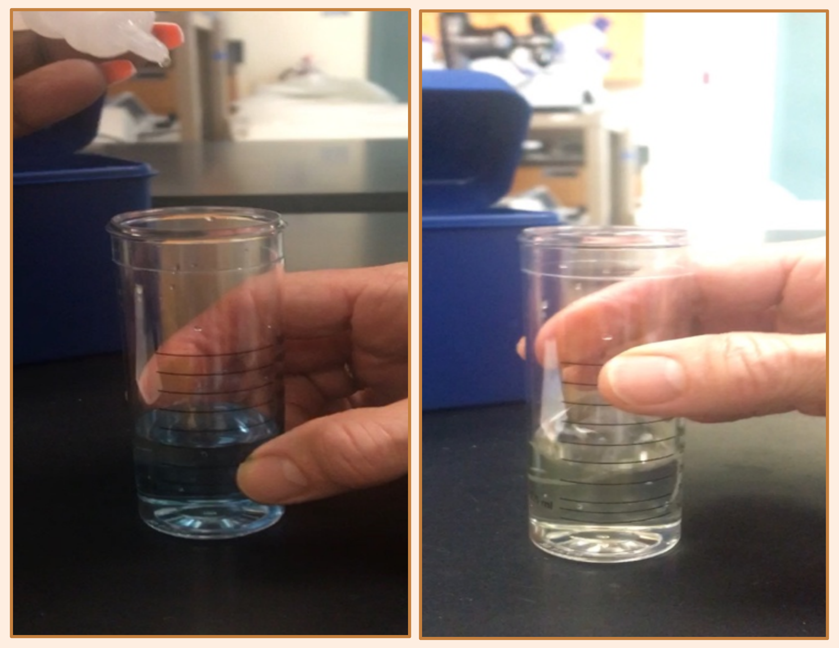

Fig 5. Titration for Alkalinity Result Showing Alkalinity of 670ppm.

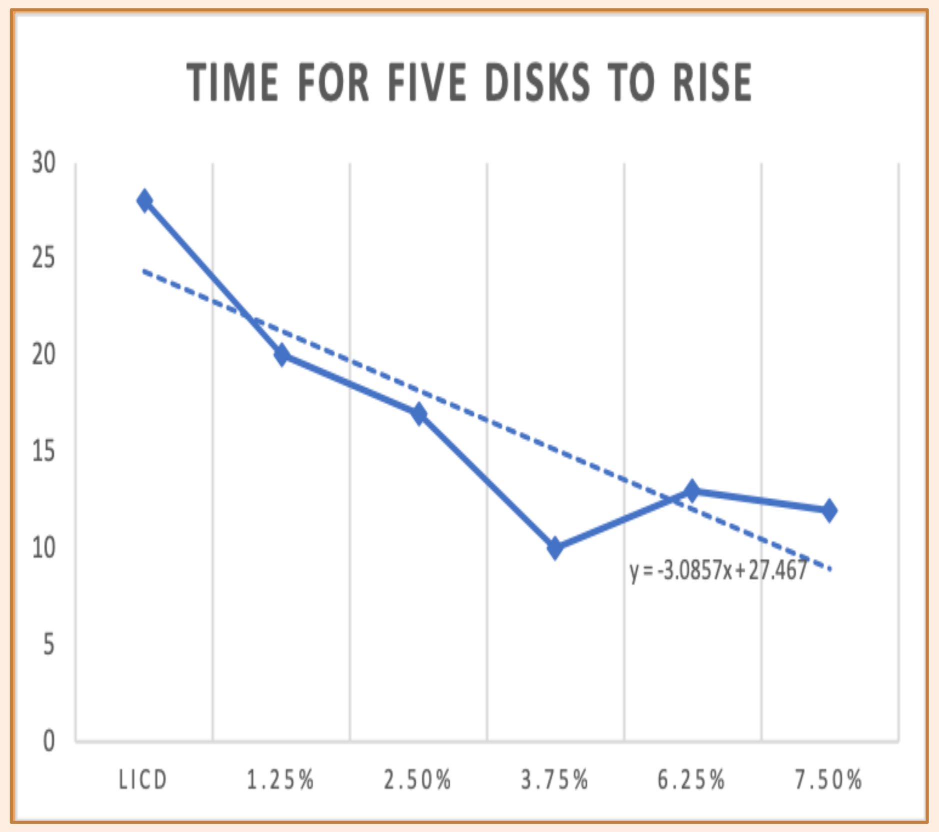

Fig 6. Photosynthesis rate suggests CO_2 level lower than 1.25%.

Results

- TDS=29740mg/l; the highest level of average salinity in brackish water (Table 1).
- Dialysis bag test and cell observation show high level of salinity (Fig 1-2).
- Table 3 and Fig 4 suggest bacterial growth.
- Oxygen level of 4.8ppm (Table 4).

Discussion and Conclusion

- ✓ High level of salinity (Table 1, Fig 1) suggests particular organisms that can live in the water because of effects of salinity on cells (Fig 2) –region with more fresh water may have slightly different ecosystem.
- ✓ Slow enzyme reaction in the LICD sample (Table 2) is expected due to high level of salinity.
- ✓ Wide range of bacteria group expected to be found as optimum O_2 level (Table 4) and low CO_2 level (Fig 6).
- ✓ Finding of Coliforms (Fig 4) suggests water contamination from sewage pollution.

Future work

- Extensive research on aquatic lives in the East River and relationship between salinity and each organisms.
- Research on aquatic lives in higher and lower salinity in the East River.
- Collection of more various samples for bacterial DNA sequencing.
- Experiment on enzyme activity rate in different salinity level.

References

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