EFFECTS OF C/N RATIO ON WATER QUALITY IN ZERO WATER EXCHANGE MICROCOSMS.

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Introduction

- **The experimental work upon which we base the computations presented here was obtained in Dr Pohan Thesis. We further utilized these data to draw more general conclusions/**

Experimental System

- **The experimental system of simulating bio-flocs technology was based upon culturing shrimp (Monodon) in 160 l tanks, at a density equivalent to 30 PL/m2. There was no water exchange during an experimental period of 8-12 weeks.**
- **Shrimp were fed according to conventional methods**

Carbon / Nitrogen Ratios

- **C/N ratios in the feed were obtained by adding molasses to 38% protein feed pellets.**

A. Effect of feed C/N ratio on TAN in the water

- Avnimelech (1999) predicted this effect using the following assumptions:
- 1. 50% of N in feed is excreted to the water. (This is probably a low estimate. An average value computed from 12 published studies is 70% excretion)
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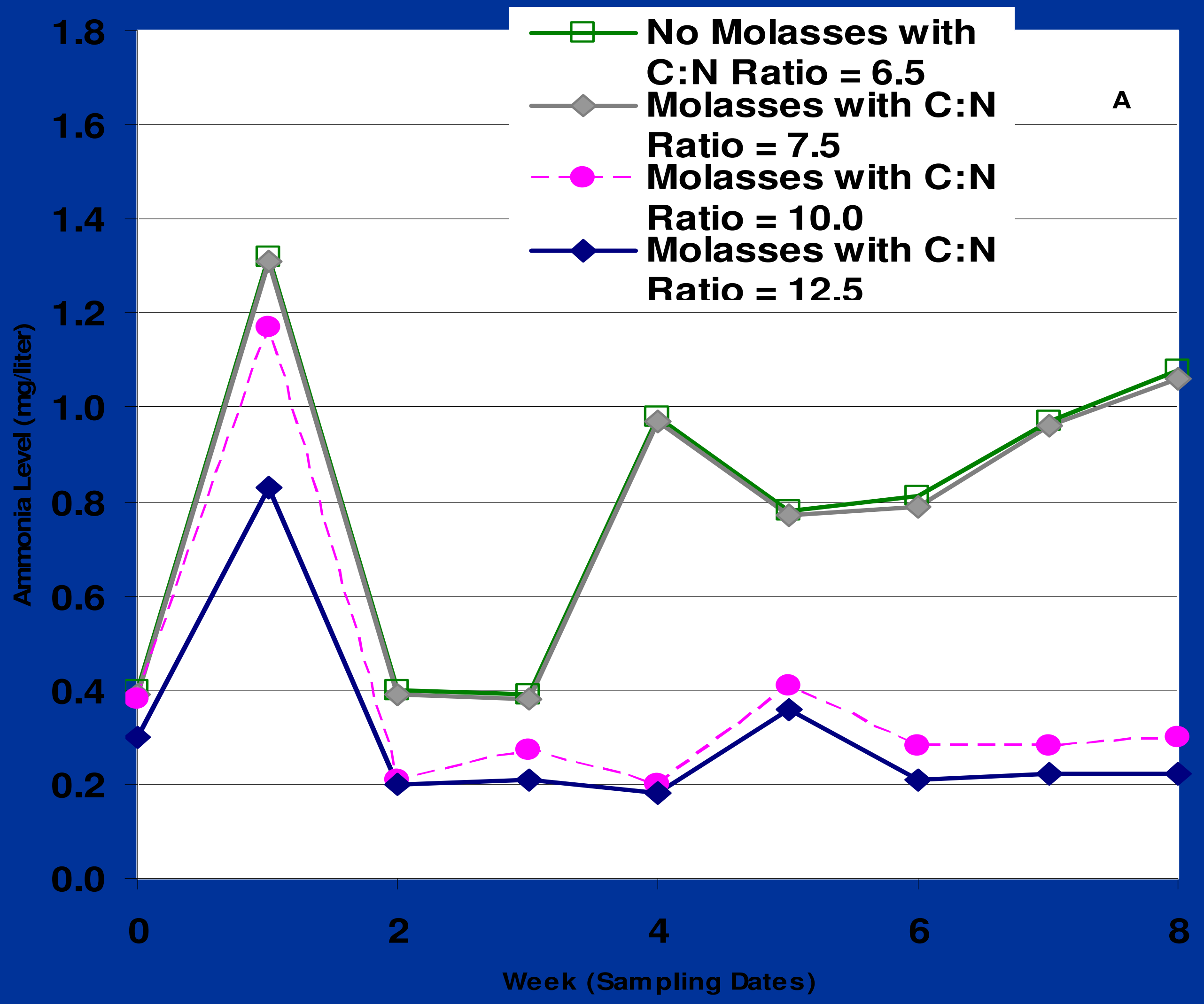
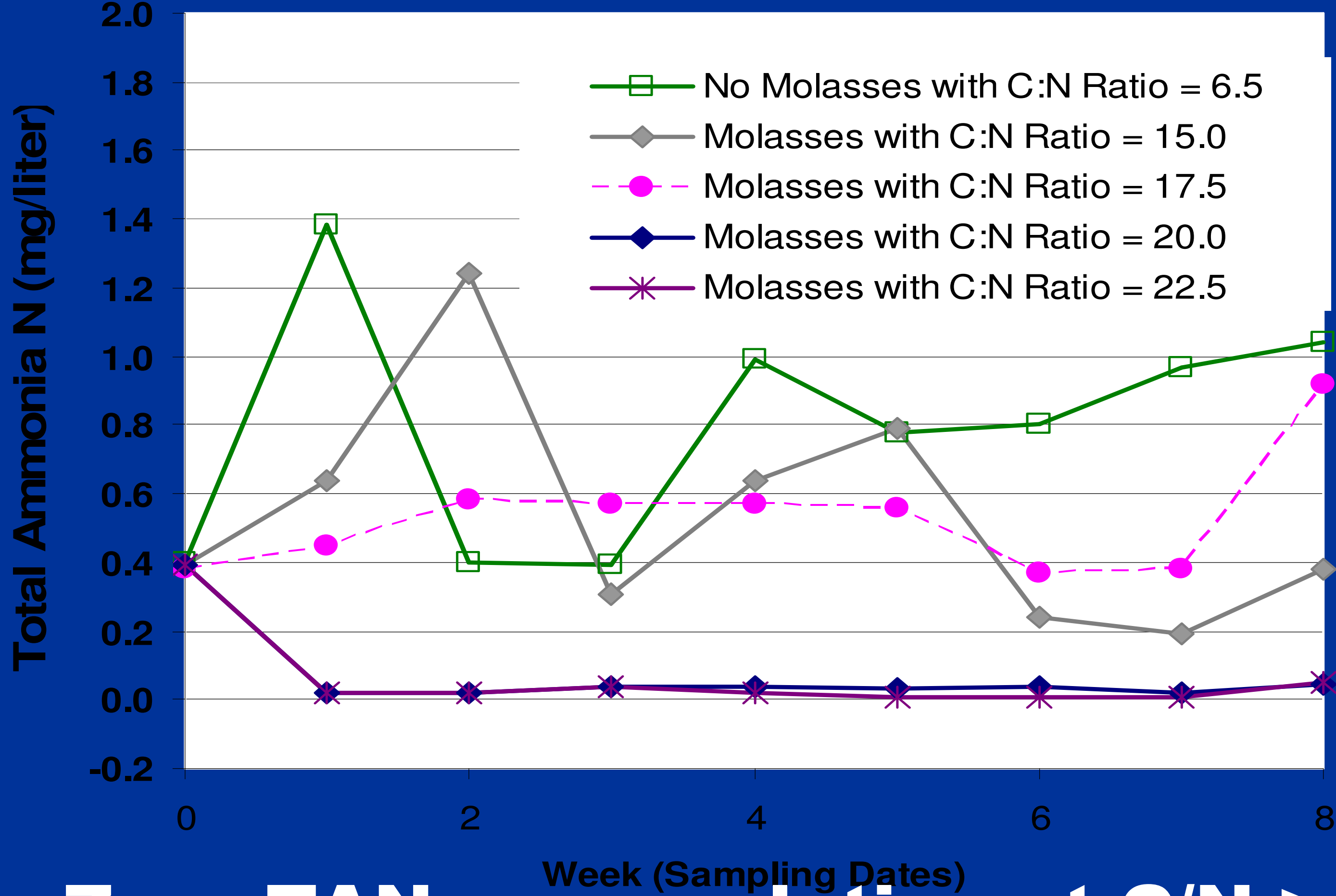
Assumed parameters (2)

- 2. **Microbial conversion efficiency** (i.e. % assimilation of total metabolized feed) **= 50%**
- 3. **Average C/N ratio of bacteria = 4**
- **4. Feed contain 50% carbon**
- **According to these assumptions, a C/N ratio of feed equal to 18 will prevent TAN accumulation in water.**

C/N ratio 6.5 – 12.5

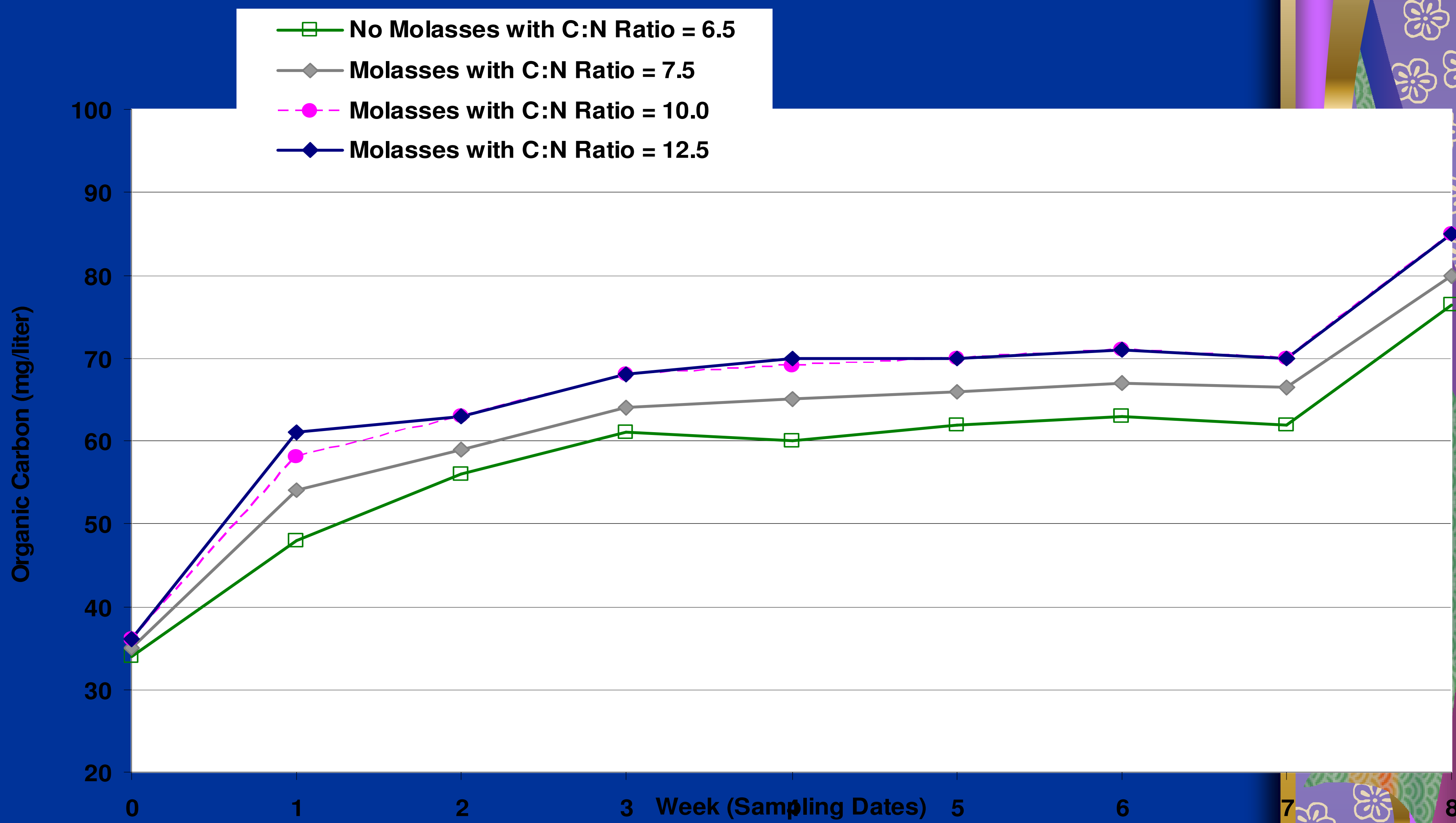


C/N Ratio = 6.5 – 22.5

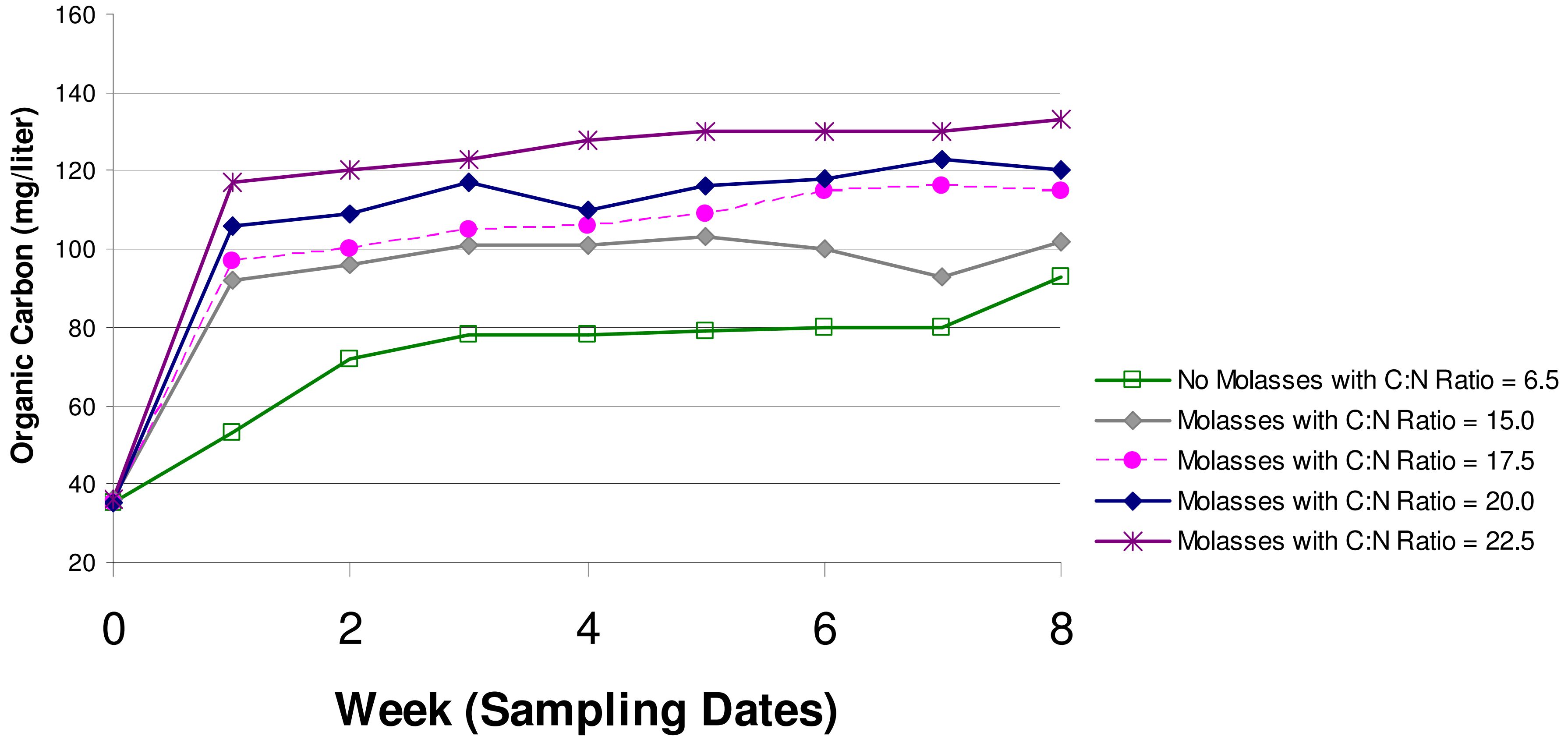


Zero TAN accumulation at C/N > 20

Steady state development



No Molasses with C:N Ratio = 6.5
Molasses with C:N Ratio = 7.5
Molasses with C:N Ratio = 10.0
Molasses with C:N Ratio = 12.5
Organic Carbon (mg/liter)
100
90
80
70
60
50
40
30
20
0
1
2
3
4
5
6
7
8
Week (Sampling Dates)



160
140
120
100
80
60
40
20
Organic Carbon (mg/liter)
0
2
4
6
8
Week (Sampling Dates)
No Molasses with C:N Ratio = 6.5
Molasses with C:N Ratio = 15.0
Molasses with C:N Ratio = 17.5
Molasses with C:N Ratio = 20.0
Molasses with C:N Ratio = 22.5

The nature of a steady state

- **The achievement of a steady state is very common in natural systems.**
- **Example: Accumulation of organic matter on ponds bottom (Avnimelech 1984).**
- **Organic matter is added daily (roughly the same addition daily, = B)**
- **Organic matter degradation is a linear function of organic matter concentration = k*(C)**

The nature of a steady state (2)

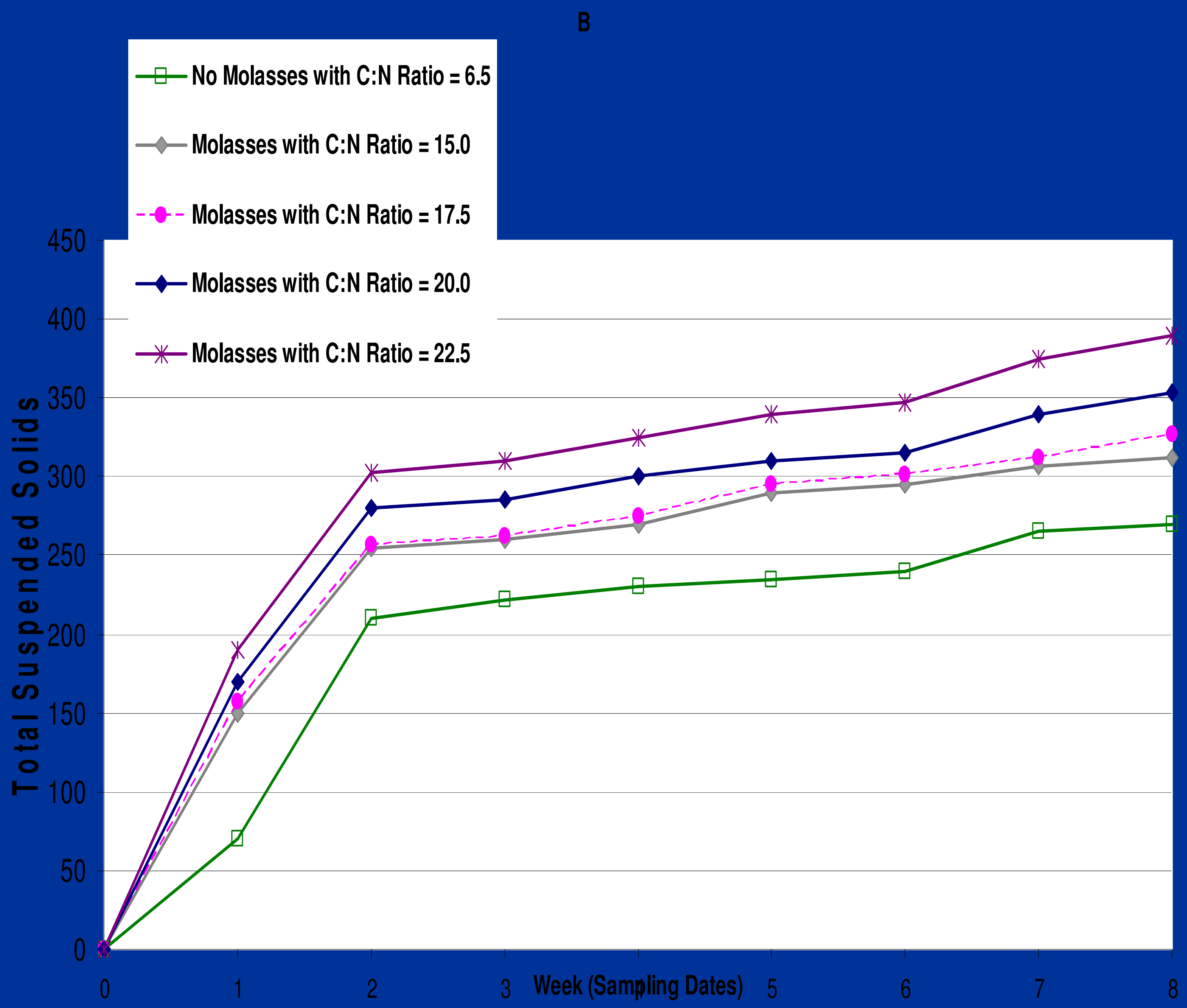
- $dC/dt = B - k^*(C)$
- Degradation rise with the increase of C, till a point where
- Degradation = Addition.
- From this point onward, $dC/dt = 0$
- i.e.There is no change of concentration with time.

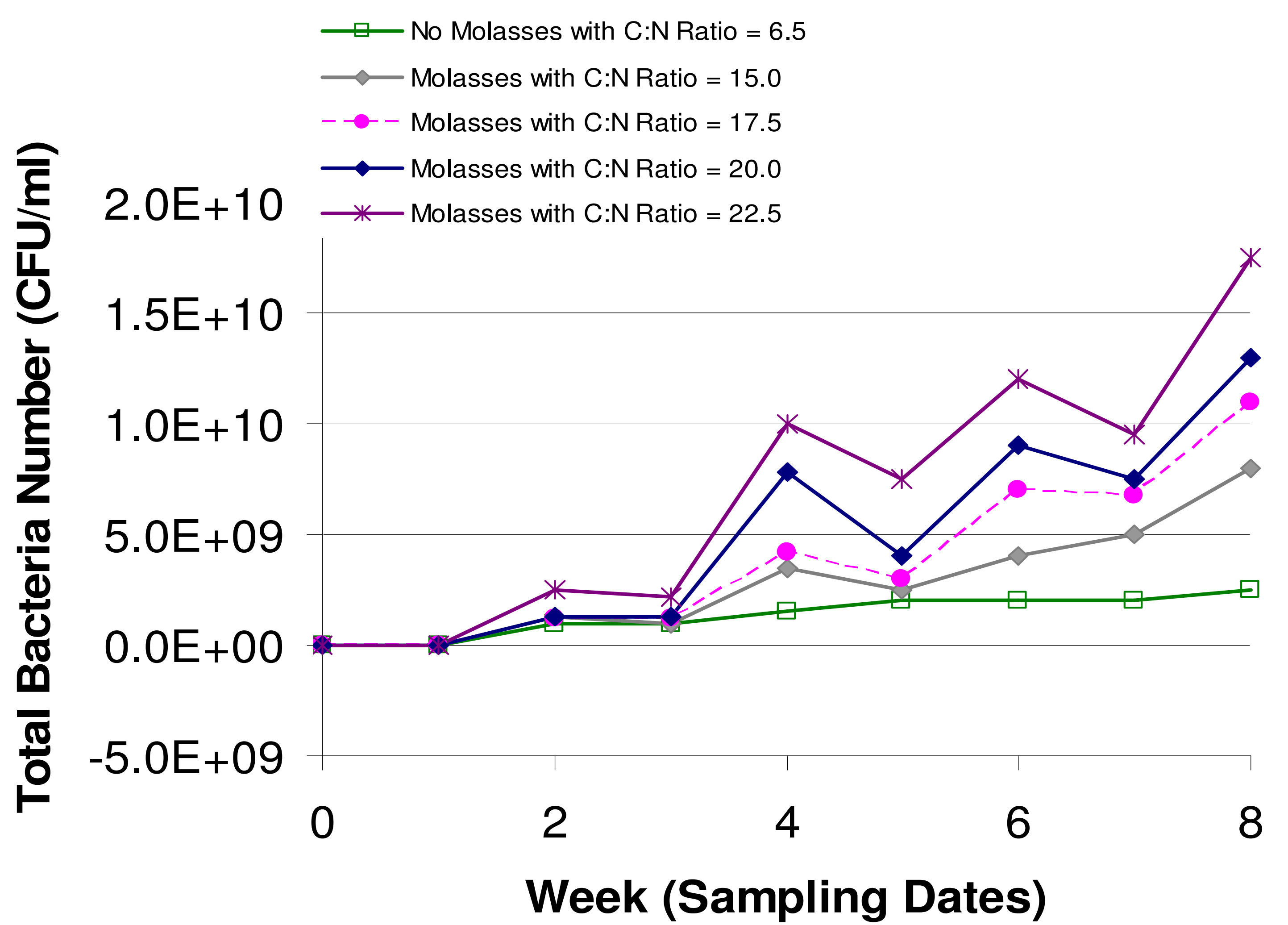
The nature of a steady state (3)

- (1) dC/dt = B – k*(C)
- (2)C= (B - e-Kt *(B - KC0))/K
- When Kt rise (long time, high degradation rate), e-Kt → 0
- And:
- (3) C = B/K
- C is constant, higher with addition rate (B) and lowered with the degradation rate

Computed steady state parameters

- **The data obtained here are in agreement with theory.**
- **The derived degradation constant in this work is 0.05 1/day, similar to data derived in ponds.**


B
No Molasses with C:N Ratio = 6.5
Molasses with C:N Ratio = 15.0
Molasses with C:N Ratio = 17.5
Molasses with C:N Ratio = 20.0
Molasses with C:N Ratio = 22.5
Total Suspended Solids
0
50
100
150
200
250
300
350
400
450
Week (Sampling Dates)
0
1
2
3
4
5
6
7
8



No Molasses with C:N Ratio = 6.5
Molasses with C:N Ratio = 15.0
Molasses with C:N Ratio = 17.5
Molasses with C:N Ratio = 20.0
Molasses with C:N Ratio = 22.5
Total Bacteria Number (CFU/ml)
2.0E+10
1.5E+10
1.0E+10
5.0E+09
0.0E+00
-5.0E+09
0
2
4
6
8
Week (Sampling Dates)

Conclusions

- **Experimental results were in agreement with theoretical considerations.**
- **Data obtained can be used to refine previous assumptions.**

THANK FOR THE ATTENTION

- This presentation, as well as other
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