SPATIAL AND TEMPORAL VARIATIONS OF CARBOHYDRATE SPECIES IN THE NORTHERN GULF OF MEXICO

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Background information

• Masters student; The University of Southern Mississippi.

• Major: Chemical Oceanography.

• Masters thesis on carbohydrates, acidic polysaccharides, dioxin in rivers and coastal water in the Northern Gulf of Mexico.
Mentor’s information

• Mentor: Dr. William (Monty) Graham.

• Chair and Professor of DMS/USM.

• Research interest: marine zooplankton ecology, climate change in river dominated system, long term ecosystem dynamics.
What I did

- Data processing and interpretation of carbohydrate samples collected and analyzed from a previous NGI project.

- APS analysis.
Sample processing and analysis
Introduction

• DOC: largest organic carbon reservoir in the ocean; composed of CHO, protein, lipids and others.

• CHO: major focus; CHO: C, H, O; (CH$_2$O), present in both dissolved and particulate phases.

• Dissolved carbohydrate (d-CHO): A major component of DOM (10-85%), including monosaccharide (MCHO) and polysaccharides (PCHO).

• Particulate p-CHO.
Why carbohydrates (CHO)?

- structural component
- energy storage in living cells
- indicator of the bioreactivity and diagenetic state of both DOM and POM.
- plays an important role in the carbon budget and its biogeochemical cycling
Sources and Sinks

• Sources:
  – Phytoplankton
  – Bacteria
  – organic matter decomposition
  – river run-off or terrestrial organic matter
  – sediment resuspension

• Sinks:
  – Biological uptake, decomposition
  – Coagulation
Acid Polysaccharides (APS)

- Neutral and charged CHO
- Produced by marine algae and bacteria
- Trace metals scavenging; bioavailability and toxicity
- Important in humic acid formation
- Very little work done in the Northern GOM.
Significance of the study

• Scarce p-CHO, APS data in the literature for the northern GOM.

• First dataset for the Mississippi Sound/Bight
Objectives

• To examine the partitioning and distribution of dissolved and particulate carbohydrate and APS along a salinity gradient.

• To determine the seasonal variations of CHO in the Mississippi Sound/Bight.

• To determine major factors controlling the dynamics of carbohydrates in the study area.
Methods

• DOC
  – high temperature combustion method using a Shimadzu TOC-V analyzer.
• CHO measurements
  – TPTZ (2,4,6-tripyridyl-s-triazine) (Wang et al., 2010).
• POC, SPM, nutrients and Chl-a
  Mojzis (2011); Guo and Santschi (1997);
• APS (particulate)
  - alcian blue method/80% sulfuric acids/878 nm (Hung et al, 2010; Xu et al., 2011)
Sampling sites

Sampling stations along a transect from near-shore to offshore in the Mississippi Sound/Bight.
Monosaccharides

MCHO V. Salinity

Showing a riverine source and somewhat conservative
Polysaccharides

PCHO Vs. S

PCHO-- a more dynamic distribution and different sources
Follow the trend of suspended particulate matter concentration, POC and Chl-a
Variations in OC-normalized p-CHO

Showing less variability when p-CHO is normalized with POC
Correlation of p-CHO with POC or Chl-a

\[
\begin{align*}
R^2 &= 0.9567 \\
R^2 &= 0.9478 \\
R^2 &= 0.9509 \\
R^2 &= 0.9854
\end{align*}
\]

The graph shows the correlation of p-CHO with POC or Chl-a, with various months represented by different markers and colors. The correlation coefficients for each month are indicated on the graph.
Partitioning of CHO in the Mississippi Sound/ Bight

Summer 2010
- M/D 67%
- P/D 33%

Summer 2011
- M/D 77%
- P/D 23%

MCHO (M) vs. PCHO (P)
Dissolved (D) vs. Particulate (p)

D/t: total

- Summer 2010: M/D 67%, P/D 33%; p/t 28%, D/t 72%
- Summer 2011: M/D 77%, P/D 23%; p/t 35%, D/t 65%
Partitioning of CHO in the Mississippi Sound/ Bight

**Spring**
- M/D 83%
- P/D 17%

**Winter**
- M/D 69%
- P/D 31%

MCHO (M) vs. PCHO (P)

**Spring**
- D/t 81%
- p/t 19%

**Winter**
- D/t 82%
- p/t 18%

Dissolved (D) vs. particulate (p)

t: total
APS with salinity

Mid-salinity maximum
Correlation of APS with POC and Chl-a

![Graph showing the correlation of APS with POC and Chl-a with months as a legend.](image)
Conclusions

• MCHO was the dominant CHO species.

• High MCHO abundance during March and May 2011.

• During summer 2011, p-CHO was higher than in 2010, because of the flooding/nutrient-input and higher biomass.

• Particulate-CHO increased with increasing salinity; mid salinity maximum.

• Positive correlation with POC and Chl-a

• River discharge/terrestrial inputs, nutrients, and biological processes are major factors in controlling the distribution and partitioning of CHO species in the MS/MB.
What I learned

• Better skills on graphing, interpreting the data, writing skills.

• Awareness of NOAA, their entities and their missions.
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