Graduate Students, Energy and Environment

Quantifying biomass of microphytobenthos in sediments of mangroves in the east coast of Qatar

Dina J. Isaifan, Yousra Soliman

Department of Biological and Environmental Sciences, College of Arts and Sciences

Background

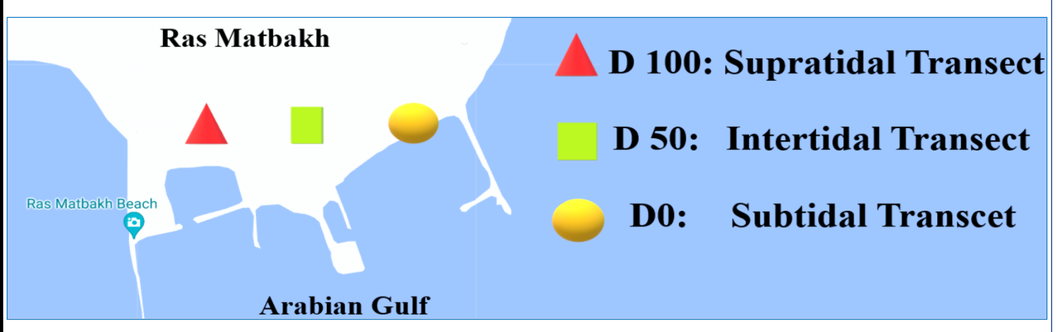
Mangroves, *Avicennia marina,* are highly productive coastal ecosystems with capacity to store carbon within plants and in sediments. They are a key component to mitigate climate change naturally. These Blue Carbon ecosystems sequester ≈ 4-20 Pg of global carbon annually. Micropytobenthos (MPB) in the sediments also fix carbon and play a significant role in carbon burial. However, there is paucity of information on roles of MPB in coastal carbon budget. We quantified the biomass of MPB as an important carbon pool in the mangrove of Al Thakhira, east coast of Qatar.

Research Objectives

- To quantify micro-phytobenthic chlorophyll (a) concentration as a proxy for the MPB carbon pool in the mangroves.
- To explore variabilities of MPB biomass and physiochemical properties of sediments (TOC, grain size) down depth gradients in Al Thakhira .

Materials and Methods

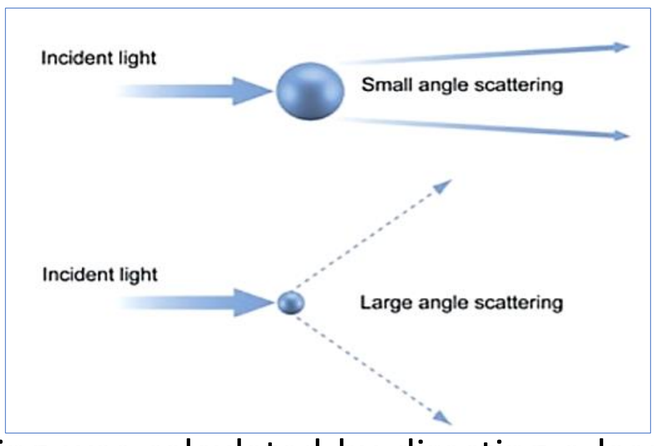
1. Sediment collection at different tidal levels



Tidal zones (supratidal, intertidal and subtidal) represent gradients in environmental conditions that affect the growth and biomass of MPB.

2. Sediment processing and analysis

Samples were dried at 200°C for 48 hours then finely ground and sieved.



Grain sizing was calculated by directing a laser beam at the sediment particulate. The measured intensity of angular disparity in scattered light is used to calculate grain size

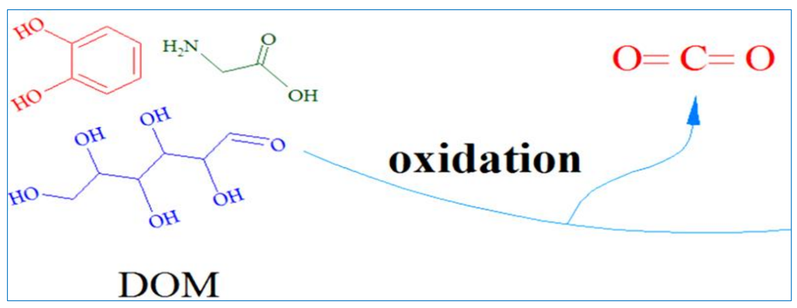
3. Total Carbon and Inorganic Carbon measurements

Carbon Analyzer oxidizes sediment sample at 1100°C, converting organic matter into CO_2. The Inorganic Carbon (IC) was determined by acidifying the sediment which converted the IC to CO_2.

Total Carbon (TC) = Total Inorganic Carbon (TIC) + Total Organic Carbon (TOC) ***(1)***

(TOC) = TC – TIC ***(2)***

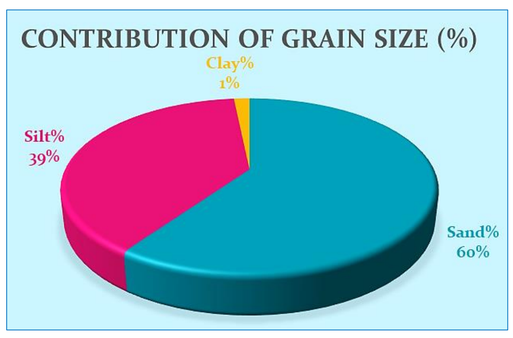
4. Chlorophyll -a extraction and quantification



Acetone (90% v/v) was used to extract the chlorophyll (a) from sediments. Absorbance of Chlorophyll (a) pigment was measured at 665 and 750 nm using UV-Spectrophotometer

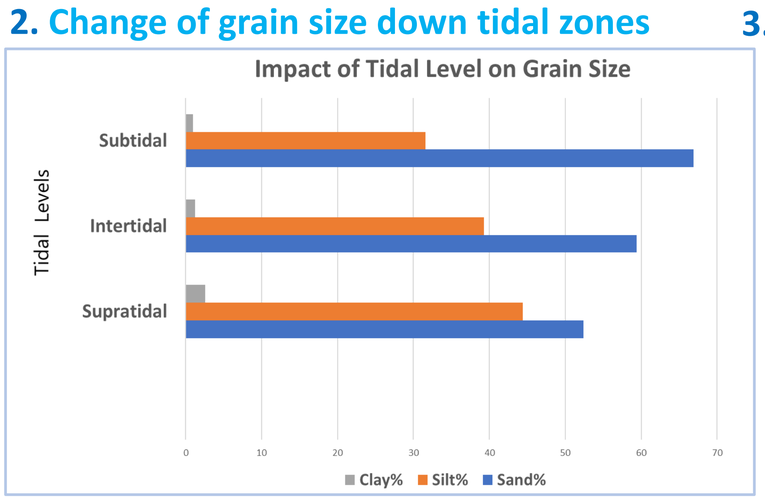
Results

1. Sediments grain size in the mangrove



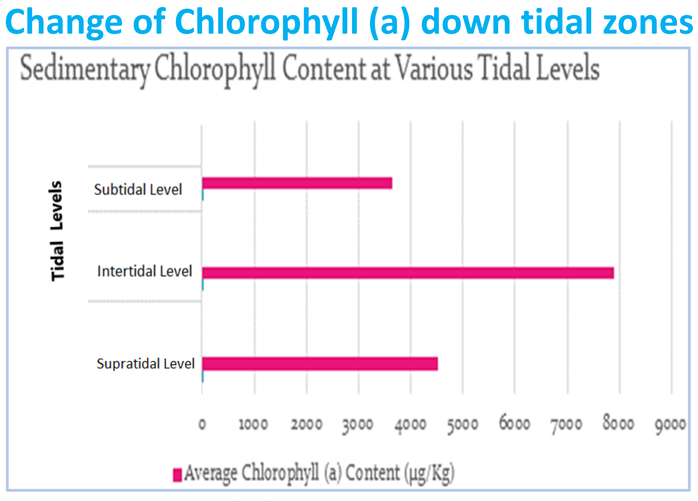
Sand was the dominant species (60%), followed by silt (39%) and clay (1%).

2. Change of grain size down tidal zones



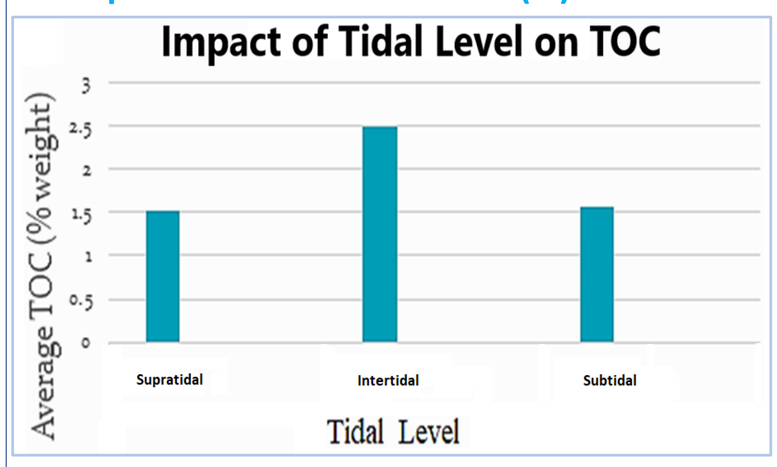
The supratidal level had significantly higher silty sand content while silt dominated the intertidal levels.

3. Change of Chlorophyll (a) down tidal zones



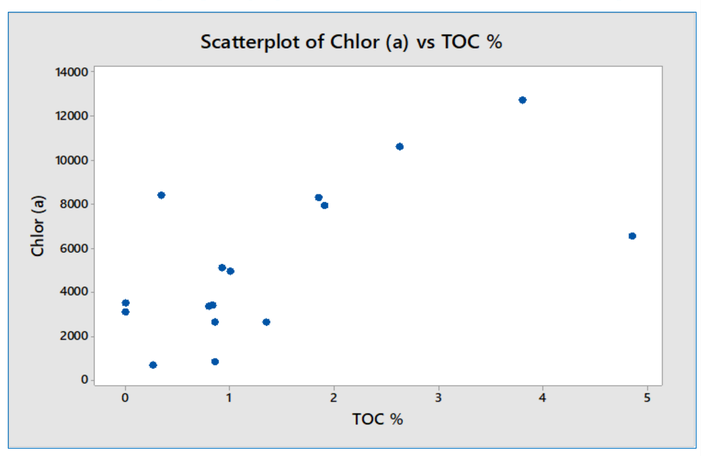
Chlorophyll (a) was significantly influenced by tidal levels with highest levels in the subtidal level sediments where mangroves grow extensively.

4. Impact of tidal level on TOC (%)



As we move towards the intertidal zone, the total carbon content in sediments gets higher.

5. Chlorophyll (a) & TOC % relationship



Chlorophyll (a) content gets significantly higher as TOC% is increased.

Conclusions

- Al Thakhira mangrove sediments have low chlorophyll (a) concentration and organic matter content.
- The Chlorophyll (a) concentration was high at the intertidal zone and decreased in pattern toward mudflat.
- Dry conditions and long solar exposure periods between tidal cycles may be responsible for low Chlorophyll (a) content in mangrove sediments.
- Higher decomposition rate of organic carbon may explain low TOC levels in sediments.

Recommendations

Mangrove forests in Qatar should be protected by special sanctuaries and law-enforcement to maintain this natural dynamic Blue carbon ecosystem.

References

1. Al-Khayat, J., Abdulla, M., Alatalo, J. (2019). Aquatic Sciences, 81:4-11.

2. Al-Mahasheer H. (2018). Environmental Monitoring Assessment, 190:85.

3. Al-Naimi, N., Al-Ghouti, M., Balakrishnan, P. (2016). Environ Monit Assess 188:268.

4. Alistair, R., Grinham, Tim J., Carruthers, L., Fisher, U., Dennison, W. (2007). Limnol. Oceanogr.: Methods, 5:119–125.