TRANSPARENT EXOPOLYMERIC SUBSTANCES (TEP) IN HUDSON BAY DURING FALL: SIGNIFICANCE AND POTENTIAL ROLES

Christine Michel¹, Amandine Lapoussière², Bernard LeBlanc¹, and Michel Starr³

¹ Fisheries and Oceans Canada, Freshwater Institute, 501 University Crescent, Winnipeg (Manitoba), Canada, R3T 2N6
² Institut des sciences de la mer (ISMER), Université du Québec à Rimouski, Rimouski (Québec), Canada, G5L 3A1
³ Fisheries and Oceans Canada, Institut Maurice Lamontagne, Mont-Joli (Québec), Canada, G5H 3Z4

INTRODUCTION

Transparent exopolymeric substances (TEP) are part of a diverse group of high molecular weight polymers that play a significant role in marine environments. These polymers, gel-like substances with sticky characteristics, are abundantly produced by algae at the end of blooms, and to a lesser extent by bacteria (e.g. Declo, 2000; Passow, 2002). TEP are involved in various ecological processes in the pelagic environment, e.g. in cell locomotion (Wetherbee et al., 1996), adhesion to surfaces (Colessey and Wigleyworth-Cooksey, 1989), and protection against harmful conditions (Raymond and jarrett, 2003). In addition, TEP contributes to biogeochemical cycling in various ways, e.g. by enhancing (Passow, 2002) or retarding (Azetsu-Scott and Passow, 2004) the sinking flux of particles, and by shifting the carbon to nitrogen (C/N) ratio of particulate organic matter towards high values compared to the Redfield ratio (e.g. Engle, 2004). Through various bio-ecological interactions, TEP play an important role in the cycling of organic material in marine systems, yet their role in Arctic and sub-Arctic pelagic environments remain poorly studied.

This paper presents preliminary results on TEP and dissolved organic carbon (DOC) concentrations in Hudson Bay waters during the fall, at a time that typically follows the phytoplankton blooms. These preliminary results were obtained during the MERICA expeditions in 2005 and 2006.

MATERIAL AND METHODS

Sampling was conducted at stations distributed along an East-West transect in northern Hudson Bay, and in Hudson Strait and Foxe Basin during MERICA expeditions in August 2005 and 2006 (Figure 1). At each station, CTD profiles and vertical characterization of biochemical variables were performed with a CTD-Rosette sampler, equipped with a fluorometer probe. At each station, 7 euphotic depths (100%, 50%, 30%, 15%, 5%, 1%, and 0.2% of surface irradiance) and 3 aphotic depths were sampled. The water was immediately transferred into Nalgene containers and analyzed for the following:

- Chlorophyll a and phytoplankton: Total chlorophyll a was determined fluorometrically after filtration of duplicate samples on Whatman GF/F glass/fiber filters and extraction in 90% acetone in the dark at 4°C for 24 h (Parsons et al., 1984).
- TEP were measured spectrophotometrically after filtration of duplicate samples on 0.4 µm polycarbonate filters, staining with Alcian Blue and extraction in 80% H2SO4 (Passow and Aller, 1995).
- Dissolved organic carbon (DOC) was measured on samples filtered through Whatman GF/F glass/fiber filters, using high-temperature catalytic combustion on a Sebacine Dorhman TOC/TN analyzer.

Due to limitations in the availability of data at the time of preparation of this paper, preliminary results on DOC are from the 2005 expedition while results on TEP are from the 2006 expedition.

PRELIMINARY RESULTS

Dissolved organic carbon (DOC) was measured on samples filtered through combusted Whatman GF/F filters, using high-temperature catalytic combustion on a Sebacine Dorhman TOC/TN analyzer. TEP were measured spectrophotometrically after filtration of triplicate samples on 0.4 µm polycarbonate filters, staining with Alcian Blue and extraction in 80% H2SO4 (Passow and Aller, 1995). TEP concentrations were variable at DOC concentrations were highest at surface (Fig. 2).

Typical vertical profiles in TEP concentrations mirrored those in chlorophyll a, with maximum TEP concentrations observed at the depth of the chlorophyll a maximum. However, at stations closer to shore (HB02), an increase in TEP concentrations was also observed at surface (Fig. 3).

In surface waters (top 100m), TEP concentrations were positively correlated with chlorophyll a concentrations (Fig. 4).

KEY POINTS:

- DOC concentrations ranged between 46 and 145 µM, and generally increased with proximity to the chlorophyll a max at stations located in the center of Hudson Bay (HB04). At stations located closer to shore (HB02), DOC concentrations were highest at surface (Fig. 2).
- Typical vertical profiles in TEP concentrations mirrored those in chlorophyll a, with maximum TEP concentrations observed at the depth of the chlorophyll a max. However, at stations closer to shore (HB02), an increase in TEP concentrations was also observed at surface (Fig. 3).
- In surface waters (top 100m), TEP concentrations were positively significantly correlated with chlorophyll a concentrations (Fig. 4).

REFERENCES


ACKNOWLEDGEMENTS

This research was supported by Fisheries and Oceans Canada research grants to C.M. and M.S. We acknowledge NCE ArcticNet (Network Centre of Excellence, Natural Sciences and Engineering Research Council (NSERC) of Canada. We express our sincere thanks to the officers and crew of the Canadian icebreaker Pierre Radisson, to H. Harvey and other colleagues for their help during the expedition and in the laboratory.