THE EFFECTS OF PARTICLE SIZE ON THE SOURCES AND DISTRIBUTION OF GDGTS IN SURFACE SEDIMENTS OF THE CHANGJIANG ESTUARY

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Introduction

Glycerol dialkyl glycerol tetraethers (GDGTs) are widespread archaeal and bacterial membrane lipids in marine and terrestrial environments, providing abundant information on the biogeochemistry and microbial ecology of natural ecosystems in modern estuarine environments (Schouten et al., 2000, 2002; Weijers et al., 2007; Lipp et al., 2008; Liu et al., 2012). Although there has been tremendous work on the spatial distribution of GDGTs in estuaries and marginal seas (e.g., Zhu et al., 2011; Lv et al., 2014; Xing et al., 2015), the distribution patterns of GDGTs in different size fraction of sediments remain poorly understood. In this study, eleven surface sediment samples collected from the Changjiang Estuary to the adjacent shelf in August 2013 were separated into four size fractions (<20 μm, 20-32 μm, 32-63 μm and 63-125 μm) by wet sieving method, and then the bulk and size-fractionated sediments were analyzed for GDGT core lipids. The primary objectives of this work were to investigate the distribution patterns of various GDGT structures and their related proxy parameters among different size fractions and different stations, in order to better constrain the effects of particle size on the sources and distribution of sedimentary GDGTs in the Changjiang Estuary.

Results

Contents of iso-GDGTs and br-GDGTs varied significantly among size fractions of each sediments. The largest size fractions contained the highest contents of iso-GDGTs, ranging from 15 ng/g to 400 ng/g. In the 20-32 μm to 63-125 μm size fractions, average contents of iso-GDGTs increased from 49 ng/g to 67 ng/g. Contents of br-GDGTs were high in the largest and smallest size fractions (35 and 34 ng/g in average). The spatial distribution patterns of isoprenoid GDGTs (iso-GDGTs) and branched GDGTs (br-GDGTs) in different size fractions were distinct. In offshore stations, contents of iso-GDGTs and br-GDGTs in the smallest size fractions were relatively high (222 and 42 ng/g in average, respectively), whereas contents of iso-GDGTs and br-GDGTs in the largest size fractions were low (88 and 23 ng/g in average, respectively). On the contrary, in nearshore stations, contents of iso-GDGTs and br-GDGTs were highest in the largest size fractions (34 and 49 ng/g in average, respectively), while contents of iso-GDGTs and br-GDGTs were low in the smallest size fractions (27 and 22 ng/g in average, respectively). For the 20-32 μm size fraction, contents of iso-GDGTs and br-GDGTs in all stations were lowest (49 and 18 ng/g in average, respectively). The BIT index (branched and isoprenoid tetraethers index) (Hopmans et al., 2004) increased as size increased. The average values of BIT index were 0.25 in the smallest size fractions and 0.39 in the largest size fractions. The spatial distribution patterns of BIT in different size fractions were distinct. In the nearshore stations, BIT values in the largest size fraction were highest (avg. 0.67), whereas BIT values in the smallest size fraction were

lowest (avg. 0.47). In the offshore, the average values of BIT ranged from 0.16 in the smallest size fractions to 0.47 in the largest size fractions.

Conclusions

1 Iso-GDGTs was concentrated in the smallest size fractions while the concentrations of br-GDGTs were high in both smallest and largest size fractions.
2 Iso-GDGTs was dominated in the smallest size fractions in offshore stations, whereas iso-GDGTs were relatively abundant in the largest size fractions in nearshore stations. Similar to iso-GDGTs, brGDGTs were preferentially found in the smallest size fractions in the offshore stations and in the largest size fractions in the nearshore stations.
3 The 20-32 μm size fractions contained lower concentrations of GDGTs than other size fractions, possibly because this fraction is easily resuspended, which may result in high degradation of GDGTs.
4 The BIT values were higher in the larger size fractions than smaller size fractions.
5 The BIT values were higher in the nearshore station than offshore stations due to high terrestrial material input in the nearshore stations.
6 This work shows that hydrodynamic sorting processes play an important role on the dispersal of GDGTs from different sources in these highly dynamic systems.

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