

# **Evaluation of Denitrification Capabilities in the Tidal Flats of the Ariake and Yatsushiro Inland Seas**

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Denitrification rates in the tidal flats of the Ariake and Yatsushiro Inland Seas were measured by the acetylene block method. Factors affecting denitrification rates in the tidal flat of the Midori River estuary in Kumamoto Prefecture were evaluated by the experimental results obtained from field surveys conducted every 3 months over a period of 2 years. It was found that denitrification capabilities in the tidal flats were highly dependent on the silt and clay contents of tidal mud with a correlation coefficient of 0.991. Denitrification rates were higher in coastal areas where the silt and clay contents of the mud were relatively high. Denitrification rates followed double Michaelis-Menten kinetics with respect to nitrate nitrogen ( $\text{NO}_3\text{-N}$ ) and total organic carbon (TOC) concentrations. In situ denitrification rates of the tidal flats were estimated by substituting  $\text{NO}_3\text{-N}$  and TOC concentrations of the water extracted from tidal mud into the double Michaelis-Menten equations that we developed. The denitrification rates in the tidal flats increased with an increase in water temperature up to  $35^\circ\text{C}$  and decreased thereafter. The temperature coefficient for the denitrification reaction was determined to be 1.13, which implies a rather high temperature dependency compared to most biological reactions. Comparing the denitrification capabilities of various tidal flats in the Ariake and Yatsushiro Inland Seas with differing silt and clay contents, the highest denitrification rate was found to be  $3.5\text{g-N/g/d}$  for a tidal flat in Saga Prefecture that had a high silt and clay content. It was thus concluded that the denitrification capability is highest in the summer season when the water temperature is high at locations where the tidal mud is rich with silt and clay. It was also demonstrated from the evaluation of the diffusion model that  $\text{NO}_3\text{-N}$  can diffuse only within the top 30cm of the tidal flats. From the correlation of the change in denitrification rate with change in depth, the purification capabilities of the tidal flats in the Ariake and Yatsushiro Inland Seas were further evaluated. From this study, it was understood that the tidal flats have a high denitrification capacity and play an important role in nitrogen abatement in the inland seas.