Preface

Since the Industrial Revolution, huge amounts of carbon dioxide have been released into the atmosphere as a result of human activities. The increase of anthropogenic CO_2 in the atmosphere is thought to cause global warming that gives rise to climate change. About one-third of the anthropogenic CO_2 has been absorbed by the oceans. When dissolved in seawater, CO_2 exists in the form of carbonic acid. Therefore, the uptake of anthropogenic CO_2 by the world's oceans leads to acidification of the oceans. Ocean acidification is of great concern because it can seriously affect marine ecosystems. Therefore, it is necessary to monitor the pH of seawater, which is a measure of ocean acidification.

Measurements of pH have long been used in the field of chemistry. However, a universally accepted method of measurement, which includes the standards for measurements of seawater samples, has not yet been established. Consequently, comparison of pH data obtained from different sources is problematic. Furthermore, pH measurements collected from different cruises or other locations must be directly comparable so that ocean acidification may be detected.

For these reasons, the present study was initiated with financial support from the research programme "Global Carbon Cycle and Related Mapping based on Satellite Imaginary Programme" of the Research Promotion Fund from the Ministry of Education, Culture, Sports, Science and Technology, Japan, as well as the research programmes "Observational Study on the Seasonal and Interannual Variability and its Mechanisms of the Carbon Dioxide System at the Air-Sea Interface and in the Upper Layer of the Ocean" and "Observational Study on the Variability of Carbon Cycle in the Ocean, I and II" of the Meteorological Research Institute, Japan Meteorological Agency's research fund.

In this technical report, a new spectrophotometric technique for the measurement of pH_T, pH as measured on the total hydrogen ion concentration scale, is described. This technique provides pH_T values for seawater with repeatability better than 0.002 and with comparability of 0.003. By applying the technique to oceanic waters, we will be able to detect seawater acidification as well as obtain new information on ocean carbon cycles.

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