

氏名	SARAWUT LUNVONGSA
授与した学位	博士
専攻分野の名称	学術
学位授与番号	博甲第3263号
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学位授与の要件	自然科学研究科物質分子科学専攻 (学位規則第4条第1項該当)
学位論文の題目	Studies on Novel Catalytic Reaction-Based Detection Systems and Their Application to Trace Metal Analysis (新規接触反応検出系及びその微量金属分析への応用に関する研究)
論文審査委員	教授 本水昌二      教授 山本峻三      助教授 大島光子

### 学位論文内容の要旨

This thesis describes the development of novel catalytic reaction-based detection and their application to flow injection (FI) spectrophotometric methods for ultratrace metals analysis. The reaction developed in this research is a catalytic oxidation reaction of *N,N*-dimethyl-*p*-phenylenediamine (DPD) with iron and/or copper in the presence of hydrogen peroxide. The application of this reaction has been validated as it could be applied to real samples. One of the applications of this reaction was the determination of dissolved and total amounts of iron contents in natural waters. As the reaction is very sensitive, it was also applied to the quantification of trace iron in ultrapure mineral acids. In these two cases, triethylenetetramine (TETA) was used as a masking agent for suppressing the interference from copper. By masking effect of TETA, a sequential determination of iron and copper in bottled-mineral drinking waters was successfully achieved.

The second detection reaction developed in this research is a catalytic oxidative coupling reaction of DPD with 1,3-phenylenediamine (mPD) with iron and/or copper in the presence of hydrogen peroxide. In this reaction, detailed studies of pH effect on sensitivity and selectivity for iron and copper detection was done by FI method. The selective and highly sensitive determination of iron and copper were accomplished under the optimal pH condition for their determination. The developed methods were successfully applied to the determination of iron and copper in tap and natural waters. Moreover, the developed detection reaction has the possibility for the determination of cobalt, manganese and chromium.

The third interesting catalytic reactions, the reduction reaction of indigo carmine and methylene blue by sulfide in alkaline solution, were also developed for nickel determination. According to the present results, these two reactions show the possibility for the quantification of trace amounts of nickel in water samples.

The present thesis will greatly contribute to improve the transition metal ion analysis and the clarification of the catalytic phenomena of trace metals in analytical chemistry.

## 論文審査結果の要旨

This thesis describes the development of novel catalytic reaction-based detection and their application to flow injection (FI) spectrophotometric methods for ultratrace metals analysis. The reaction developed in this research is a catalytic oxidation reaction of *N,N*-dimethyl-*p*-phenylenediamine (DPD) with iron and/or copper in the presence of hydrogen peroxide. The application of this reaction has been validated as it could be applied to real samples. One of the applications of this reaction was the determination of dissolved and total amounts of iron contents in natural waters. As the reaction is very sensitive, it was also applied to the quantification of trace iron in ultrapure mineral acids. In these two cases, triethylenetetramine (TETA) was used as a masking agent for suppressing the interference from copper. By masking effect of TETA, a sequential determination of iron and copper in bottled-mineral drinking waters was successfully achieved.

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In view of original contents and creative results obtained in this research, the committee evaluated this dissertation as PhD degree's worth of research.