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Novel Strategies for Colorimetric Sensing of Reactive Oxygen Species

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Abstract

Novel colorimetric sensing mechanisms toward various reactive oxygen species such as hydrogen peroxide, hypochlorite, etc. has been developed. By copolymerizing boronic acid and tertiary amine monomers with acrylamide and a crosslinker on a glass plate, a boronic acid-containing thin film was obtained. After immersing in aqueous solutions containing various concentration of hydrogen peroxide, the thin film was successively immersed in an anionic dye solution. The amount of adsorbed dye increased with increasing hydrogen peroxide concentration, whereas the dye was scarcely adsorbed in the absence of hydrogen peroxide. These phenomena should be derived from a change in the charge state of the thin film in response to the conversion of negatively-charged boronate group into non-charged phenol group by the reaction with hydrogen peroxide. Thus the thin film changed from colorless to colored in response to hydrogen peroxide. Various pattern of color-change was achieved by changing conditions such as monomer composition of the thin film, charge and color of dyes, etc. For the sensing of hypochlorite, thin films containing hydroxyl groups were also utilized. It was revealed that thin films having tertiary amino or hydroxyl groups but not have boronic acid group are effective for the selective detection of hypochlorite. Since hypochlorite is highly oxidative, these functional groups are converted into negatively-charged carboxylate group. As the results, the thin films become possible to adsorb cationic dyes after reaction with hypochlorite.

Biography

Dr. Yasumasa Kanekiyo received his B. Sci. and M. Sci. from Nagoya University in 1993 and 1995, respectively. He obtained his PhD in Chemistry from Kyushu University under the supervision of Prof. Seiji Shinkai in 2001. From 2001 to 2006, he worked as Postdoc at National Institute of Advanced Industrial Science and Technology (AIST), Japan. Since 2006, He has worked as an associate professor at Kitami Institute of Technology, Japan.

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