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Development of Ion-Selective Electrodes for Agriculture

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[Abstract]

There is a growing need to develop ion sensors for agriculture. As a result, several technologies have been developed, such as colorimetry, spectrophotometry, and ion-selective electrode (ISE). Among them, ISE has some advantages compared to others. First, it does not require pre-treatment processes and expensive equipment. Second, it is possible for the portable detection system by introducing small-sized electrodes. Finally, real-time and multiple detections of several ions are pursued. It is well-known that N, P, and K nutrients are critical for crop growth. With the development of agriculture techniques, the importance of soil nutrient analysis has attracted much attention for cost-effective and eco-friendly agriculture. Among several issues, minimizing the use of fertilizers is significant through quantitative analysis of soil nutrients. As a result, it is highly important to analyze certain nutrients, such as N (ammonium ion, nitrate ion, nitrite ion), P (dihydrogen phosphate ion, monohydrogen phosphate ion), and K (potassium ion). Therefore, developing sensors for accurate analysis of soil nutrients is highly desired.

In this study, several ISEs have been fabricated to detect N, P, and K. Their performance has been intensively studied, such as sensitivity, selectivity coefficient, and concentration range, and compared with commercialized ISEs. In addition, preliminary tests on the in-situ N, P, and K monitoring have been conducted inside the soil.

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