Review – Plant nutritional status analysis employing the visible and near-infrared spectroscopy spectral sensor

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ABSTRACT

Experiments demonstrated that visible and near-infrared (Vis-NIR) spectroscopy is a highly reliable tool for determining the nutritional status of plants. Although numerous studies on various kinds of plants have been conducted, there are only a few summaries of the research findings regarding the absorbance bands in the visible and near-infrared region and how they relate to the nutritional status of plants. This article will discuss the application of Vis-NIR spectroscopy for monitoring the nutrient conditions of plants, with a particular emphasis on three major components required by plants, namely nitrogen (N), phosphorus (P), and potassium (K), or NPK. Each section discussed different topics, for instance, the essential nutrients needed by plants, the application of Vis-NIR spectroscopy in nutrient status analysis, chemometrics tools, and absorbance bands related to the nutrient status, respectively. Deduction made concluded that factors affecting the plant's structure are contributed by several circumstances like the age of leaves, concentration of pigments, and water content. These factors are intertwined, strongly correlated, and can be observed in the visible and near-infrared regions. While the visible region is commonly utilised for nutritional analysis in plants, the literature review performed in this paper shows that the near-infrared region as well contains valuable information about the plant's nutritional status. A few wavelengths related to the direct estimation of nutrients in this review explained that information on nutrients can be linked with chlorophyll and water absorption bands such that N and P are the components of chlorophyll and protein; on the other hand, K exists in the form of cationic carbohydrates which are sensitive to water region.