

NUCLEAR MAGNETIC SPECTROSCOPY TO IMPROVE THE SUSTAINABILITY AND REPRODUCIBILITY OF CROPS

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Abstract

Nowadays one of the actual problems is creating reliable and fast methods of rapid control of condensed matter, which allow acquiring information about the deviation from standard state on site of measurement. Especially it is necessary for various researches with using of condensed mediums, biological solutions and liquid fertilizers and in cases of checking the production quality (e.g. commercial production or customs control).

In this article, one of the possible ways for creating fast and reliable methods of rapid control of liquid mediums used in agriculture is considered. Using small NMR spectrometers allows determining the deviation degree of considered medium from standard state. Further processing of registered NMR signal with wavelet transform gives us a possibility to detect composition and relative components concentrations for a number of researched mediums. Results of the experimental researches of different mediums are shown.

Overview of the different publications showed that the problem of effective rapid testing of liquid media is very relevant for agriculture. Especially when using a liquid fertilizer which have long kept. The researches have shown that usage of compact NMR spectrometers for rapid control of liquid mediums might become the solution for this problem. With measured T1 and T2 relaxation times of the researched mediums, one could designate the deviation degree from normal state on site of measurement with an error no more than 1%. Besides measurements with NMR spectrometer do not change the chemical composition and physical structure of medium. All of this makes the offered method of rapid control using NMR spectroscopy demanded in different areas and shows the necessity of further research for improving its functional capabilities. The promising approach is to use the wavelet transform for processing the detected NMR signals.

Wavelet analysis provides a unique possibility to recognize local and "thin" signal (function) features and to get the spectral components of the signal. It allows using wavelet analysis for processing the NMR signals, which were registered from mixtures of liquid mediums formed by substances similar in chemical composition and physical structure (e.g. a mixture of fertilizer or aqueous solutions of soluble salts). By mixing these mediums there is no dissolving of one medium into another and a conglomerate is forming that has a quite homogeneous character if the mixing have been done qualitatively. Acquired NMR signal from such a mixture is a sum of signals from each component in the mixture.

This is particularly important for environmental monitoring in agriculture.