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New Type of Modified Nanocellulose with Cyclodextrins for Analytical Applications

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Extended Abstract

Nanomaterials are of great interest due to their numerous applications in many areas owing to their unique thermal, mechanical, electronic and biological properties not found in conventional materials. Nanocellulose (NC) consists in single individual fibers with nanometric size based on natural and renewable biopolymer. NC exhibit fascinating properties such as high specific surface area, high chemical or biological reactivity, and occasionally even high porosity.

β -cyclodextrin (β -CD) is a cyclic oligosaccharide with the ability to form stable and reversible inclusion complexes and recognize analytes selectively (Prabaharan & Mano, 2006; Uekama, 2002). One of the most important applications in analytical science of CD is their use in separation processes and as additives in the enhancement for the sensitivity and selectivity of different analytical techniques. Li and Purdy reviewed the application of cyclodextrins in diverse fields of analytical chemistry (Li & Purdy, 1992).

In this study, we described the preparation of functionalized NC with β -cyclodextrin for the first time. The introduction of β -cyclodextrin was performed via amidation reaction with the use of coupling reagents. Characterization of modified NC with CD was performed by using Kaiser Test, TGA, NMR and IR spectroscopy.

Application of β -cyclodextrin functionalized NC as efficient and selective sorbent in Solid Phase Microextraction (SPME) for preconcentrating specific analytes is shown in this communication. Due to the uncontrolled use of veterinary fluoroquinolones and their unfavorable effects on the environment, we proposed a methodology for the selective preconcentration of Danofloxacin and posterior determination using fluorescence measurements.

This innovative nanomaterial presented reusable properties and reproducible extraction efficiency (98.1 %) for at least 30 direct extractions of Danofloxacin (relative standard deviation (RSD) is 0.62%). The reproducibility between SPME cartridges in terms of relative standard deviation is 1.38%. The optimization of the elution was performed by varying the proportions of organic solvent, phosphate buffer, and pH value.

The proposed method allows their automatization owing to the high reusability of SPME cartridges with reproducible timing of extraction and desorption steps. The whole fluidics circuit is powered by a peristaltic pump programmed and controlled by a computer. Reglo ICC peristaltic pump is able to control all three channels that are involved in the sample preparation independently. This allows for individual optimization of extraction, preconcentration and elution processes.

The method was characterized on the basis of its linearity, sensibility, precision and recovery. The sensitivity of the method was evaluated according to the limit of detection (LOD). LOD is calculated, as three times the standard deviation of the blank signal divided by the slope of the calibration curve, was 0.11 mg L^{-1} . The limit of quantification (LQ), established for ten times the standard deviation of the blank signal divided by the slope of the calibration curve, was 0.36 mg L^{-1} .

References

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