Research Article

Journal of Chemistry Letters
journal homepage: www.jchemlett.com
ISSN (online)

Application of Nano-sized Poly (N-methyl pyrrole-pyrrole) Fiber to the Headspace Solid-Phase Microextraction of Volatile Organic Compounds from Yogurt

Abdolkarim Saidfar, Mohammad Alizadeh and Sajad Pirsa*

Department of Food Science and Technology Faculty of Agriculture, Urmia University, P. O. Box 57561-51818, Urmia, Iran

ARTICLE INFO

Article history:
Received
Received in revised form
Accepted
Available online

Keywords:
Poly N-Methyl pyrrole
Polypyrrole
Solid phase microextraction fiber
Nanostructure
Experimental design

ABSTRACT

A new poly (N-methyl pyrrole-co-pyrrole) (P-NMPy-co-Py) coated flexible polyester fiber was provided by chemically-deposition of P-NMPy-co-Py on the surface of polyester fiber in the mixed electrolytes of sodium dodecyl sulphonate (SDS) and $FeCl_3$ (as an oxidant). The Scanning Electron Microscopy (SEM) and Fourier Transform Infrared spectroscopy (FTIR) were used for characterization of morphology, size, porosity and composition of synthesized copolymer. The nanosized and spheral P-NMPy-co-Py particles are observed according to the SEM results. The P-NMPy-co-Py fiber was employed to extraction of volatile organic compounds (VOCs) in yogurt samples as an extractor. An experimental design was utilized to optimize operational parameters that affect the analysis of VOCs in yogurt samples using headspace solid phase microextraction (HS-SPME) in the pre-concentration step. Some parameters including, sample pH, temperature, ionic strength (NaCl percent W/W %) were optimized. Gas chromatography-flame ionization detection (GC-FID) was used for separation, detection and quantitation of VOCs. Results show that P-NMPy-co-Py modified polyester fiber is provided fast and easily by chemical method and is suitable for the successful extraction of the VOCs from yogurt samples.

1. Introduction

In recent years conducting organic polymers, copolymers and their composites have been studied intensively as electroactive material, filter and membrane [1-3]. Conducting polymer films and membranes have received considerable attention for generating modified fibers and electrodes with analytical utility, like as an absorbant [4-6]. These polymers can be used also as polymeric batteries, membranes, light emitting diodes, sensing devices such as muscle like actuators, or as transistor circuits. Polypyrrole, polyaniline and other conducting polymers can be functionalized by different dopants or other organic polymers to provide special films, membrane and electrodes to enhance determination, filtration or absorption ability of these polymers [7-9]. The functionalization of conducting polymer films can be achieved by electrostatic or chemical incorporation of anionic complexing ligands during the chemical or electrochemical polymerization step [5-11]. Among conducting polymers polypyrrole and its copolymers and derivatives like poly N-methyl pyrrole, pyrrole-N-methyl pyrrole copolymer and so have more attention in research studies [5-11]. Poly (N-methyl pyrrole) and pyrrole-N-methyl pyrrole copolymer could be obtained on mild steel or other fibers successfully from acid medium in the presence of oxidant agent. N-methyl pyrrole has some advantage in contrast to pyrrole, methyl group in N-methyl pyrrole which can create the hydrophobic effect of pyrrole ring. On the other hand, this group could also increase the adhesive strength of organic compounds to the polymer surface [9-11]. Copolymerization is also very useful for tailoring diverse properties of coatings. The obtained polymer will have different properties depending on the ratio of monomer concentrations [8-11].

Solid-phase microextraction (SPME) has been successfully used as a universal tool for isolation and preconcentration of pollutants, volatile and other organic compounds from water, solid and air samples [12 and 13].

In the SPME analytes is partitioned between the sample matrix and the extraction medium (polymeric

* Corresponding author. Tel.: +989145454914; e-mail: Pirsa7@gmail.com; s.pirsa@urmia.ac.ir