Nanochemistry and biotechnology

The antioxidative effect of carbon nanospheres in organic liquids

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Research in the field of carbon nanomaterials are increasing exponentially in recent decades. The starting point for such a significant interest in the carbon nanostructures was the discovery in 1985 of fullerenes. Carbon nanospheres (CNSs) become novel interesting form of carbon nanomaterials with plenty of scantily explored properties [1].

Previously [2], it was found that CNSs reveal antioxidative action in chains termination of initiated oxidation of the benzyl alcohol.

In the present work, evaluation of the antioxidant activity (AOA) of the CNSs was carried out under benzyl alcohol autoxidation conditions at 70 °C. The products of the oxidation reactions were studied using GLC.

The investigated carbon nanoparticles have a spheroidal shape. The size of individual nanoparticles is 3...45 nm. According to photon correlation spectroscopy, particles sizes in benzyl alcohol solution were described as typical Gaussian distribution with maximum about 21 nm.

It was shown that additives of CNSs to the oxidizing medium of benzyl alcohol in the amount of $1.26 \cdot 10^{-3}$ g/l slightly reduces the rate of benzyl alcohol oxidation, and in the amount of $1.26 \cdot 10^{-2}$ g/l reduces the rate of benzyl alcohol oxidation from $3.2 \cdot 10^{-6}$ mol/(l·s) to $2.07 \cdot 10^{-6}$ mol/(l·s) (≈ 35 %). It effectively protects against oxidation of benzyl alcohol at concentrations of $1.26 \cdot 10^{-1}$ g/l.

Analysis of the research shows that the CNSs are effective inhibitors of liquid-phase oxidation of benzyl alcohol. In the future, it could be used as antioxidant additives for polymers and oils during long storage.

1. *Jariwala D., Sangwan V.K., Lauhon L.J., Marks T.J., Hersam M.C.* Carbon nanomaterials for electronics, optoelectronics, photovoltaics, and sensing // Chem. Soc. Rev. – 2013.**- 42**. – P. 2824-2860.

2. *Kyrpach K.O., Kameneva T.M., Sheludko Ye.V., Kremenitskiy V.V., Polunkin Ye.V., Zhyla R.S.* Carbon nanospheres in the chains termination of the benzyl alcohol oxidation // Kataliz i neftekhimia. – 2014. – N 23. – P. 9–14.