

## Ferrosilicates with low iron content in oxidation processes

© Evgenia A. Tarasenko,\* and Olga E. Lebedeva<sup>†</sup>

General Chemistry Department. Institute of Engineering Technologies and Natural Sciences.

Belgorod National State Research University. Pobedy St., 85. Belgorod, 308015.

Phone: +7 (422) 30-11-66. E-mail: OLebedeva@bsu.edu.ru

\*Supervising author, <sup>†</sup>Corresponding author

**Keywords:** oxidation, nitroaniline, ferrosilicates, sol-gel technique.

### Abstract

Ferrosilicates with a low (0.85-3.05% by weight) iron content were obtained by sol-gel synthesis via hydrolysis of tetraethoxysilane in an acidic medium in the presence of iron(III) nitrate and characterized. It has been established that all samples of silicates are X-ray amorphous, however the formation of a new highly dispersed phase in ferrosilicate with the maximum studied iron content was evidenced by transmission electron microscopy. This sample has a relatively smaller specific surface area and a positive electrokinetic potential at pH = 3. The efficiency of all samples is estimated in the oxidative degradation of 2-nitroaniline in presence of hydrogen peroxide. Adsorption of 2-nitroaniline on the surface of ferrosilicates was negligibly low. It was shown that in the presence of iron silicates, the substrate was degraded. The highest rate of destruction of 2-nitroaniline in the presence of hydrogen peroxide at pH = 3 was observed with the sample of iron silicate with an iron content of 3wt%. At the same time, the yield of iron in the solution was insignificant. Oxidation is supposed to occur with the participation of hydroxyl radicals, which are generated from hydrogen peroxide by ferric cations (Fenton-like process).

### References

- [1] R. Dewil, D. Mantzavinos, I. Poulios, M.A. Rodrigo. New perspectives for Advanced Oxidation Processes. *J. Environmental Management*. **2017**. Vol.195. P.93-99.
- [2] J.J. Pignatello, E. Oliveros, A. MacKay Advanced Oxidation Processes for Organic Contaminant Destruction Based on the Fenton Reaction and Related Chemistry. *Environ. Sci. Technol.* **2006**. Vol.36. No.1. P.1-84.
- [3] N. Wang, T. Zheng, G. Zhang, P. Wang. A review on Fenton-like processes for organic wastewater treatment. *J. Environmental Chemical Engineering*. **2016**. Vol.4. No.1. P.762-787.
- [4] Y. Flores, R. Flores, A.A. Gallegos. Heterogeneous catalysis in the Fenton-type system reactive black 5/H<sub>2</sub>O<sub>2</sub>. *Journal of Molecular Catalysis A: Chemical*. **2008**. Vol.281. P.184-191.
- [5] K.K. Kishibaev, K.S. Erokhin, O.E. Lebedeva, O.I. Ponomarenko, M.K. Kisibaeva. Heterogeneous catalytic oxidation of persistent organic water pollutants. *Bulletin of KazNU Ecological Series*. **2012**. Vol.2. No.34. P.38-42. (russian)
- [6] A.A. Soloveva, O.E. Lebedeva. Oxidation of mono- and dinitro-substituted phenols with hydrogen peroxide in the presence of iron (II) and (III) ions. *Chemistry for Sustainable Development*. **2010**. Vol.18. No.5. P.615-619. (russian)
- [7] C.J. Brinker, G.W. Scherer. Sol-gel Science: The Physics and Chemistry of Sol-gel Processing. *Academic Press – USA*. **1990**. 908p.
- [8] V.P. Vasiliev. Analytical chemistry (laboratory practice). Ed. by Vasilyev V.P. 3edition., Stereotype. *Moscow: Drofa*. **2006**. 414p. (russian)