

Influence of different oxidants on toxicity level of aqueous humic substances assayed by chlorophyll fluorescence of *Scenedesmus quadricauda* (Turp.)

Mikhaylov G.S., Zimbovskaya M.M., Timofeev N.P., Matorin D.N., Pankratov D.A.
Lomonosov Moscow State University, Moscow, Russia, pankratov@radio.chem.msu.ru

Keywords: ferrate, ozone, toxicity, water treatment

doi: 10.36291/HIT.2019.mikhaylov.095

Current list of water pollutants is long and includes heavy metals, organic compounds, microorganisms, etc. A common organic pollutant is humic substances (HSs), known surfactants, which creates a problem of higher metal content in water. Furthermore, HSs are polydisperse which leads to premature sorbent saturation and filter clogging, shortening their lifespan. In addition to that, humic acid salts are highly soluble in water, changing its organoleptic parameters and making it importable. Therefore, HSs removal from water is an important task for water quality improvement. An important part of water purification process intended to reduce organic compound content is its treatment with oxidizing agents.

The task of this work was to assay the process of potassium humate (concentration ranging from 0 to 250 mg l⁻¹) treatment by two oxidizing agents of different nature. Oxygen-ozone mixture was a control oxidant as it is commonly used for water purification. Aqueous ferrate-ion was used as an alternative, formed by leaching the product of self-propagating high-temperature synthesis (SHS) between iron and potassium nitrate [1]. Compared to ozone water treatment, ferrate as an oxidizing agent offers many advantages. As such, ferrates have high redox potential. Also, their reduction results in iron (III) hydroxide formation suspension able to absorb remaining pollutants making it easier to remove them by filtration.

HSs content after the oxidation was monitored by spectrophotometry and permanganate index method. It was shown that the nature of oxidizing agent affects to reaction mechanism and HSs removal effectiveness from water. Comparative assessment of aqueous HSs toxicity towards *Scenedesmus quadricauda* (Turp.) algae before and after oxidation was carried out by chlorophyll fluorescence measurement after one day long exposure of algae to the HSs solutions. It was shown that in the high HSs concentration interval (above 100 mg l⁻¹) the ozonized oxygen treatment decreases the toxicity level while ferrate-ion treatment increases the toxicity of HSs solution. In the concentration interval below 100 mg l⁻¹ both oxidants decrease the toxicity level after treatment. It was also shown that oxidation using ferrate decreases Fv/Fm ratio which indicates the decrease in the number of active photosystems. This number shows that such conditions as exposition to ferrate oxidized HSs are extreme for algae and cause it to become dormant. Therefore, as shown in the two examples of oxidants, using oxidizing agents for water treatment requires further analysis of possible consequences of HSs harsh oxidation.

Acknowledgements. The study was funded by RFBR according to the research project № 20-03-00854.

References

1. Pankratov D.A. et al. // Patent #RU 2600346.