

## **Innovation: Ecosystem health and water pollution control: studying water self-purification**

<http://5bio5.blogspot.com/2012/08/revolutionary-innovation-ecosystem.html>

\*\*

Tags: environmental health, hydrobiology, water, pollution, environmental, toxicology, self-purification, aquatic, ecosystems, sustainability, water safety,

\*\*

During the period 1998 – 2012 a series of publications (including papers and books) on aquatic ecosystems, water quality and hazard assessment were published by Dr. Sergei A. Ostroumov (Laboratory of Physico-Chemistry of Biomembranes, Faculty of Biology, M.V. Lomonosov Moscow State University, Moscow 119991, Russian Federation) and co-workers (e.g., [1-6]). His research was conducted at many institutions: at Moscow State University, Russian Academy of Sciences, University of Massachusetts (U.S.A.) , Plymouth Marine Laboratory (U.K.) , Institute of Biology of Sothern Seas (Sevastopol), and some others.

The new data generated by the experimental research of this author covered a variety of topics relevant to better insight into how aquatic ecosystem counteracts water pollution. E.g., the author discovered new facts on the roles of aquatic invertebrates that filter water and of aquatic macrophytes that contribute to a decrease in concentrations of pollutants in the aquatic environment. On the basis of his new experiments and current scientific literature, he made a fresh analysis of the complex of ecological factors and processes that contribute to improving water quality, in other words, to water self-purification. This analysis combined together the current knowledge of physical, chemical and biological processes which contribute to improving water quality.

In making this analysis, Dr. S. O. proposed to use the word 'biomachinery' [4]. It helps to emphasize the role of multi-faceted ecological mechanisms that include biological communities and biodiversity; biomachinery's function is improving water quality.

His experimental studies included the inhibitory analysis of water filtration by a number of marine and freshwater filter- feeders, e.g. new inhibitory effects of synthetic surfactants on filter-feeders were found. The organisms studied were the bivalve mollusks *Mytilus edulis*, *Mytilus galloprovincialis*, *Crassostrea gigas*, *Unio tumidus*, crustaceans *Daphnia magna*, and rotifers. Moreover, a significant series of experiments were conducted using aquatic macrophytes, e.g., *Elodea canadensis*, *Potamogeton crispus*, *Ceratophyllum demersum* and others. These macrophytes demonstrated their potential in improving water quality and in decreasing the concentrations of chemical pollutants in aquatic medium. Among the chemical pollutants studied were synthetic surfactants, detergents [1-5 ], heavy metals (in the form of water-soluble salts), and nanoparticles containing heavy metals [6].

As a result of his studies, Dr. S.O. formulated a new ecological theory of how aquatic ecosystems control, maintain and improve water quality. This theory has a number of names: the theory of biocontrol of water quality [7], the theory of multi-functional role of aquatic organisms (biota) in water self-purification [9], the theory of water self-purification, the theory of the polyfunctional role of biodiversity in water purification [2], the theory of biomachinery for maintaining water quality and natural water self-purification [4], the theory of biotic self-purification of aquatic ecosystems [8].

Among the innovations in the S.A.Ostroumov's theory as well as in the series of his publications - papers and books - was the conclusion on a fundamentally bigger role (than it

was thought before) of the community of aquatic organisms in safety and sustainability of water resources and water supply.

The theory of biomachinery was substantiated and supported in the large series of these publications.

It is logical to expect that in the case of a better knowledge of the biomachinery of water self-purification we will be able to better use the natural potential of aquatic ecosystems for maintaining and improving water quality. This may give us a new hope for a wiser management of aquatic systems. This may help us with water safety and water sustainability.

This conclusion leads to not only a fundamental change in the understanding some details of freshwater and marine ecosystems but also to a change in setting goals in management of water resources and aquatic bio-resources. The conclusions mean that without healthy aquatic ecosystems and healthy state of aquatic organisms it is impossible to maintain safe water supply. It makes the protection of biodiversity and healthy state of aquatic organisms not only a humanistic goal but also a rigid prerequisite for having water of acceptable quality. This is a fundamental change in goals and perhaps in practice of environmental and resource management of to-day and to-morrow.

#### **Evidence of usefulness: citation**

These papers are a continuation of a series of other publications of the same author, Dr. S.O., that were accepted well by the international scientific community and were cited in various parts of the world: Europe, North America, India, China, and Australia [ 10 ]. Some of the papers of this series were often cited also in dissertations [11].

#### **References.**

1. Ostroumov S.A. Inhibitory analysis of top-down control: new keys to studying eutrophication, algal blooms, and water self-purification. – *Hydrobiologia*. 2002, vol. 469, p. 117-129. <http://www.scribd.com/doc/52598579/>; DOI: 10.1023/A:1015559123646
2. Ostroumov S.A. Polyfunctional role of biodiversity in processes leading to water purification: current conceptualizations and concluding remarks. - *Hydrobiologia*. 2002. V. 469 (1-3): 203-204. <http://www.scribd.com/doc/52627327/2H469p203-Polyfunctional-role-w-Addendum>; DOI: 10.1023/A:1015555022737
3. Ostroumov S.A. *Biological Effects of Surfactants*. CRC Press. Taylor & Francis. Boca Raton, London, New York. 2006. 279 p. <http://www.citeulike.org/user/ATP/article/9744280>; [http://www.goodreads.com/book/show/1527248.Biolo\\_Eff\\_of\\_Surf](http://www.goodreads.com/book/show/1527248.Biolo_Eff_of_Surf); <http://www.scribd.com/doc/46637373/>;
4. Ostroumov S.A. Biomachinery for maintaining water quality and natural water self-purification in marine and estuarine systems: elements of a qualitative theory. - *International Journal of Oceans and Oceanography*. 2006. Volume 1, No.1. p.111-118. [ISSN 0973-2667]. [www.vliz.be/imisdocs/publications/100141.pdf](http://www.vliz.be/imisdocs/publications/100141.pdf);
5. Ostroumov S.A., Widdows J. Inhibition of mussel suspension feeding by surfactants of three classes. - *Hydrobiologia*. 2006. Vol. 556, No.1. P. 381 – 386. <http://www.scribd.com/doc/45958156/>; [scribd.com/doc/59544597/](http://www.scribd.com/doc/59544597/); DOI: 10.1007/s10750-005-1200-7
- 6 Johnson M. E., Ostroumov S. A., Tyson J. F., Xing B. Study of the interactions between *Elodea canadensis* and CuO nanoparticles. - *Russian Journal of General Chemistry*, 2011, Vol. 81, No. 13, pp. 2688-2693, doi:10.1134/S107036321113010X;
7. Ostroumov S. A. Biocontrol of Water Quality: Multifunctional Role of Biota in Water Self-Purification. – *Russian Journal of General Chemistry*, 2010, Vol. 80, No. 13, pp. 2754–2761; Abstract: <http://www.chemeurope.com/en/publications/211554/biocontrol-of-water-quality-multifunctional-role-of-biota-in-water-self-purification.html>;

Abstract: <http://www.scribd.com/doc/75101299/> Full

text: <http://www.scribd.com/doc/49131150/>; <http://www.scribd.com/doc/73175163/>; DOI: 10.1134/S1070363210130086;

8. Ostroumov S.A. On the Biotic Self-purification of Aquatic Ecosystems: Elements of the Theory. - Doklady Biological Sciences, 2004, v.396, No.1-6; pp.206-211. Full text: <http://www.scribd.com/doc/48099028/> DOI: 10.1023/B:DOBS.0000033278.12858.12

9. Ostroumov S. A. On the Multifunctional Role of the Biota in the Self-Purification of Aquatic Ecosystems. - Russian Journal of Ecology, 2005. Vol. 36, No. 6, P. 414-420. <http://www.scribd.com/doc/45572968/>; <http://www.scribd.com/doc/49131150/>; DOI: 10.1007/s11184-005-0095-x

10. Citation in scientific articles in reviewed journals worldwide : <http://www.scribd.com/doc/57036289/>

11. Citation in dissertations: <http://www.scribd.com/doc/80743444/>

**\*\* Some relevant sites:**

First opinion paper and review paper in which a multi-aspect innovative analysis of the ecological role of organisms that filter water was made: <http://5bio5.blogspot.com/2012/08/first-opinion-paper-and-review-paper-in.html>

\*\*

Breakthrough, ecology paradigm shift: new conceptualization of fundamentals of ecology, especially aquatic ecology: Contribution to development of a new theory of ecological mechanism of water quality control: <http://5bio5.blogspot.com/2012/08/ecology-paradigm-shift-new.html>

<http://5bio5.blogspot.com/2012/08/concept-of-aquatic-biota-as-labile-and.html>

\*\*

WATER SUSTAINABILITY, SAFETY: discovery of a key factor to water sustainability and safety (here you will also find some relevant sites in French, Spanish, Japanese, Chinese, Korean): <http://5bio5.blogspot.com/2012/07/water-sustainability-safety-discovery.html>

\*\*

Water filtering activity of filter-feeders: a review paper with innovative analysis:

<http://5bio5.blogspot.com/2012/08/water-filtering-activity-of-filter.html>

(Ostroumov S.A. Some aspects of water filtering activity of filter-feeders.- Hydrobiologia. 2005)

\*\*

new theory of ecological mechanism of water quality control:

<http://5bio5.blogspot.com/2012/08/new-theory-of-ecological-mechanism-of.html>

\*\*

Water Biomachinery: Innovative conceptualization. A step to a silent revolution in ecology, environmental science, and water science.

<http://5bio5.blogspot.com/2012/07/innovative-conceptualization-of.html>

\*\*

In user-friendly, reader-friendly format, on innovations, discoveries, breakthroughs, findings in areas of ecology, environment, water safety: Blog post titles, key words, web addresses of the sites: <http://5bio5.blogspot.com/2012/07/user-friendly-info-on-innovations.html>

\*\*

WATER and ecosystem's values. SELF-RELIANCE:

<http://5bio5.blogspot.com/2012/07/water-and-ecosystems-values-self.html>

\*\*

\*\*

*"Knowing is not enough; we must apply.*

*Willing is not enough, we must do."*

\*\*

**Mini-Abstract in Russian:**

Результаты изучения научных основ экологической безопасности источников водоснабжения - поверхностных водных экосистем-

<http://5bio5.blogspot.com/2012/08/revolutionary-innovation-ecosystem.html>

<http://scipeople.ru/group/366/topic/6469/#.UC8Weao-9i4.twitter>

**Key words:**

environmental health, hydrobiology, water, pollution, environmental, toxicology, self-purification, aquatic, ecosystems, sustainability, water safety, biota, filter-feeders, suspension feeders, surfactants, detergents, bivalve, mollusks, *Mytilus edulis*, *Mytilus galloprovincialis*, *Crassostrea gigas*, *Unio tumidus*, *Daphnia magna*, rotifers, aquatic macrophytes, *Elodea canadensis*, *Potamogeton crispus*, *Ceratophyllum demersum*,  
Water, sustainability, water safety, quality, self-purification, supply, ecosystems, freshwater, marine, estuarine, systems, fresh, modern, analysis, management,  
نده های آب، آلا ی ت آب، آلودگی ی ف ی ک، ecology، ه آب ی س ت م، تص ف ی س ت م سلامت اکوس ی ان، اکوس ی ا ب ز ی منابع آب، بوم شناس الملوثات، الموارد المائية، علم البيئة المائية، النظم، نوعية المياه، تلوث المياه، ایכות המים، זיהום، hydrobiology، ממים، מימיים אקולוגיה، מערכות אקולוגיות הבריאות של מערכות אקולוגיות מים، מזהמים، מים ומשאבים، מימיים אקולוגיה، מערכות אקולוגיות הבריאות של מערכות אקולוגיות מים، טיהור מים، 水的質量， 水體污染， 污染物， 水資源， 水生生態， 生態系統 生態系統的健康， 水的淨化， 水的质量， 水体污染， 污染物， 水资源， 水生生态， 生态系统 生态系统的健康， 水的净化， ποιότητα των υδάτων, ρύπανση των υδάτων, ρύπων, υδάτινων πόρων, υδατική οικολογία, οικοσυστήματα η υγεία των οικοσυστημάτων, καθαρισμού του νερού, kwaliteit van het water, waterverontreiniging, stoffen, watervoorraden, aquatische ecologie, ecosystemen de gezondheid van ecosystemen, waterzuivering, la calidad del agua, la contaminación del agua, contaminantes, los recursos hídricos, ecología acuática, los ecosistemas la salud de los ecosistemas, de purificación de agua, Wasserqualität, Wasserverschmutzung, Schadstoffe, Wasserressourcen, Aquatische, Ökologie, Ökosysteme, die Gesundheit der Ökosysteme, Wasserreinigung, загрязнение воды, поллютанты, водные ресурсы, водная экология, экосистемы, здоровье экосистем, очищение воды, S.A.Ostroumov, С.А.Остроумов, качество воды, qualité de l'eau, pollution de l'eau, polluants, ressources en eau, l'écologie aquatique, les écosystèmes la santé des écosystèmes, purification de l'eau,