

CURRICULUM VITAE

Dr. Sergey Polyakov

906 Spruce St.

Ashland, PA 17291

E-mail: spolyakov@uspolyresearch.com

EDUCATION

- PhD in Chemical Engineering (1982, Water Reclamation in Space Technology), Institute of Biomedical Problems, Moscow, Russia
- M.S./B.S. in Electrophysical Engineering (1974), Kharkov Polytechnic Institute, Kharkov, Ukraine

PROFESSIONAL EXPERIENCE

- 2002 - present Researcher, USPolyResearch, PA
- 1998 - 2001 Engineer, MasTec North America, Leavenworth, WA
- 1992 - 1998 Scientific Consultant, Institute of Biomedical Problems, Moscow, Russia
- 1987 - 1992 Senior Researcher, Institute of Nuclear Power Engineering, Moscow, Russia
- 1985 - 1987 Senior Researcher, Institute of Electrical Engineering, Moscow, Russia
- 1978 - 1985 Senior/Lead Research Engineer, Institute of Biomedical Problems, Moscow, Russia
- 1975 - 1978 Engineer/Technologist, Computer Manufacturing Plant, Moscow, Russia
- 1974 - 1975 Research Engineer, Moscow Institute of Chemical Engineering, Moscow, Russia

RESEARCH INTERESTS AND ACTIVITIES

Life-support systems (LSS) design

- Factors determining the configuration of LSSs
- Factors determining the choice of separation units (water, air) in LSSs
- Interrelation between main functional units in LSSs
- Optimization of LSS operation and design with regard to water/air quality and capital and operational costs

Separation Processes

- Fouling and concentration polarization in reverse osmosis and nanofiltration elements
- Gel formation in ultrafiltration elements
- Particle deposition and mechanism of selectivity of microfiltration membranes
- Particle collection with reversible adsorption in depth filtration
- Removal of solutes from highly concentrated solutions by low- and high-temperature evaporation (membrane, wick, ceramic)
- Air cleaning/revitalization (oxygen recovery, removal of carbon oxides, particle removal) by gas membranes
- Removal of radioactive pollutants from contaminated water
- Treatment of oil-, petroleum-, and grease-containing effluents

MAJOR ACHIEVEMENTS

- Studied the feasibility of various methods (reverse osmosis, nanofiltration, ultrafiltration, microfiltration, low-temperature membrane evaporation, wick air evaporation, evaporation across ceramic membrane, depth filtration, adsorption) with respect to water recovery from human wastes
- Designed a hygiene water reclamation subsystem that used depth filtration, reverse osmosis, and adsorption, which was a part of a complex water-recovery and air-revitalization system for long-duration space flights
- Studied the influence of various pollutants fallen into human wastes, on the performance of the water recovery system in long-term ground-based, closed-chamber experiments. The results were used to formulate the requirements for hygiene care means, dishwash and laundry detergents, food, clothes, and so on, as well as to predict the lifetime of the separation units
- Using the mathematical models describing the operation of the depth filtration, reverse osmosis, and adsorption units, developed an algorithm optimizing the design of the hygiene water reclamation subsystem
- Developed simple approximate methods for calculating the concentration polarization in various reverse osmosis elements (flat channel, tubular, channel with a turbulence promoter, and so forth)
- Developed simple approximate methods for predicting the gel formation in ultrafiltration elements
- Developed a kinetic model of depth filtration with reversible adsorption that predicts the influence of electrokinetic, technological, and particle-size parameters on the filter performance
- Developed mathematical methods for designing semicontinuous and batch membrane installations
- Designed a simple, membrane test cell for determining the true values of membrane selectivities and production rates, in which concentration polarization and gel formation were reduced to a practically zero level
- Investigated the structure of polyvinyltrimethylsilane membranes and suggested how to considerably improve their selectivity and permeability with respect to oxygen. Designed a gas-separation module for a multiple-stage oxygen-enriching system for closed chambers like military headquarters (in case of nuclear, biological, or chemical attacks)
- Studied the removal of radioactive pollutants from highly diluted water by various separation methods to design plants for water supply of crews working in contaminated areas. Designed cheap mobile setups producing clean and safe water.
- Studied the membrane-based technology of treating effluents containing oil, grease, and petroleum contaminants and designed a process in which the ultrafiltration concentrate was used as a fuel in furnaces

ACTIVITY IN SCHOLARLY JOURNALS

- Chief English Language and Scientific Editor (1994-1998) in Theoretical Foundations of Chemical Engineering (Teoreticheskie Osnovy Khimicheskoi Tekhnologii) and Doklady Chemical Technology (Chemical Technology Reports)
- Reviewer for Journal of Membrane Sciences and Theoretical Foundations of Chemical Engineering.

TEACHING ACTIVITY

- Physics (1974 – 1975)
- State-of the art in membrane technology (separate lectures for membrane specialists in 1983 – 1995)

SCIENTIFIC PAPERS
(partial list)

Reports on water reclamation life support system design

- S.V. Polyakov, E.D. Maksimov, E.N. Starikov, Yu.E. Sinyak, On the design of a wash wastewater treatment unit for interplanetary manned spaceships/45th International Astronautical Congress, Jerusalem (Israel), October 9-14, 1994, p. 33.
- Yu.E. Sinyak, V.D. Volgin, S.V. Polyakov et al., Medical and technical justification of a complex water recovery system based on membrane technology for currently orbiting, long-duration space stations, Moscow: Institute of Biomedical Problems, 1979, report no. 4885, 95 p.
- Yu.E. Sinyak, V.D. Volgin, S.V. Polyakov et al., Development of methods for designing membrane separators with regard to water reclamation systems, Moscow: Institute of Biomedical Problems, 1980, report no. O-1387, 101 p.
- Yu.E. Sinyak, V.D. Volgin, S.V. Polyakov et al., R & D of preserver chemical formulas, methods of preserving human wastes in closed chambers, and water reclamation systems technical requirements, Moscow: Institute of Biomedical Problems, 1982, report no. 5429, 215 p.
- Yu.E. Sinyak, V.D. Volgin, S.V. Polyakov et al., Research of reverse osmosis reclamation of water from closed chamber human wastes, Moscow: Institute of Biomedical Problems, 1983, report no. 5651, 74 p.
- Yu.E. Sinyak, V.D. Volgin, S.V. Polyakov et al., Development of reverse osmosis water reclamation from hygiene wastewaters and its hygiene estimation, Moscow: Institute of Biomedical Problems, 1983, report no. 5720, 59 p.
- N.F. Batushkina, S.V. Polyakov, S.P. Laziev, New method of studying the concentration field in water reclamation membrane separators/Problems of Current Concern in Space Biology and Medicine, Moscow: Institute of Biomedical Problems, 1980.

Journal papers

- Mirsaidov, U., Timashev, S. F., Polyakov, Yu. S., Misurkin, P. I., Musaev, I., Polyakov, S. V., Analytical Method for Parameterizing the Random Profile Components of Nanosurfaces Imaged by Atomic Force Microscopy/Analyst, 2011, vol. 136, pp. 570-576.
- Yu.S. Polyakov, I. Musaev, S.V. Polyakov, Closed Bioregenerative Life Support Systems: Applicability to Hot Deserts/Advances in Space Research, 2010, vol. 46, no. 6, pp. 775-786.
- Yu.S. Polyakov, D.A. Kazenin, E.D. Maksimov, S.V. Polyakov, Kinetic Model of Depth Filtration with Reversible Adsorption/Theoretical Foundations of Chemical Engineering, 2003, vol. 37, no. 5, pp. 439-446.
- V.S. Polyakov, S.V. Polyakov, On the calculation of RO plants with spiral-wound membrane elements/Desalination, 1996, vol. 104, pp. 215-226.
- S.V. Polyakov, E.D. Maksimov, V.S. Polyakov, One-dimensional microfiltration models/Theoretical Foundations of Chemical Engineering, 1995, vol. 29, no. 4, pp. 357-361.
- V.S. Polyakov, E.D. Maksimov, S.V. Polyakov, Mathematical Modeling of Crossflow Microfiltration /Theoretical Foundations of Chemical Engineering, 1995, vol. 29, no. 3, pp. 300-308.
- S.V. Polyakov, F.N. Karelin, Turbulence promoter geometry: its influence on salt rejection and pressure losses of a composite-membrane spiral wound module/J. Membrane Sci., 1992, vol. 75, pp. 205-211.
- S.V. Polyakov, Concentration polarization in narrow channel with semipermeable walls and turbulizer/Theoretical Foundations of Chemical Engineering, 1992, vol. 26, no. 4, pp. 440-444.
- S.P. Samsonova, S.V. Polyakov, Design of UF plants for the treatment of waste detergent solutions/Vodosnabzhen. Sanitar. Tekhn. (Water Supply and Sanitary Equipment), 1991, no. 3, pp. 28-30.

- S.V. Polyakov, F.N. Karelin, A.A. Askerniya, S.B. Milovanov, A.I. Bon, I.S. Belyaev, Determination of RO Composite Membrane Performance Characteristics/Khim. Tekhnol. Vody (Water Chemistry and Treatment), 1989, vol. 11, no. 5, pp. 424–427.
- S.V. Polyakov, E.D. Maksimov, Calculation of the ultrafiltration process in a flat channel with a cake forming on the membrane surface, Theoretical Foundations of Chemical Engineering, 1986, vol. 20, no. 4, pp. 270-275.
- S.V. Polyakov, V.D. Volgin, Yu.E. Sinyak, E.D. Maksimov, V.I. Novikov, Reclamation of wash water in prolonged space flights by reverse osmosis, Kosmicheskaya Biologiya I Aviakosmicheskaya Meditsina (Space Biology and Airspace Medicine), 1986, no. 2, pp. 78-80.
- S.V. Polyakov, E.D. Maksimov, V.D. Volgin, Design of semicontinuous and batch membrane installations /Theoretical Foundations of Chemical Engineering, 1985, vol. 19, no. 4, pp. 286-293.
- S.V. Polyakov, V.D. Volgin, N.F. Starikova, Yu. E. Sinyak, S.P. Laziev, Consideration of the effect of concentration polarization in reverse osmosis and ultrafiltration research, Theoretical Foundations of Chemical Engineering, 1982, vol. 16, no. 4, pp. 319-325.
- S.V. Polyakov, V.D. Volgin, E.D. Maksimov, Effect of concentration on the parameters used in mathematical description of desalination by reverse osmosis/Khim. Tekhnol. Vody (Water Chemistry and Treatment), 1982, vol. 4, no. 2, pp. 107–111.
- S.V. Polyakov, V.D. Volgin, E.D. Maksimov, S.P. Laziev, Methods of calculating the concentration field in unstirred reverse osmosis cells/Khim. Tekhnol. Vody (Water Chemistry and Treatment), 1982, vol. 4, no. 3, pp. 203-208.
- S.V. Polyakov, V.D. Volgin, E.D. Maksimov, Yu. E. Sinyak, Calculation of concentration polarization in reverse osmosis plants with flat channel membrane elements/Khim. Tekhnol. Vody (Water Chemistry and Treatment), 1982, vol. 4, no. 4, pp. 299-304.
- S.V. Polyakov, V.D. Volgin, E.D. Maksimov, Calculation of concentration polarization in reverse osmosis and ultrafiltration plants with tubular membrane elements, Inzhenerno-Fizicheskii Zhurnal (Journal of Engineering Physics and Thermophysics (JEPTER)), 1982, vol. 42, no. 6.
- S.V. Polyakov, V.D. Volgin, E.D. Maksimov, Yu.E. Sinyak, Calculation of concentration polarization in reverse osmosis and ultrafiltration plants with flat channel membrane elements, Inzhenerno-Fizicheskii Zhurnal (Journal of Engineering Physics and Thermophysics (JEPTER)), 1982, vol. 42, no. 5.
- V.D. Volgin, S.V. Polyakov, L.G. Shadrin, On the existence of through pores in gas separation polyvinyltrimethylsilane membranes, Theoretical Foundations of Chemical Engineering, 1978, vol. 12, no. 4.
- V.D. Volgin, S.V. Polyakov, L.G. Shadrin, Additivity of the permeability of gas separation membranes, Theoretical Foundations of Chemical Engineering, 1978, vol. 12, no. 3, pp. 232-233.

Some conference papers on membrane technology applications

- S.V. Polyakov, E.D. Maksimov, V.D. Volgin, V.I. Novikov, Yu.E. Sinyak, Application of reverse osmosis to laundry wastewater treatment/Theory and Equipment for Selective Separation of Liquid Mixtures Using Semipermeable Membranes, Moscow: ZINTIKHIMNEFTEMASH, 1983.
- E.D. Maksimov, S.V. Polyakov, V.D. Volgin, Yu.E. Sinyak, Application of ultrafiltration to the removal of iron and suspended colloids from water/Moscow: ZINTIKHIMNEFTEMASH, 1981, Ser. XM-1, no. 12.