

Curriculum Vitae

BAICANG LIU, Ph.D., Professor

No.2, Section 2, Chuanda Road

Tel: +86-28-85995998

College of Architecture and Environment

Fax: +86-28-62138325

Institute of New Energy and Low-Carbon Technology

E-mail: bcliu@scu.edu.cn

Sichuan University, Chengdu, PR China. 610207

<http://www.baicangliu.org>

I. EDUCATION

2019.2-2019.2 Short Visiting, Harvard University, USA

2011 – 2012 Visiting Scholar, Georgia Institute of Technology, USA

2004 – 2009 Ph.D., Environmental Engineering, Harbin Institute of Technology, PR China

2000 – 2004 B.S., Environmental Engineering, Wuhan University, PR China

II. RESEARCH INTERESTS

Water and Wastewater Treatment Processes; Advanced Membranes for Water and Wastewater Reuse; Shale Gas Wastewater Reuse; Water-Energy Nexus.

III. AWARDS & HONORS

- Beijing Capital Group *Gold Medal* for Technological Progress in 2021
- Nanjing University Zijin Quanxing Award in 2020
- Outstanding Scientific Research Talent Award of Sichuan University in 2020
- Royal Society of Chemistry 2020 RSC Science Video Outstanding Instructor Award
- Thirteenth national college student energy conservation and emission reduction social practice and science and technology competition first prize instructor, 2020

- Good Future Scholar of Sichuan University in 2019
- Sichuan University excellent undergraduate graduation thesis (design) third prize instructor, 2019
- Sichuan University excellent undergraduate student thesis (design) second prize instructor, 2018
- Sichuan University excellent undergraduate student thesis (design) third prize instructor, 2017
- Sichuan University excellent undergraduate student thesis (design) first prize instructor, 2016
- Classroom Teaching Quality Excellence Award for undergraduate teaching work in 2014
- Undergraduate Mentor Award of science and technology practice, 2012, 2014
- Outstanding Young Teachers Award by Sichuan University, 2009,2012,2013
- Distinguished Ph.D. Graduation Award by Heilongjiang Province, 2009
- Ph.D. Visiting Scholarship Funded by Ministry of Education of the PR China, 2007-2008

IV. PUBLICATIONS

Articles

119. Zhou, G.; Wu, Q.; Wei, X.-F.; Chen, C.; Ma, J.; Crittenden, J. C.; **Liu, B.***, Tracing microplastics in rural drinking water in Chongqing, China: Their presence and pathways from source to tap. *Journal of Hazardous materials* 2023, 459, 132206.

118. Wang, L.; Chen, C.; Tang, Y.; **Liu, B.***, Efficient nitrogen removal by a novel extreme strain, *Pseudomonas reactans* WL20-3 under dual stresses of low temperature and high alkalinity: Characterization, mechanism, and application. *Bioresource Technology* 2023, 385, 129465.

117. Jiao, J.; Li, Y.*; Luo, T.*; Song, Q.; Liu, L.; **Liu, B.**, High performance of graphene oxide (GO)-thiosemicarbazide (TSC) modified membrane for pervaporation desalination with TSC performed as a novel cross-linker. *Separation and Purification Technology* 2023, 124415.

116. Wang, L.; Chen, C.; Tang, Y.; **Liu, B.***, A novel hypothermic strain, *Pseudomonas reactans* WL20-3 with high nitrate removal from actual sewage, and its synergistic resistance mechanism for efficient nitrate removal at 4 °C. *Bioresource Technology* 2023, 385, 129389.

115. Zhang, N.; Zhang, J.; Yang, X.; Zhou, C.; Zhu, X.; **Liu, B.**; Chen, Y.; Lin, S.; Wang, Z.*; Janus Membrane with Hydrogel-like Coating for Robust Fouling and Wetting Resistance in Membrane Distillation. *ACS Applied Materials & Interfaces* 2023, 15, (15), 19504-19513.
114. Liu, Y. #; An, N. #; Tian, L.; Yang, P.; Wang, W.*; **Liu, B.***, Multifunctional carbon aerogel granules designed for column reactor for efficient treatment of shale gas flowback and produced water. *Chemical Engineering Journal* 2023, 459, 141544.
113. Ji, X.; Tiraferri, A.; Zhang, X.; Liu, P.; Gan, Z.; Crittenden, J. C.; Ma, J.; **Liu, B.***, Dissolved organic matter in complex shale gas wastewater analyzed with ESI FT-ICR MS: Typical characteristics and potential of biological treatment. *Journal of Hazardous materials* 2023, 447, 130823.
112. Zhong, C.*; Hou, D.; **Liu, B.**; Zhu, S.; Wei, T.; Gehman, J.; Alessi, D. S.; Qian, P.-Y.*; Water footprint of shale gas development in China in the carbon neutral era. *Journal of Environmental Management* 2023, 331, 117238.
111. Wu, Q.; Chen, C.; Zhang, Y.; Tang, P.; Ren, X.; Shu, J.; Liu, X.; Cheng, X.; Tiraferri, A.; **Liu, B.***, Safe purification of rural drinking water by biological aerated filter coupled with ultrafiltration. *Science of the Total Environment* 2023, 868, 161632.
110. Chen, G.; Xie, W.; Chen, C.; Wu, Q.; Qin, S.; **Liu, B.***, Preparation of High Flux Chlorinated Polyvinyl Chloride Composite Ultrafiltration Membranes with Ternary Amphiphilic Copolymers as Anchor Pore-Forming Agents and Enhanced Anti-Fouling Behavior. *Industrial & Engineering Chemistry Research* 2023, 62, (3), 1390-1403.
109. Song, Q.; Li, Y.*; Xie, W.; Gao, C.; Liu, L.; **Liu, B.***, Catalytic degradation of carbamazepine by metal organic frameworks (MOFs) derived magnetic catalyst Fe@PC in an electro-Fenton coupled membrane filtration system: Performance, pathway, and mechanism. *Separation and Purification Technology* 2023, 309, 122988.
108. Xie, W.; Chen, G.; Chen, C.; Song, Z.; Wu, Q.; Tian, L.; Dai, Z.; Liang, S.; Tang, P.; Zhang, X.; Ma, J.; **Liu, B.***, Polydopamine/ polyethyleneimine/ MOF ternary-coated poly (vinyl chloride) nanocomposite membranes based on green solvent for shale gas wastewater treatment. *Journal of Membrane Science* 2023, 665, 121100.
107. Zhou, G.; Wu, Q.; Tang, P.; Chen, C.; Cheng, X.; Wei, X.; Ma, J.; **Liu, B.***, How Many Microplastics Do We Ingest When Using Disposable Drink Cups? *Journal of Hazardous Materials.* 2023, 441, 129982.

106. Wang, X.-S.; Liu, Y.-L.; Li, M.; Song, H.; Huang, X.; Gao, Z.; Zhang, J.; Cui, C.-W.; **Liu, B.-C.**; Ma, J.; Wang, L.*, Occurrence of Iodophenols in Aquatic Environments and the Deiodination of Organic Iodine with Ferrate(VI). *Environmental Science & Technology* 2022, 56, (22), 16104-16114.
105. Yang, Y.; Tian, L.; Borch, T.; Tariq, H.; Li, T.*; Bai, Y.; Su, Y.; Tiraferri, A.; Crittenden, J.; **Liu, B.***, Safety and Technical Feasibility of Sustainable Reuse of Shale Gas Flowback and Produced Water after Advanced Treatment Aimed at Wheat Irrigation. *ACS Sustainable Chemistry & Engineering*. 2022, 10 (38), 12540-12551.
104. Tian, L.; Liu, Y.; Tang, P.; Yang, Y.; Wang, X.; Chen, T.; Bai, Y.; Tiraferri, A.; **Liu, B.***, Lithium extraction from shale gas flowback and produced water using H1.33Mn1.67O4 adsorbent. *Resources, Conservation and Recycling* 2022, 185, 106476.
103. Xie, W.; Tian, L.; Tang, P.; Cui, J.; Wang, T.; Zhu, Y.; Bai, Y.; Tiraferri, A.; Crittenden, J.C.; **Liu, B.***, Shale gas wastewater characterization: comprehensive detection, evaluation of valuable metals, and environmental risks of heavy metals and radionuclides. *Water Research*. 2022, 118703.
102. Song, Z.; Tiraferri, A.; Yuan, R.; Cao, J.; Tang, P.; Xie, W.; Crittenden, J.C.; **Liu, B.***, Theoretical evaluation of the evaporation rate of 2D solar-driven interfacial evaporation and of its large-scale application potential. *Desalination*. 2022, 537, 115891.
101. Liang, J. #; Xie, T. #; Liu, Y.; Wu, Q.; Bai, Y.; **Liu, B.***, Granular activated carbon (GAC) fixed bed adsorption combined with ultrafiltration for shale gas wastewater internal reuse. *Environmental Research* 2022, 212, 113486.
100. Tang, P.; Xie, W.; Tian, L.; Tan, B.; Zhang, Y.; Yang, Z.*; Chen, C.; Zhang, W.; **Liu, B.***, Oxidation-biotreatment-membrane combined process for external reuse of shale gas wastewater. *Separation and Purification Technology* **2022**, 120920.
99. Luo, J.*; Maier, R.M.; Yu, D.; **Liu, B.**; Zhu, N.; Amy, G.L.; Crittenden, J.C., Double-network Hydrogel: A Potential Practical Adsorbent for Critical Metals Extraction and Recovery from Water. *Environmental Science & Technology* **2022**, 56, (8), 4715-4717.
98. Li, Y.; Jiao, J.; Wu, Q.; Song, Q.; Xie, W.; **Liu, B.***, Environmental applications of graphene oxide composite membranes. *Chinese Chemical Letters* **2022**, In Press (doi.org/10.1016/j.ccllet.2022.01.034).
97. Wei, X.-F.*; Capezza, A. J.; Cui, Y.; Li, L.; Hakonen, A.; **Liu, B.**; Hedenqvist, M. S.*, Millions of microplastics released from a biodegradable polymer during biodegradation/enzymatic hydrolysis. *Water Research* **2022**, 211, 118068.

96. Zhao, Y.; Yang, Q.; Yan, B.; **Liu, B.**; Gu, Y.; Lin, Y.; Shang, J.; Liu, W.; Chen, S.*; Lan, J.*, Aminated Polyacrylonitrile Nanofiber Membranes for the Removal of Organic Dyes. *ACS Applied Nano Materials* **2022**, 5, (1), 1131-1140.
95. Liu, Y.; Wu, Q.; Chen, C.; Li, T.; Liu, S.; He, Q.; Yang, P.*; Bai, Y.; **Liu, B.***, An efficient system of aerogel adsorbent combined with membranes for reuse of shale gas wastewater. *Desalination* **2022**, 526, 115545.
94. Liu, X.; Tang, P.; Liu, Y.; Xie, W.; Chen, C.; Li, T.; He, Q.; Bao, J.; Tiraferri, A.; **Liu, B.***, Efficient removal of organic compounds from shale gas wastewater by coupled ozonation and moving-bed-biofilm submerged membrane bioreactor. *Bioresource Technology*. **2022**, 344, 126191.
93. Xie, W.; Tang, P.; Wu, Q.; Chen, C.; Song, Z.; Li, T.; Bai, Y.; Lin, S.; Tiraferri, A.; **Liu, B.***, Solar-driven desalination and resource recovery of shale gas wastewater by on-site interfacial evaporation. *Chemical Engineering Journal* **2022**, 428, 132624.
92. Tang, P.; **Liu, B.***; Xie, W.; Wang, P.; He, Q.; Bao, J.; Zhang, Y.*; Zhang, Z.; Li, J.; Ma, J., Synergistic mechanism of combined ferrate and ultrafiltration process for shale gas wastewater treatment. *Journal of Membrane Science* **2022**, 641, 119921.
91. Tang, P.; Xie, W.; Tiraferri, A.; Zhang, Y.; Zhu, J.; Li, J.; Lin, D.; Crittenden, J. C.; **Liu, B.***, Organics removal from shale gas wastewater by pre-oxidation combined with biologically active filtration. *Water Research* **2021**, 196, 117041.
90. Tang, P.; Shi, M.; Li, X.; Zhang, Y.; Lin, D.; Li, T.; Zhang, W.; Tiraferri, A.; **Liu, B.***, Can pre-ozonation be combined with gravity-driven membrane filtration to treat shale gas wastewater? *Science of the Total Environment* **2021**, 797, 149181.
89. Hu, M.; Wu, Q.; Chen, C.; Liang, S.; Liu, Y.; Bai, Y.; Tiraferri, A.; **Liu, B.***, Facile preparation of antifouling nanofiltration membrane by grafting zwitterions for reuse of shale gas wastewater. *Separation and Purification Technology* **2021**, 276, 119310.
88. Liu, Y.; Tang, P.; Zhu, Y.; Xie, W.; Yang, P.*; Zhang, Z.; **Liu, B.***, Green aerogel adsorbent for removal of organic compounds in shale gas wastewater: High-performance tuning and adsorption mechanism. *Chemical Engineering Journal* **2021**. 416, 129100.
87. Xie, W.; Tiraferri, A.; Ji, X.; Chen, C.; Bai, Y.; Crittenden, J.; **Liu, B.***, Green and sustainable method of manufacturing anti-fouling zwitterionic polymers-modified poly(vinyl chloride) ultrafiltration membranes. *Journal of Colloid and Interface Science* **2021**, 591, 343-351.

86. Xie, W.; Li, T.; Tiraferri, A.; Drioli, E.; Figoli, A.; Crittenden, J. C.; **Liu, B.***, Toward the Next Generation of Sustainable Membranes from Green Chemistry Principles. *ACS Sustainable Chemistry & Engineering* **2021**, 9, (1), 50-75. **(Front Cover)**
85. Tang, P.; Li, J.; Li, T.; Tian, L.; Sun, Y.; Xie, W.; He, Q.; Chang, H.; Tiraferri, A.; **Liu, B.***, Efficient integrated module of gravity driven membrane filtration, solar aeration and GAC adsorption for pretreatment of shale gas wastewater. *Journal of Hazardous materials* **2021**, 405, 124166.
84. Sun, Y.; Wu, M.; Tong, T.; Li, P.; Tang, P.; Gan, Z.; Yang, P.*; He, Q.; **Liu, B.***, Organic compounds in Weiyuan shale gas produced water: Identification, detection and rejection by ultrafiltration-reverse osmosis processes. *Chemical Engineering Journal* **2021**, 412, 128699.
83. Peng, H.#; Yan, B.#; Jiang, M.; **Liu, B.**; Gu, Y.; Yao, G.; Zhang, Y.; Ye, L.; Bai, X.; Chen, S.*. A coral-like polyaniline/barium titanate nanocomposite electrode with double electric polarization for electrochromic energy storage applications. *Journal of Materials Chemistry A* **2021**, 9, (3), 1669-1677.
82. Novichkova, A.; Shang, W.; Yang, Y.; Qiao, X.; Tang, Y.; **Liu, B.***, Effect of Ultrafiltration–Reverse-Osmosis-Treated Shale Gas Wastewater on Seed Germination and Plant Growth. *Energy & Fuels* **2021**, 35, (2), 1629-1637.
81. Chang, H.; **Liu, B.***; Zhang, Z.; Pawar, R.; Yan, Z.; Crittenden, J. C.; Vidic, R. D.*. A Critical Review of Membrane Wettability in Membrane Distillation from the Perspective of Interfacial Interactions. *Environmental Science & Technology* **2021**, 55, (3), 1395-1418. **(Front Cover)**
80. Xie, W.; Tiraferri, A.; **Liu, B.***; Tang, P.; Wang, F.; Chen, S.; Figoli, A.; Chu, L.-Y., First Exploration on a Poly(vinyl chloride) Ultrafiltration Membrane Prepared by Using the Sustainable Green Solvent PolarClean. *ACS Sustainable Chemistry & Engineering* **2020**, 8, (1), 91-101. **(Front Cover)**
79. Wu, Q.; Tiraferri, A.; Li, T.; Xie, W.; Chang, H.; Bai, Y.; **Liu, B.***, Superwetable PVDF/PVDF-g-PEGMA Ultrafiltration Membranes. *ACS Omega* **2020**, 5, (36), 23450-23459.
78. Tian, L.#; Chang, H.#; Tang, P.; Li, T.; Zhang, X.; Liu, S.; He, Q.; Wang, T.; Yang, J.; Bai, Y.; Vidic, R. D.; Crittenden, J. C.; **Liu, B.***, Rare Earth Elements Occurrence and Economical Recovery Strategy from Shale Gas Wastewater in the Sichuan Basin, China. *ACS Sustainable Chemistry & Engineering* **2020**, 8, (32), 11914-11920. **(Front Cover)**

77. Tang, P.; **Liu, B.***; Zhang, Y.*; Chang, H.; Zhou, P.; Feng, M.; Sharma, V. K., Sustainable reuse of shale gas wastewater by pre-ozonation with ultrafiltration-reverse osmosis. *Chemical Engineering Journal* **2020**, 123743.
76. Shang, W.; Liu, Y.; He, Q.; Liu, S.; Zhu, Y.; Tong, T.; **Liu, B.***, Efficient adsorption of organic matters and ions by porous biochar aerogel as pre-treatment of ultrafiltration for shale gas wastewater reuse. *Chemical Engineering Journal Advances* **2020**, 2, 100011.
75. Li, J.#; Chang, H.#; Tang, P.; Shang, W.; He, Q.; **Liu, B.***, Effects of membrane property and hydrostatic pressure on the performance of gravity-driven membrane for shale gas flowback and produced water treatment. *Journal of Water Process Engineering* **2020**, 33, 101117.
74. He, M.; Li, T.; Hu, M.; Chen, C.; **Liu, B.***; Crittenden, J.; Chu, L.-Y.; Ng, H. Y., Performance improvement for thin-film composite nanofiltration membranes prepared on PSf/PSf-g-PEG blended substrates. *Separation and Purification Technology* **2020**, 230, 115855.
73. Chang, H.; Liu, S.; Tong, T.; He, Q.; Crittenden, J. C.; Vidic, R. D.; **Liu, B.***, On-Site Treatment of Shale Gas Flowback and Produced Water in Sichuan Basin by Fertilizer Drawn Forward Osmosis for Irrigation. *Environmental Science & Technology* **2020**, 54, (17), 10926-10935. **(Front Cover)**
72. Zhao, P.; Bai, Y.; **Liu, B.***; Chang, H.; Cao, Y.; Fang, J., Process optimization for producing ultrapure water with high resistivity and low total organic carbon. *Process Safety and Environmental Protection* **2019**, 126, 232-241.
71. Xie, W.; Li, T.; Chen, C.; Wu, H.; Liang, S.; Chang, H.; **Liu, B.***; Drioli, E.; Wang, Q.; Crittenden, J. C., Using the Green Solvent Dimethyl Sulfoxide To Replace Traditional Solvents Partly and Fabricating PVC/PVC-g-PEGMA Blended Ultrafiltration Membranes with High Permeability and Rejection. *Industrial & Engineering Chemistry Research* **2019**, 58, (16), 6413-6423. **(Front Cover)**
70. Wu, Q.; Xie, W.; Wu, H.; Wang, L.*; Liang, S.; Chang, H.; **Liu, B.***, Effect of volatile solvent and evaporation time on formation and performance of PVC/PVC-g-PEGMA blended membranes. *RSC Advances* **2019**, 9, (59), 34486-34495.
69. Wu, Q.; Tiraferri, A.; Wu, H.; Xie, W.; **Liu, B.***, Improving the Performance of PVDF/PVDF-g-PEGMA Ultrafiltration Membranes by Partial Solvent Substitution with Green Solvent Dimethyl Sulfoxide during Fabrication. *ACS Omega* **2019**, 4, (22), 19799-19807. **(Front Cover)**
68. Shang, W.; Tiraferri, A.; He, Q.; Li, N.; Chang, H.; Liu, C.; **Liu, B.***, Reuse of shale gas flowback and produced water: Effects of coagulation and adsorption

on ultrafiltration, reverse osmosis combined process. *Science of the Total Environment* **2019**, 689, 47-56.

67. Hu, F.; Yan, B.; Sun, G.; Xu, J.; Gu, Y.; Lin, S.; Zhang, S.; **Liu, B.**; Chen, S.*, Conductive Polymer Nanotubes for Electrochromic Applications. *ACS Applied Nano Materials* **2019**, 2, (5), 3154-3160.

66. He, M.; Liu, Z.; Li, T.; Chen, C.; **Liu, B.***; Crittenden, J. C., Effect of adding a smart potassium ion-responsive copolymer into polysulfone support membrane on the performance of thin-film composite nanofiltration membrane. *Frontiers of Chemical Science and Engineering* **2019**, 13, (2), 400-414.

65. Chang, H.; **Liu, B.***; Yang, P.; Wang, Q.; Li, K.; Li, G.; Liang, H.*, Salt backwashing of organic-fouled ultrafiltration membranes: Effects of feed water properties and hydrodynamic conditions. *Journal of Water Process Engineering* **2019**, 30, 100429.

64. Chang, H.; **Liu, B.***; Yang, B.; Yang, X.; Guo, C.; He, Q.; Liang, S.; Chen, S.; Yang, P., An integrated coagulation-ultrafiltration-nanofiltration process for internal reuse of shale gas flowback and produced water. *Separation and Purification Technology* **2019**, 211, 310-321.

63. Chang, H.; **Liu, B.***; Wang, H.; Zhang, S.-Y.; Chen, S.; Tiraferri, A.; Tang, Y.-Q., Evaluating the performance of gravity-driven membrane filtration as desalination pretreatment of shale gas flowback and produced water. *Journal of Membrane Science* **2019**, 587, 117187.

62. Chang, H.; **Liu, B.***; Crittenden, J. C.; Vidic, R. D., Resource Recovery and Reuse for Hydraulic Fracturing Wastewater in Unconventional Shale Gas and Oil Extraction. *Environmental Science & Technology* **2019**, 53, (23), 13547-13548.

61. Chang, H.; Li, T.; **Liu, B.***; Vidic, R. D.; Elimelech, M.; Crittenden, J. C., Potential and implemented membrane-based technologies for the treatment and reuse of flowback and produced water from shale gas and oil plays: A review. *Desalination* **2019**, 455, 34-57.

60. Chang, H.; Li, T.; **Liu, B.***; Chen, C.; He, Q.; Crittenden, J. C., Smart ultrafiltration membrane fouling control as desalination pretreatment of shale gas fracturing wastewater: The effects of backwash water. *Environment International* **2019**, 130, 104869.

59. Wu, H.; Li, T.; **Liu, B.***; Chen, C.; Wang, S.; Crittenden, J. C., Blended PVC/PVC-g-PEGMA ultrafiltration membranes with enhanced performance and antifouling properties. *Applied Surface Science* **2018**, 455, 987-996.

58. Wang, S.; Li, T.; Chen, C.; **Liu, B.***; Crittenden, J. C., PVDF ultrafiltration membranes of controlled performance via blending PVDF-g-PEGMA copolymer

synthesized under different reaction times. *Frontiers of Environmental Science & Engineering* **2018**, 12, (2).

57. Wang, S.; Li, T.; Chen, C.; Chen, S.; **Liu, B.***; Crittenden, J., Non-woven PET fabric reinforced and enhanced the performance of ultrafiltration membranes composed of PVDF blended with PVDF-g-PEGMA for industrial applications. *Applied Surface Science* **2018**, 435, 1072-1079.

56. **Liu, B.***; Wang, S.; Zhao, P.; Liang, H.; Zhang, W.; Crittenden, J., High-performance polyamide thin-film composite nanofiltration membrane: Role of thermal treatment. *Applied Surface Science* **2018**, 435, 415-423.

55. Guo, C.; **Liu, B.***; Chen, C.; Chang, H.; Wang, S.; He, M.; Crittenden, J., Development of an efficient approach for separating bubbles and flocs in a submerged membrane ultrafiltration process. *Water Science and Technology-Water Supply* **2018**, 18, (3), 808-818.

54. Guo, C.#; Chang, H.#; **Liu, B.***; He, Q.; Xiong, B.; Kumar, M.; Zydney, A. L., A combined ultrafiltration-reverse osmosis process for external reuse of Weiyuan shale gas flowback and produced water. *Environmental Science-Water Research & Technology* **2018**, 4, (7), 942-955.

53. Yang, B.; Yang, X.; **Liu, B.***; Chen, Z.*; Chen, C.; Liang, S.; Chu, L.-Y.; Crittenden, J., PVDF blended PVDF-g-PMAA pH-responsive membrane: Effect of additives and solvents on membrane properties and performance. *Journal of Membrane Science* **2017**, 541, 558-566.

52. He, M.; Chen, C.; Guo, C.; Wang, S.; Chang, H.; **Liu, B.***, Optimization of aeration conditions in the hybrid process of coagulation-ultrafiltration with air sparging. *Journal of Water Supply Research and Technology-Aqua* **2017**, 66, (8), 632-640.

51. Chang, H.; Liu, T.; He, Q.; Li, D.; Crittenden, J.; **Liu, B.***, Removal of calcium and magnesium ions from shale gas flowback water by chemically activated zeolite. *Water Science and Technology* **2017**, 76, (3), 575-583.

50. Chang, H.; **Liu, B.***; Liang, H.*; Yu, H.; Shao, S.; Li, G., Effect of filtration mode and backwash water on hydraulically irreversible fouling of ultrafiltration membrane. *Chemosphere* **2017**, 179, 254-264.

49. Chang, H.; Liang, H.*; Qu, F.; **Liu, B.**; Yu, H.; Du, X.; Li, G.; Snyder, S. A., Hydraulic backwashing for low-pressure membranes in drinking water treatment: A review. *Journal of Membrane Science* **2017**, 540, 362-380.

48. **Liu, B.***; Chen, C.; Zhao, P.; Li, T.; Liu, C.; Wang, Q.; Chen, Y.; Crittenden, J., Thin-film composite forward osmosis membranes with substrate layer composed of polysulfone blended with PEG or polysulfone grafted PEG methyl ether

methacrylate. *Frontiers of Chemical Science and Engineering* **2016**, 10, (4), 562-574.

47. Chen, C.; Tang, L.; **Liu, B.**; Zhang, X.; Crittenden, J.; Chen, K. L.; Chen, Y.* , Forming mechanism study of unique pillar-like and defect-free PVDF ultrafiltration membranes with high flux. *Journal of Membrane Science* **2015**, 487, (0), 1-11.

46. Chang, H.; Qu, F.; **Liu, B.**; Yu, H.; Li, K.; Shao, S.; Li, G.; Liang, H.* , Hydraulic irreversibility of ultrafiltration membrane fouling by humic acid: Effects of membrane properties and backwash water composition. *Journal of Membrane Science* **2015**, 493, 723-733.

45. Chang, H.; **Liu, B.***; Luo, W.; Li, G., Fouling mechanisms in the early stage of an enhanced coagulation-ultrafiltration process. *Frontiers of Environmental Science & Engineering* **2015**, 9, (1), 73-83.

44. Liu, J.; **Liu, B.***; Liu, T.; Bai, Y.; Yu, S., Coagulation-bubbling-ultrafiltration: Effect of floc properties on the performance of the hybrid process. *Desalination* **2014**, 333, (1), 126-133.

43. **Liu, B.**; Chen, C.; Li, T.; Crittenden, J.; Chen, Y.* , High performance ultrafiltration membrane composed of PVDF blended with its derivative copolymer PVDF-g-PEGMA. *Journal of Membrane Science* **2013**, 445, 66-75.

42. **Liu, B.**; Chen, C.; Zhang, W.; Crittenden, J.; Chen, Y.* , Low-cost antifouling PVC ultrafiltration membrane fabrication with Pluronic F 127: Effect of additives on properties and performance. *Desalination* **2012**, 307, 26-33.

41. **Liu, B.**; Ma, J.*; Luo, L.; Bai, Y.; Wang, S.; Zhang, J., Two-Dimensional LDV Measurement, Modeling, and Optimal Design of Rectangular Primary Settling Tanks. *Journal of Environmental Engineering-ASCE* **2010**, 136, (5), 501-507.

40. Wang, S.; Ma, J.*; **Liu, B.**; Jiang, Y.; Zhang, H., Degradation characteristics of secondary effluent of domestic wastewater by combined process of ozonation and biofiltration. *Journal of Hazardous materials* **2008**, 150, (1), 109-114.

39. **Liu, B.**; Ma, J.*; Huang, S.; Chen, D.; Chen, W., Two-dimensional numerical simulation of primary settling tanks by hybrid finite analytic method. *Journal of Environmental Engineering-ASCE* **2008**, 134, (4), 273-282.

38. Bai, Y.; Zhou, S.; Huang, Z.; Zhang, Y.; Tang, H.; **Liu, B.***, Analysis and Countermeasures of Operation Problems of a Sewage Plant in Neijiang City. *Technology of Water Treatment* **2022**, In Press. **(In Chinese)**

37. Bai, Y.; Zhang, X.; **Liu, B.***, Design of Sodium Hypochlorite Disinfection System in Huyan Water Treatment Plant. Technology of Water Treatment **2021**, 47, (08), 124-127. **(In Chinese)**
36. Bai, Y.; Sun, Y.; Wu, M.; Zhou, Y.; Tang, H.; Zeng, Y.; **Liu, B.***, Water Purification Efficiency of Shale Gas Flowback Water by Coagulation-Ozone/Adsorption-UF-RO Combined Process. Environmental Engineering **2021**, 39, (07), 122-127. **(In Chinese)**
35. Bai, Y.; Ma, L.; Jia, T.; Zhang, F.; Zhou, Y.; Tang, H.; **Liu, B.***, AAO-MBR Process for Non-stop Capacity Expansion and Upgrading of Wastewater Treatment Plant. Environmental Engineering **2021**, 39, 20-24. **(In Chinese)**
34. Bai, Y.; Zhang, X.; Huang, Z.; **Liu, B.***; Chen, A.; Zhu, F., AAOA—MBR Enhanced Denitrification Process for Upgrading and Reconstruction of a Wastewater Treatment Plant in Neijiang. China Water & Wastewater **2020**, 36, (24), 87-91. **(In Chinese)**
33. Mou, Y.; Wu, H.; Bai, Y.; **Liu, B.***, Advanced Sludge Dewatering System Based on High-pressure Sludge Squeezing Technology and Application. Sichuan Building Materials **2017**, 43, (09), 35-36+46. **(In Chinese)**
32. Huo, X.; **Liu, B.***; Fang, J.; Cao, Y.; Hu, Y., Process optimization of ultrapure water integrated intelligent system to reduce TOC. Water & Wastewater Engineering **2016**, 42, (7), 71-73. **(In Chinese)**
31. Guo, C.; He, M.; Li, R.; Liu, Y.; Wang, S.; **Liu, B.***, Influence of Aeration Rates on Membrane Fouling in Coagulation/Bubbling/Ultrafiltration Process. China Water & Wastewater **2015**, 31, (19), 13-15+20. **(In Chinese)**
30. Bai, Y.; Li, L.; Liu, T.; Shi, H.; **Liu, B.***; Ma, L.; Xie, Y., The Influence of Wind Speed and Direction on Flow Movement of Horizontal Sedimentation Tank Based on LDV Velocity Measurement. Southwest Water & Wastewater **2014**, 36, (04), 14-20. **(In Chinese)**
29. Wang, Y.; **Liu, B.***; Zheng, Z.; Zheng, X., Effects of the Electrode Area and Electrode Spacing on the Electricity Generation Capacity of MFCs. Renewable Energy Resources **2013**, 31, (08), 68-74. **(In Chinese)**
28. Wang, Y.; **Liu, B.***; Li, H.; Zheng, Z., The Effect of Cation Exchange Membrane Area and Anode Surface Area Optimization on the Performance of Cubic-type Microbial Fuel Cells. Science Technology and Engineering **2013**, 13, (25), 7338-7342. **(In Chinese)**
27. Liu, C.; **Liu, B.***; Lin, J.; Zhang, M.; Xie, Y.; Wang, W.; Bai, Y.; Ma, J., Study on Membrane Cleaning Method in Flocculation-Ultrafiltration Process for Treating

Surface Water Containing Ammonia Nitrogen. *Water & Wastewater Engineering* **2013**, 49, (09), 121-126. **(In Chinese)**

26. Lin, J.; **Liu, B.***; Guo, J.; Huang, E.; Yang, G.; Zhang, M.; Liu, C., Organic Matter Removal and Flux Variation Influenced by Ammonia Nitrogen in Coagulation-Ultrafiltration Combined Process. *Chinese Journal of Environmental Engineering* **2013**, 7, (01), 113-118. **(In Chinese)**

25. **Liu, B.***; Liu, F.; Wan, X.; Zhang, Y.; Li, D.; Wang, Z.; Zhang, W.; Wang, B.; Zhu, Y.; Li, X., Wastewater Quality Field Measurement and Analysis of Radial Flow Secondary Sedimentation Tanks. *China Water & Wastewater* **2012**, 28, (17), 108-112. **(In Chinese)**

24. **Liu, B.***; Liu, F.; Wan, X.; Li, D.; Wang, Z.; Ouyang, J.; Zhang, W.; Wang, B.; Zhu, Y.; Li, X., Field Measurement and Analysis of Wastewater Quality in Aeration Tanks of CAS and AOE Process. *Chinese Journal of Environmental Engineering* **2012**, 6, (09), 3085-3090. **(In Chinese)**

23. Liang, J.; Yang, Q.; Ding, R.; Liu, Y.; Huang, E.; Yang, G.; **Liu, B.***, The Relationship Between Coagulant Dose and Water Quality and Floc Size Characteristics. *Water & Wastewater Engineering* **2012**, 48, (S1), 5-9. **(In Chinese)**

22. Han, B.; **Liu, B.**; Liu, H.; Zhao, W.; Ma, J.*; Chen, Z., Enhanced Coagulation of Drinking Water in Cold Area by Potassium Permanganate Composite. *China Water & Wastewater* **2012**, 28, (13), 51-54. **(In Chinese)**

21. **Liu, B.***; Yao, X.; Zhou, X.; Wu, X., Effect of Cathode Electrode and Cation Exchange Membrane Areas on Electricity Production of H-type MFCs. *Environmental Science* **2011**, 32, (06), 1837-1842. **(In Chinese)**

20. **Liu, B.***; Xu, J.; Li, J.; Zheng, Z.; Lin, L.; Xiong, T., The Characteristics of Floc Size Variation Under the Application of Potassium Permanganate and Powdered Activated Carbon. *Technology of Water Treatment* **2011**, 37, (04), 29-32+56. **(In Chinese)**

19. **Liu, B.***; Chen, J.; Liang, Y.; Zhang, Y.; Wang, Z.; Ma, J., The Removal Efficiency of Organic Matters by Enhanced Coagulation and Ultrafiltration Processes. *Water & Wastewater Engineering* **2011**, 47, (S1), 23-27. **(In Chinese)**

18. Lu, J.; Guo, W.; Guo, X.; **Liu, B.**; Wang, Q.; Liu, Y., Progress on Advanced Oxidation Processes for the Degradation of Microcystins in Drinking Water. *Technology of Water Treatment* **2010**, 36, (04), 14-18+27. **(In Chinese)**

17. **Liu, B.***; Lu, T.; Ma, J.; Wang, L.; Liu, Z.; Li, W., Cleaning of Membrane in Combined Process of Enhanced Coagulation and Ultrafiltration. *China Water & Wastewater* **2010**, 26, (21), 8-12. **(In Chinese)**

16. **Liu, B.***; Lin, L.; Lin, J.; Zheng, J.; Liang, D.; Yuan, G., Application of EPANET in Calculation of Hydraulic and Water Quality of Urban Multi-source Water Supply Network. *Water & Wastewater Engineering* **2010**, 46, (S1), 416-419. **(In Chinese)**
15. **Liu, B.***; Huang, E.; Lu, J.; Bai, Y.; Li, T.; Yang, G.; Jiang, W., Optimization of Hydrodynamic Conditions in Coagulation Process and Study of Floc Size Characteristics. *Chinese Journal of Environmental Engineering* **2010**, 4, (09), 1968-1972. **(In Chinese)**
14. **Liu, B.**; Chen, D.; Liu, Y.; Bai, Y.; Ma, J.*, Measurement and Modeling of Rectangular Primary Sedimentation Tanks with Incoming Flow at the Middle of Inlet. *Water Technology* **2010**, 4, (05), 1-5. **(In Chinese)**
13. Bai, Y.; Wang, N.; **Liu, B.***; Li, Z.; Liu, Y., Design of Powdered Activated Carbon Feeding System in Water Treatment Plant. *Water & Wastewater Engineering* **2010**, 46, (01), 41-43. **(In Chinese)**
12. **Liu, B.**; Luo, L.; Ma, J.*; Bai, Y.; Zhang, J.; Li, X.; Wang, S., Numerical Simulation of Gravity Flow and Buoyant Flow Caused by Temperature Difference in Circular Settling Tanks. *Journal of Sichuan University (Engineering Science Edition)* **2009**, 41, (01), 34-40. **(In Chinese)**
11. **Liu, B.**; Han, B.; Ma, J.*; Chen, Z.; Zhang, J.; Li, X.; Wang, Z.; Wang, H.; Fang, J.; Liu, G.; Wang, Q.; Wang, S., Coagulation Efficiency of Powdered Activated Carbon Enhanced Conventional Water Purification. *Chinese Journal of Environmental Engineering* **2009**, 3, (05), 803-808. **(In Chinese)**
10. **Liu, B.**; Bai, Y.; Ren, C.; Wang, N.; Ma, J.*, Development and Comments on Numerical Simulation of Sedimentation Tanks. *Water & Wastewater Engineering* **2009**, 45, (11), 172-178. **(In Chinese)**
9. **Liu, B.**; Ma, J.*; Zhang, L.; Wang, H., Computational Fluid Dynamics Applied to Membrane Technology. *China Rural Water and Hydropower* **2008**, (01), 40-44. **(In Chinese)**
8. **Liu, B.**; Ma, J.*; Luo, L.; Bai, Y.; Huang, S., 2D Modeling of Rectangular Primary Settling Tanks-Verification of Mathematical Model and Numerical Method. *Journal of Sichuan University (Engineering Science Edition)* **2008**, (02), 13-18. **(In Chinese)**
7. **Liu, B.**; Ma, J.*; Huang, S.; Qian, Z.; Chen, W., Numerical Prediction of Turbulent Flow past a 2D Surface-mounted Rib. *Journal of Basic Science and Engineering* **2008**, 16, (06), 879-890. **(In Chinese)**
6. **Liu, B.**; Han, B.; Ma, J.*; Liu, G.; Fang, J.; Zhang, J.; Li, X.; Wang, Q.; Wang, S.; Yang, J.; Yu, D.; Wang, Z., Removal of Organic Pollutants from Raw Water of

Songhua River by Powdered Activated Carbon. *China Water & Wastewater* **2008**, 24, (21), 38-41. **(In Chinese)**

5. **Liu, B.**; Ma, J.*; Zhang, S.; Liang, Z.; Ma, G.; Xie, X.; Huang, S., Numerical Study of Particles Settling Processes in Lateral Flow Settling Tank with Inclined Vane Plates. *Water & Wastewater Engineering* **2007**, (11), 139-142. **(In Chinese)**

4. **Liu, B.**; Ma, J.*; Yu, H.; Huang, S., Study on the Status of Exploitation and Utilization of Water Resources in Harbin and the Sustainable Development Strategy. *Journal of Hydraulic Engineering* **2007**, (S1), 482-484. **(In Chinese)**

3. **Liu, B.**; Ma, J.*; Huang, S.; Chen, D., Expansive Study on Laminar Flow Model for Simulation of Flow Field in Settling Tank. *China Water & Wastewater* **2007**, (11), 102-104. **(In Chinese)**

2. **Liu, B.**; Huang, S.; Ma, J.*; Chen, W.; Wu, J., Numerical Simulation of Square Cavity Flow by Second-order Up-wind Finite Volume Method. *Journal of Basic Science and Engineering* **2006**, (04), 557-565. **(In Chinese)**

1. **Liu, B.**; Chen, D.*, Visualized Computational Model to Analyze 2-D Flows under Uniform Building Foundation with Arbitrary Geometry. *China Rural Water and Hydropower* **2004**, (12), 74-76. **(In Chinese)**

V. Proceedings

[25] **Liu, Baicang**, Research on Shale Gas Wastewater Treatment Based on Membrane Coupling Technology, Advanced Membrane Technology Summit for Water Treatment 2021, 2021-10-15 to 2021-10-17, Shanghai, 2021.

[24] Xie, Wancen; **Liu, Baicang***, Design the next generation of sustainable membranes based on the principles of green chemistry, Advanced Membrane Technology Summit for Water Treatment 2021, 2021-10-15 to 2021-10-17, Shanghai, 2021.

[23] Tang, Peng; **Liu, Baicang***, Development of "pre-oxidation-bio-membrane separation" combined process for shale gas wastewater reuse, Advanced Membrane Technology Summit for Water Treatment 2021, 2021-10-15 to 2021-10-17, Shanghai, 2021.

[22] **Liu, Baicang**, Research and application of sustainable reuse technology of shale gas industrial wastewater, 40 Year Annual Academic Conference of Environmental Sciences Society of Sichuan, 2021-07-05 to 2021-07-06, Chengdu, 2021.

[21] **Liu, Baicang**, Research and development of high-efficiency integrated process system for shale gas industrial wastewater recycling, China Petroleum

and Petrochemical Enterprises Water Treatment Technology Exchange Conference, Shenzhen, 2021-03-17 to 2021-03-19, Shenzhen, 2021.

[20] **Liu, Baicang**, Sustainable Membrane Technology and Industrial Application, 2020 6th National Membrane Technology Young Scientists Summit, Shenzhen, 2020-11-27 to 2020-11-29, Shenzhen, 2020.

[19] **Liu, Baicang**, Research on the reuse and resource utilization of shale gas industrial wastewater, 2020 Silk Road (Xi'an) Water Treatment Summit Forum, Xi'an, 2020-11-26 to 2020-11-28, Xi'an, 2020.

[18] **Liu, Baicang**, Research on sustainable reuse technology of shale gas flowback fluid, International Symposium on Environmental Management of Unconventional Oil and Gas Fields (2020), Chongqing, 2020-10-20 to 2020-10-21, Chongqing, 2020.

[17] **Liu, Baicang**, Sustainable Reuse and Separation Technology of Flowback Liquid from Shale Gas Production, The First National Youth Forum on Advanced Separation Technology, Shanghai, 2019-12-1 to 2019-12-2, Shanghai, 2019.

[16] **Liu, Baicang**, Optimization of thin film composite nano filtration membranes formation conditions based on tuning of substrate, The 6th International Symposium on Environmental Simulation and Pollution Control, Beijing, 2019-11-3 to 2019-11-5, Beijing, 2019.

[15] **Liu, Baicang**, Research on the optimization of the combined process of green solvent membrane and shale gas production wastewater membrane, The 10th Membrane and Membrane Process Conference, Beijing, 2019-10-26 to 2019-10-29, Beijing, 2019.

[14] **Liu, Baicang**, Desalination and Reuse of Flowback and Produced Water from Shale Oil and Gas Play, 2019 International Symposium on Environmental Science and Technology (2019 ISEST), Hangzhou, 2019-9-25 to 2019-9-28, Hangzhou, 2019.

[13] Wang, S.; Li, T.; Chen, C.; Chen, S.; **Liu, B.***; Crittenden, J. PVDF blended PVDF-g-PEGMA ultrafiltration membrane: effect of PVDF-g-PEGMA synthesis time and non-woven PET fabric on membrane performance, Membranes: Materials and Processes Gordon Research Conference, Colby-Sawyer College New London, NH, August 12-17, 2018; Colby-Sawyer College New London, NH, 2018.

[12] **Liu, Baicang**; Crittenden, John, Optimization of Thin Film Composite Nanofiltration Membranes Formation Conditions. Euromembrane 2018, Valencia, Spain, 2018.

[11] He, Meibo; **Liu, Baicang***. Improving performance of thin-film composite nanofiltration membranes by changing the properties of support membranes, 256th ACS National Meeting & Exposition, Boston, Aug 19-23, 2018; Boston, 2018.

- [10] **Baicang Liu***, A high-flux defect-free PVDF ultrafiltration membrane for efficient water production, 11th International Congress on Membranes and Membrane Processes, San Francisco, CA, USA, 2017.
- [9] Can Guo, **Baicang Liu***, Chen Chen, Haiqing Chang, Shuai Wang, Meibo He, John Crittenden, Development of an efficient approach for separating bubbles and flocs in the coagulation-bubbling-ultrafiltration process, 5th IWA Regional Conference on Membrane Technology, IWA-RMTC 2016, Kunming, Yunnan, China, 2016.
- [8] Haiqing Chang, **Baicang Liu***, Heng Liang*, Fangshu Qu, Guibai Li, Effect of solution environment and backwash water composition on ultrafiltration membrane fouling under constant flux and constant pressure, 5th IWA Regional Conference on Membrane Technology, IWA-RMTC 2016, Kunming, Yunnan, China, 2016.
- [7] **Baicang Liu**, Jianwei Liu, Tao Liu, Yang Bai, Coagulation-bubbling-ultrafiltration: Effects of flocs and bubbles properties on the performance of the hybrid process, AMTA/AWWA Membrane Technology Conference & Exposition 2014, Las Vegas, Nevada, USA., 2014.
- [6] Chen Chen, **Baicang Liu**, John Crittenden, Yongsheng Chen, Poly (vinylidene fluoride) membranes prepared from amphiphilic graft copolymer, AMTA/AWWA Membrane Technology Conference & Exposition 2013, San Antonio, Texas, USA, 2013.
- [5] **Baicang Liu**, Chen Chen, Yongsheng Chen, John Crittenden, Effect of coagulation temperature on the characteristics of synthesized PVC membrane with Pluronic F 127 additives, 243rd ACS National Meeting & Exposition, San Diego, California, USA, 2012.
- [4] Xue Yao, Xianmin Zhou, **Baicang Liu***, Effect of cathode restricted aeration on the performance of MFCs, 242nd National Meeting of the American Chemical Society (ACS), Denver, CO, USA, 2011.
- [3] **Baicang Liu**, Lin Luo, Jun Ma, Analysis on the features of flow field of rectangular primary settling tanks, the 3rd IWA-ASPIRE Conference & Exhibition, Taiwan, China, 2009.
- [2] **Baicang Liu**, Jun Ma, Shehua Huang, Liqiu Zhang, Numerical simulation of the flow containing a ladder-type turbulent promoter in a flat membrane, ACS 233rd Conference, Chicago, USA, 2007.
- [1] **Baicang Liu**, Jun Ma, A modified laminar model used to simulate flow in settling tank, the 2nd Conference of Environmental Science & Technology, Houston, USA, 2006.

VI. Patents

1. **Baicang Liu**, Meibo He, Can Guo, Coagulation - Efficient precipitation - air/gas stripping - Integrated apparatus and method reduce membrane fouling. Patent No. ZL201510813124.6
2. **Baicang Liu**, Jiaquan Xu, Lin Lin, Junjun Li, Zhe Zhen, Enhanced coagulation-gas stripping-membrane integration method and device for lightening membrane pollution. Patent No. ZL 2010 1 0101535.X
3. **Baicang Liu**, Fengkai Liu, Xin Wan, Ziwei Wang, Dan Li, Junrui Ouyang, Methods of inhibiting algae growth in the outlet of secondary sedimentation tanks. Patent No. ZL 2010 1 0168460.7
4. **Baicang Liu**, Xianmin Zhou, Ya Liu, Yongli Zhang, Xue Yao, Methods of increasing oxygen mass transfer efficiency in the cathode of microbial fuel cells. Patent No. ZL 2010 1 0553085.8
5. Jun Ma, **Baicang Liu**, Method for promoting ozone utilization rate and intensifying treatment effect of ozone contact-oxidation pool. Patent No. ZL 2005 10127322.3
6. Chen Chen, **Baicang Liu**, Pingju Zhao, Shuai Wang, Double separation layer hollow fiber ultrafiltration membrane containing tubular support net and preparation method. Patent No. ZL201810246465.3
7. **Baicang Liu**, Peng Tang, A method for reuse shale gas wastewater. Application No. 202011155209.7
8. **Baicang Liu**, Xuanyu Ji, High-efficiency treatment, reuse and zero-liquid-discharge method and system for shale gas wastewater. Application No. 202011261475.8
9. Chen Chen, **Baicang Liu**, Shuai Wang, A method for preparing high-flux polyvinylidene fluoride ultrafiltration membrane. Application No. 201510187432.2
10. Jun Ma, **Baicang Liu**, Multi-layer variable inclination inclined plate or inclined tube sedimentation tank with enhanced treatment effect. Application No. 200610151198.9
11. **Baicang Liu**, Yuanhui Liu, Chen Chen, Shi Liu, Qiping He, A method of internal reuse of shale gas wastewater based on adsorption and membrane technology. Application No. 202111418129.0
12. **Baicang Liu**, Yuhua Bai, Xinyu Liu, A method for removing organic matter in shale gas wastewater. Application No. 202110672122.5

13. **Baicang Liu**, Zhaoyang Song, Jinzhi Cao, Ruihong Yuan, Xuanyu Ji, Hong Yue, Jin Zhu, Jing Li, Dong Lin, Safe recovery of shale gas industrial wastewater based on solar evaporation. Application No. 202121312114.1

VII. Research Grants

1.PI: Baicang Liu; Title: "An integrated system for efficient desalination and organic removal of shale gas wastewater"; Funding Source: National Science Foundation of China; Award Date: 01/01/2021 – 31/12/2024; Award Amount: ¥580,000.

2.PI: Baicang Liu; Title: "Mechanism of self-assembling high flux defect-free membrane and its water purification performance"; Funding Source: National Science Foundation of China; Award Date: 01/01/2017 – 31/12/2020; Award Amount: ¥610,000.

3.PI: Baicang Liu; Title: "Membrane performance and efficiency under the coupling effect of multiphase flow in coagulation-air lift-ultrafiltration system"; Funding Source: National Science Foundation of China; Award Date: 01/01/2013 – 31/12/2016; Award Amount: ¥800,000.

4.PI: Baicang Liu, Title: "Treatment of shale gas flowback water"; Funding Source: Applied Basic Research of Sichuan Province; Award Date: 01/03/2017 – 01/03/2018;

5.PI: Baicang Liu, Title: "Industrialization of ultrafiltration membrane"; Funding Source: Litree Purifying Technology Co., Ltd; Award Date: 15/03/2016 – 15/03/2019;

6.PI: Baicang Liu; Title: "Establishing a membrane technology research center"; Funding Source: Litree Purifying Technology Co., Ltd; Award Date: 04/2013 – 04/2015;

7.PI: Baicang Liu; Title: "Self-assembly mechanism for the formation of ultrafiltration membrane and water treatment performance research "; Funding Source: Outstanding young scholars research projects of Sichuan University; Award Date: 01/2014 – 12/2016;

8.PI: Baicang Liu; Title: "Study on the effect of enhanced coagulation-ultrafiltration combined process on the removal of organic pollutants "; Funding Source: Youth Fund of Sichuan University; Award Date: 01/2010 – 12/2011;

9.PI: Baicang Liu; Title: "Influence of wind on flow field in sedimentation tanks"; Funding Source: State Key Laboratory Fund; Award Date: 2010 – 2011;

10.PI: Baicang Liu; Title: "Optimization design of flow field in settling tanks "; Funding Source: State Key Laboratory Fund; Award Date: 2008 – 2009.