

Accepted Manuscript

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Authors: Mei He, Wen-Jie Chen, Lei Tian, Bo Shao, Yan Lin



PII: S0304-3894(18)30852-5
DOI: <https://doi.org/10.1016/j.jhazmat.2018.09.058>
Reference: HAZMAT 19782

To appear in: *Journal of Hazardous Materials*

Received date: 15-3-2018
Revised date: 21-9-2018
Accepted date: 22-9-2018

Please cite this article as: He M, Chen W-Jie, Tian L, Shao B, Lin Y, Plant-microbial synergism: An effective approach for the remediation of shale-gas fracturing flowback and produced water, *Journal of Hazardous Materials* (2018), <https://doi.org/10.1016/j.jhazmat.2018.09.058>

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Plant-microbial synergism: An effective approach for the remediation of shale-gas fracturing flowback and produced water

Mei He^{a,b}, Wen-Jie Chen^b, Lei Tian^{a,c}, Bo Shao^b, Yan Lin^{*,b,d}

^a Key Laboratory of Exploration Technologies for Oil and Gas Resources (Yangtze University), Ministry of Education

^b School of Resources and Environment, Yangtze University, Wuhan 430100, China

^c School of Petroleum Engineering, Yangtze University, Wuhan 430100, China

^d Norwegian Institute for Water Research, Oslo 0349, Norway

*Corresponding author, Email: Yan.Lin@niva.no;

Telephone: +47 41768886; Fax:22185200

Highlight

- Cost effective biological methods were tested for the treatment of shale gas FPW.
- Water Dropwort and activated sludge showed the best performance.
- The method is most effective in reducing BOD, COD and TN of FPW.
- Toxicity to algae is reduced and microbial biodiversity is improved.

Abstract

Effective and affordable treatment of hydraulic fracturing flowback and produced water (FPW) is a major challenge for the sustainability of unconventional shale-gas exploration and development. We investigated the effectiveness of different combinations of activated sludge (AS), three microbial preparations, and ten plants (ryegrass, water dropwort, typha, reed, iris, canna, water caltrop, rape, water spinach, and *Alternanthera philoxeroides*) on the treatment performance of FPW. Water quality parameters ($\text{NH}_4\text{-N}$, $\text{NO}_3\text{-N}$, $\text{NO}_2\text{-N}$, COD_{cr} , and BOD) and the algal toxicity of the treated FPW were used as metrics to assess the treatment efficiency. The results showed that AS had higher treatment efficiency than the prepared microorganisms, and water dropwort was the best plant candidate for boosting performance of AS treatment of FPW. The treated FPW showed improved water quality and microbial diversity. The Shannon-Wiener index increased from 4.76 to 7.98 with FPW treatment. The

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