

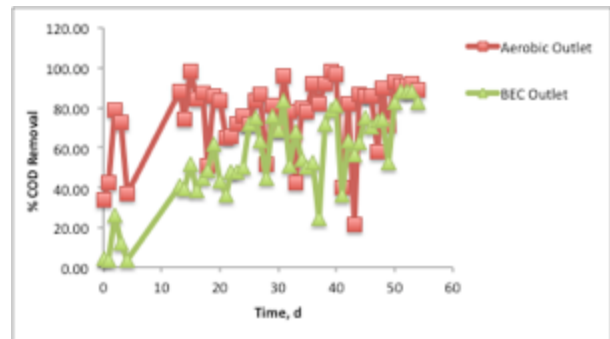
PBEC™: Sustainable Aeration Substitute for Wastewater Treatment

Aerobic processes requiring aeration are effective methods to reduce organic compounds (i.e., BOD) in wastewaters, and are typical components in the wastewater treatment plant design. However, aerobic processes carry significant operational and economic problems:

- **High Energy Consumption**
 - Approximately 3% of the total energy consumption in the U.S. is from wastewater treatment
 - Up to 70% of the energy consumption in municipal wastewater treatment plants is due to aeration.
 - The U.S. EPA estimates that approximately aeration consumes 61 million kWh per day for all wastewater treatment facilities in the U.S
 - This energy consumption costs wastewater treatment plants approximately \$4 million (USD) per day
- **High Sludge Production Rate**
 - In the U.S., approximately 7 million dry tonnes of sludge is produced annually from the wastewater treatment plants, which is ~400 tonnes per plant annually
 - Further processing of the sludge and disposal requires additional energy and can be burdensome without effective sludge reduction processes (e.g., anaerobic digestion)

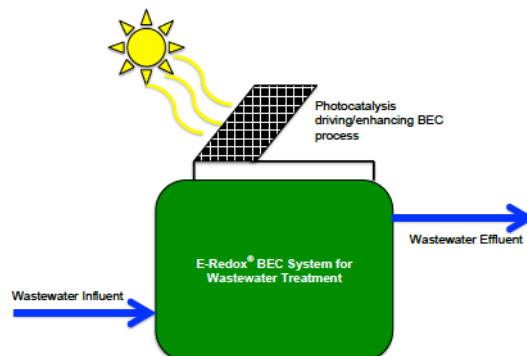


Advanced Environmental Technologies, LLC (AET) has developed and patented an innovative bioelectrochemical (BEC) system for wastewater treatment, which is commercially known as E-Redox®. The E-Redox® BEC system has demonstrated that this unique BEC system can treat wastewater at rates comparable to conventional aeration systems. This demonstration conducted at a wastewater treatment plant yielded chemical oxygen demand (COD) degradation rates that were within 4% of the aerated wastewater treatment system, which can substantially reduce energy requirements since BEC systems require zero energy input.

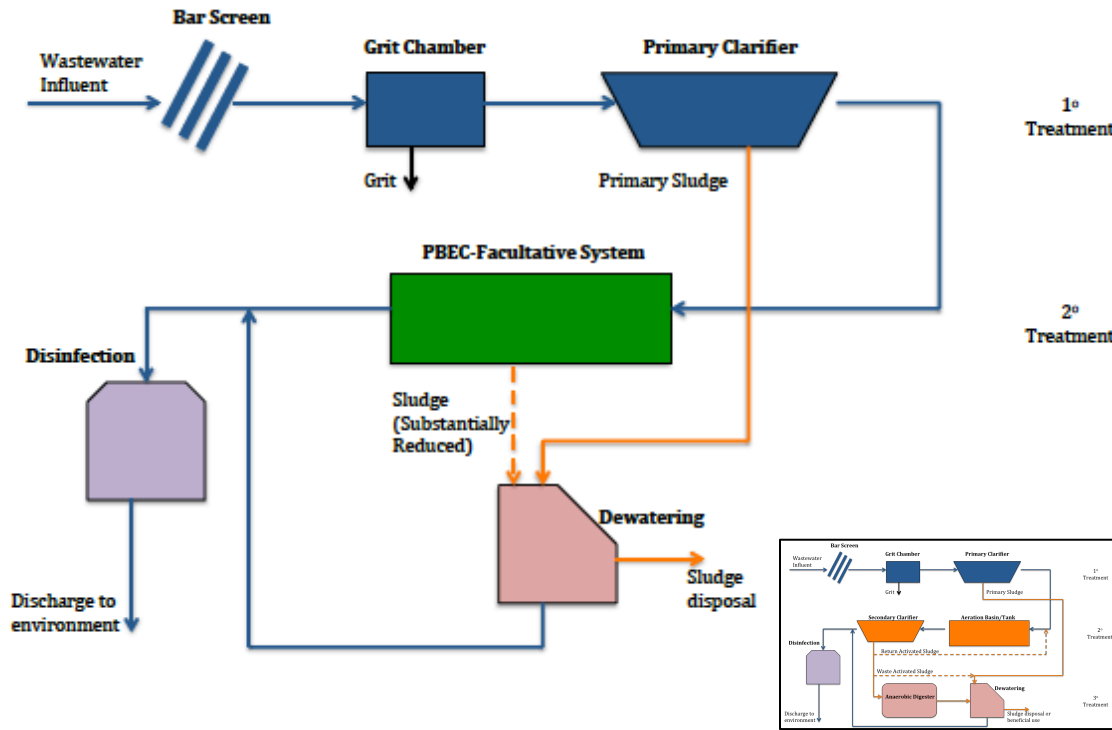


Performance Improvement by PBEC™

AET has further improved and enhanced the performance of the E-Redox® systems by integrating photocatalytic materials. Photocatalytically-enhanced BEC (or PBEC) systems have been tested at small-scale by the E-Redox® team, where the PBEC™ system degraded and maintained COD at levels comparable or surpassing conventional aeration (activated sludge) system (see Case Study).

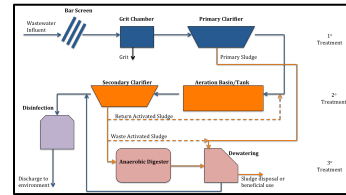


Integrated PBEC™ + Facultative MBR to Achieve Significant Savings in Wastewater Treatment



1^o Treatment
2^o Treatment

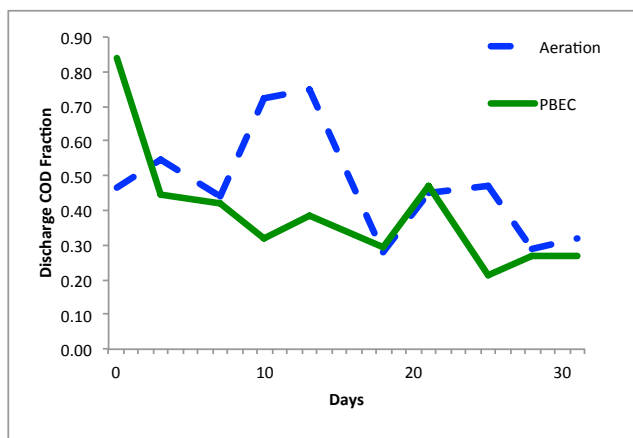
AET has formed a strategic alliance with JDL International to revolutionize the traditional wastewater treatment train. JDL has developed and commercialized a facultative MBR technology that can effectively remove COD and nutrients from wastewater while minimizing sludge generation. By integrating AET's PBEC technology with JDL's FMBR technology. The new package results in simplification of the steps of conventional wastewater treatment train, minimizing sludge issues, and achieving significant savings in footprint reduction and capital investments as well as total cost in wastewater



Conventional Wastewater Treatment Process

Case Study

To determine the effectiveness of a PBEC system for wastewater treatment, tests consisted of two different treatment reactors: (1) Aeration (simulating conventional aeration basin); (2) PBEC system. The pumping rate of synthetic sewage was set to give a hydraulic retention time (HRT) of 12 hours. The wastewater treatment tests ran for 57 days, where the integration of photocatalysis in the PBEC system resulted in 8-55% greater COD removal than that of the aeration process.



About Us

Advanced Environmental Technologies, LLC (AET) is a technology innovator and implementer, specializing in sustainable treatment solutions for wastewater, contaminated soils, groundwater, and sediments. Our patented technologies focus on remediation of a variety of recalcitrant contaminants, wastewater treatment, and low-value compounds to energy conversion. We provide both technologies and specialized services to project owners and engineering companies by offering innovative and sustainable solutions for environmental remediation, wastewater treatment, and bioenergy.



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