

高氮有機廢水污染物的產電技術 Energy Generation from Nitrogenous Organic Pollutants in Wastewater

利用電去離子及固體氧化物燃料電池耦合技術處理廢水及提取能源生產電力
Wastewater treatment and electricity generation by electrodeionization-solid oxide fuel
coupling set-up

專利編號: 62/353,137 (美國)

隨着能源危機日益加劇，大眾愈來愈重視能源的開發，其中包括從廢水中提取的沼氣和氨氣等氣體。為此，本團隊研發出一項全新的高氮廢水處理耦合技術（EDI-SOFC），來處理廢水中的碳氮有機污染物，並同時產生電力。

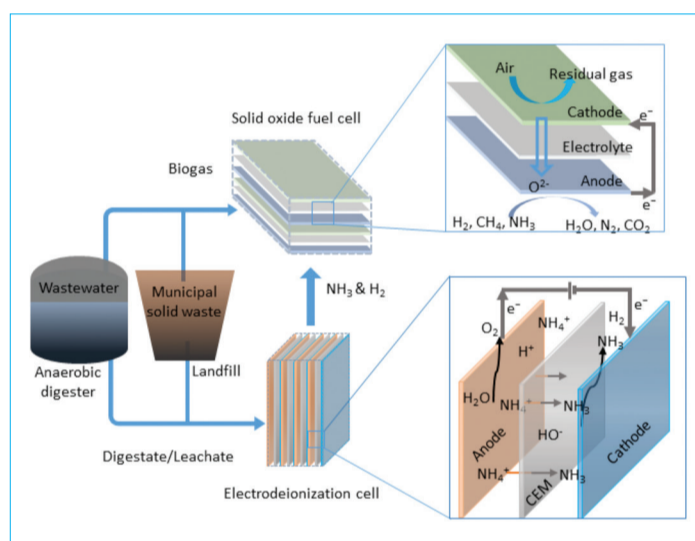
目前，最常用的污染物產電設備是固體氧化物燃料電池（SOFC）。SOFC的產電效率雖高，但卻不能直接以廢水為燃料。因此，我們把SOFC和電去離子技術(EDI)結合起來，先將廢水中的氨鹽基濃縮並轉化成氨氣，再利用氨氣產生電力，整個過程耗能低、效率高，與傳統廢水產電的技術相比，效能提升近60%。

特色與優點

- 耗能低，產電率高達60%左右
- 耗時少，污泥量小
- 佔地少，流程簡單
- 零污染，轉化徹底
- 廢水中碳氮污染物能源以電能的形式輸出

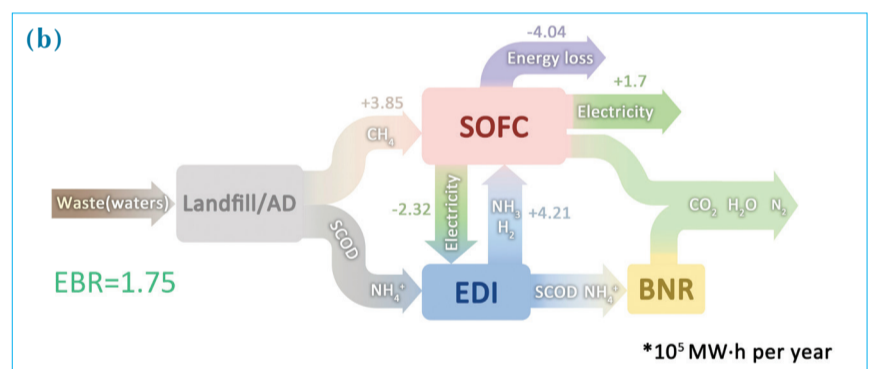
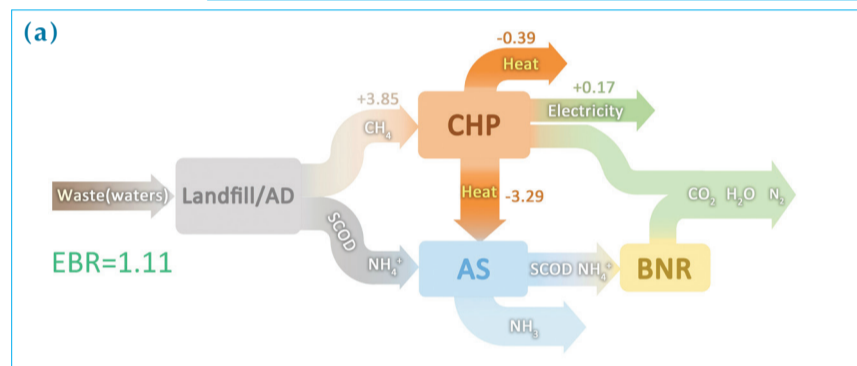
應用

- 高濃度氮廢水處理
- 提取垃圾滲濾液中的氨氮及去除所帶有的重金屬
- 可與其他生物技術整合，將沼氣和廢物中的發酵液及滲出液能源化，令其能源轉化率倍增



AD-EDI-SOFC 耦合裝置示意圖
Schematic diagram of the EDI-SOFC system integrated with anaerobic treatment (AD)

比較傳統發電技術(a) AS-CHP 與本研發技術 (b) EDI-SOFC能源效率轉換圖
Comparison of energy efficiency between conventional (a) AS-CHP system and our (b) EDI-SOFC system



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As global energy crisis intensifies, the development of alternative energy sources has become a major concern. Among these resources, biogas and ammonia extracted from wastewater are gaining wide attention. In light of this, PolyU has developed an electrodeionization-solid oxide fuel coupling (EDI-SOFC) technology to process carbonaceous and nitrogenous pollutants in wastewater and generate electricity at the same time.

Solid oxide fuel cell (SOFC), a traditional electrochemical conversion device, is highly efficient in electricity generation. However, wastewater cannot be used directly as fuel in SOFC. By coupling electrodeionization (EDI) and SOFC, the ammonium in wastewater can be converted into ammonia, which can then be used in SOFC to generate electricity. The process demonstrates low energy consumption and high efficiency. The EDI-SOFC technology is almost 60% more efficient than conventional methods of energy generation from wastewater.

Special Features and Advantages

- Low energy consumption, high electricity production (~ 60%)
- Less time-consuming, small amount of sludge yield
- Small footprint, straightforward process
- Zero pollution, thorough conversion
- Output of energy stored in carbonaceous and nitrogenous pollutants in the form of electricity

Applications

- Treatment of wastewater with concentrated ammonia
- Ammonia extraction and heavy metals removal from landfill leachate
- Coupling other biotechnologies to convert biogas and digestate/ landfill into electricity with double conversion efficiency

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