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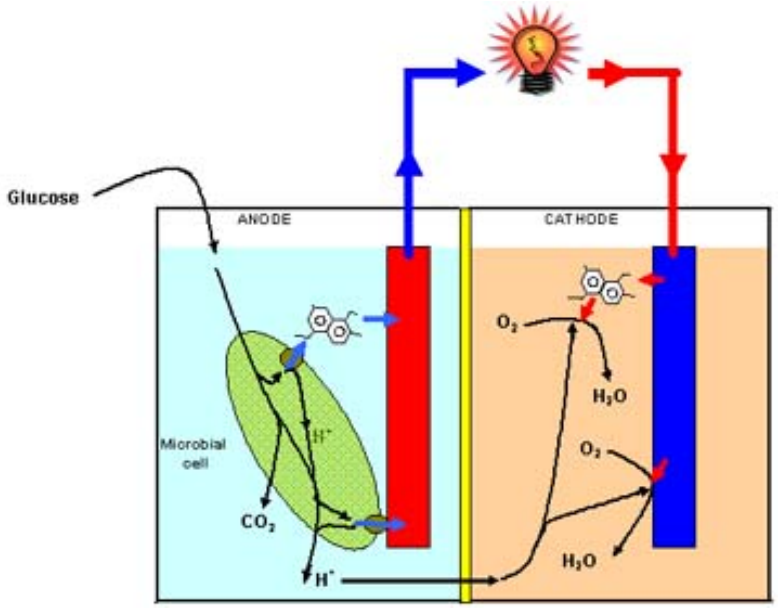
# Microbial fuel cells for energy production from wastewaters: the way toward practical application

Key words:

Microbial fuel cell, Wastewater treatment, Sustainability, Scale up, Chemical production

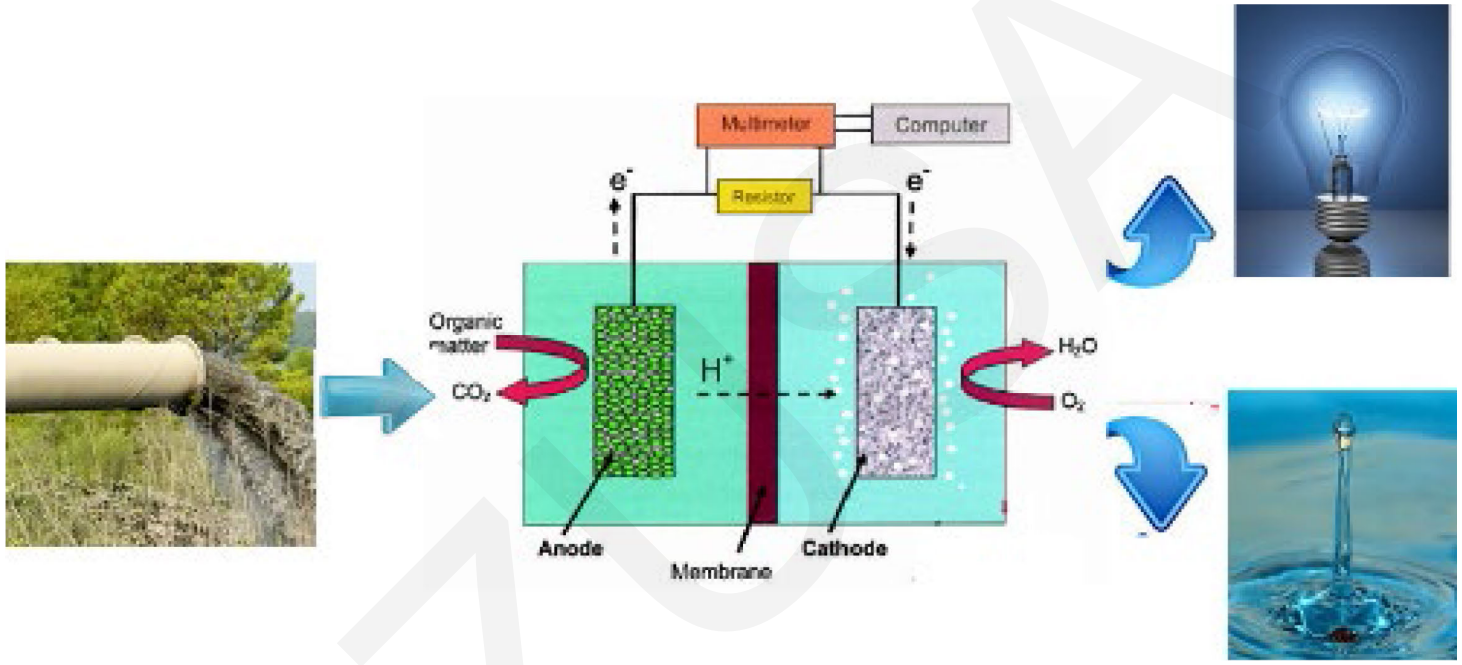


# Sustainable treatment and utilization of wastewater

- Wastewaters contain huge amount of energy.

- Howe to efficiently capture the huge energy potential in wastewaters is of great significance for meeting the world's energy needs, reducing the wastewater handling costs and increasing the sustainability of wastewater treatment.

# microbial fuel cells (MFCs) : a promising technology for sustainable wastewater treatment and energy production




***Opportunities :***

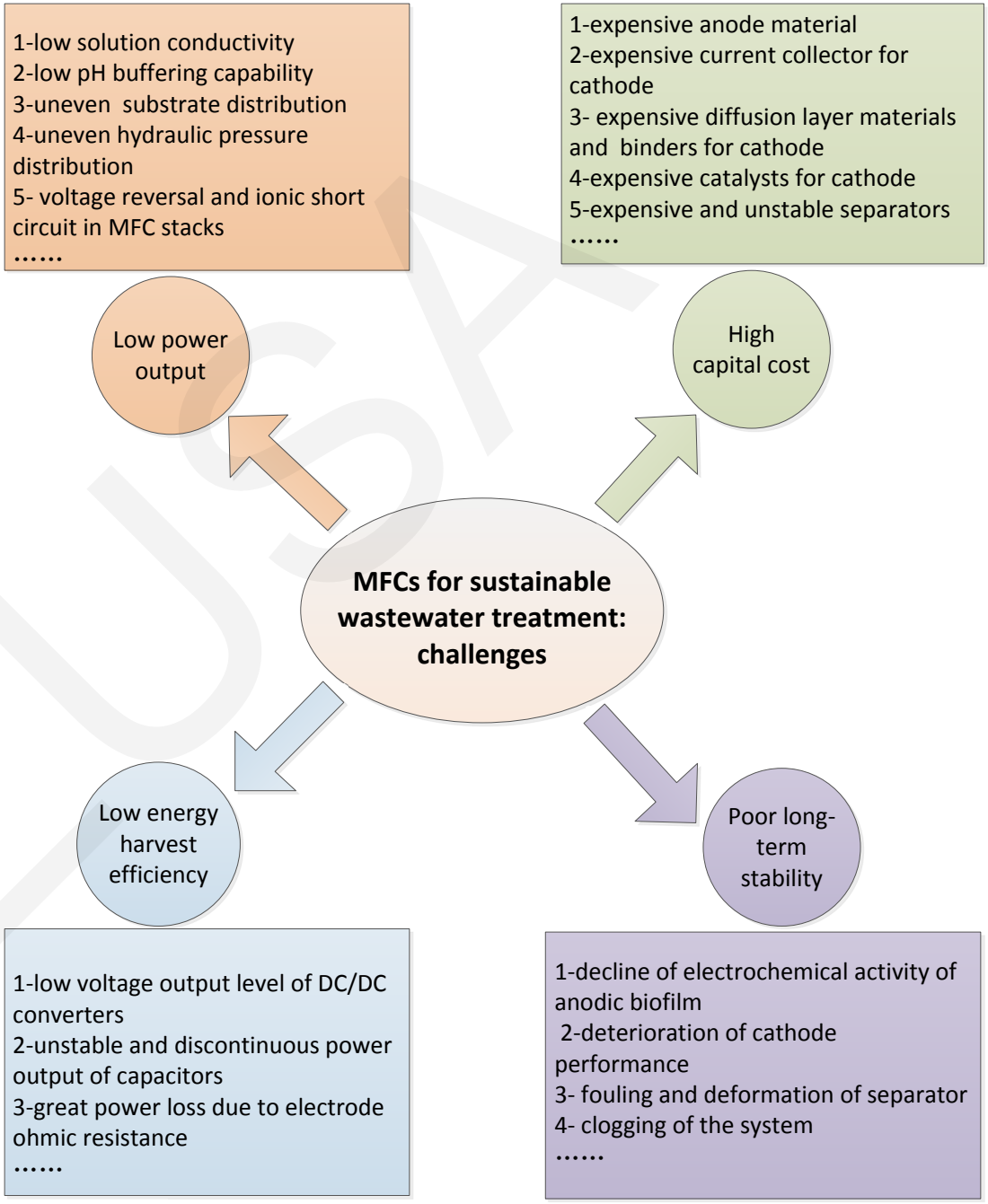
(1) low energy consumption and direct electricity generation;

(2) low adverse impact on the environment;

(3) theoretical good operation stability and low operation cost

Application of MFCs in real-world wastewater treatment is currently far from success!

# CHALLENGES



# Scaling up MFCs to a practical level

## —major challenges and developing directions

**(1) Increasing power output :**

- decrease the electrode spacing
- increase the solution conductivity
- reduce the electrode overpotential
- maintain a homogeneous distribution of substrate within the reactor
- alleviate the effect of uneven distribution of hydraulic pressure on the MFC performance
- avoid the voltage reversal and ionic shortage in MFC stacks

## Scaling up MFCs to a practical level

**(2) Reducing capital cost**

anode, cathode and separator

**(3) efficiently harvesting the electrical energy**

- Increase the voltage output level of DC/DC boost converter
- Increase the stability of capacitors
- Optimize the current collection mode of electrode

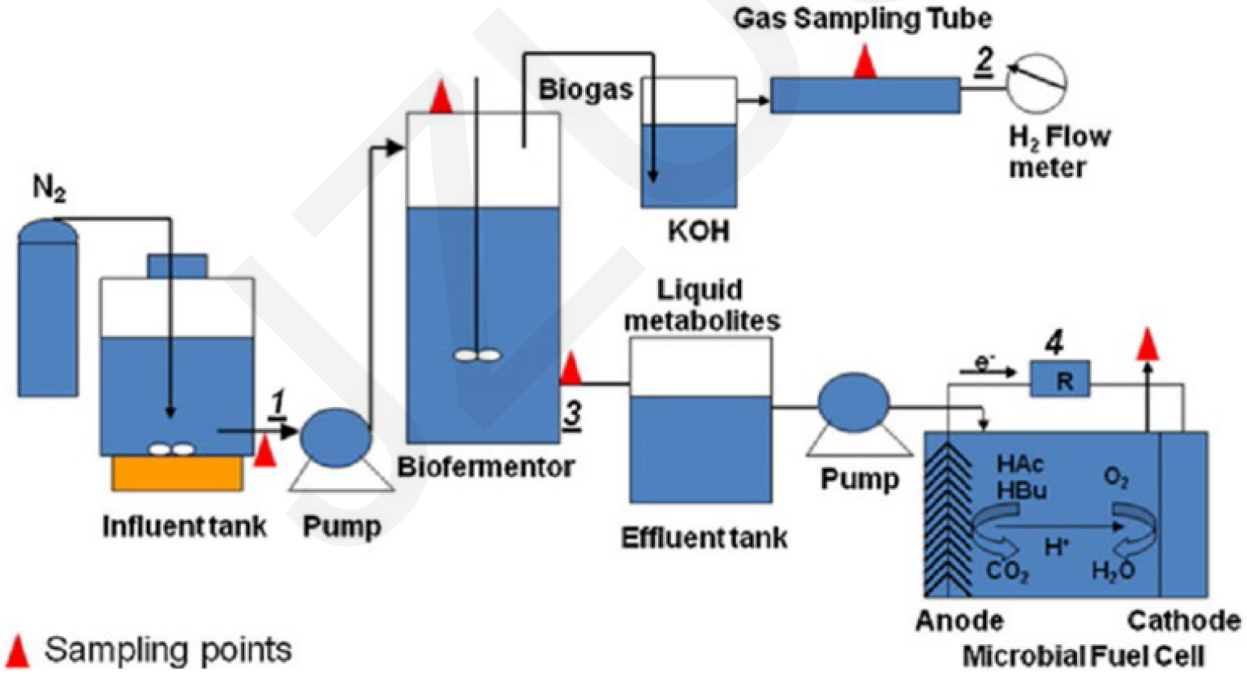
**(4) Increasing the long-term stability**

- Maintain the electrochemical activity of anodic biofilm
- Reduce the cathode deterioration
- Prevent the fouling and deformation of separators

# Synergies of MFC and other treatment technologies

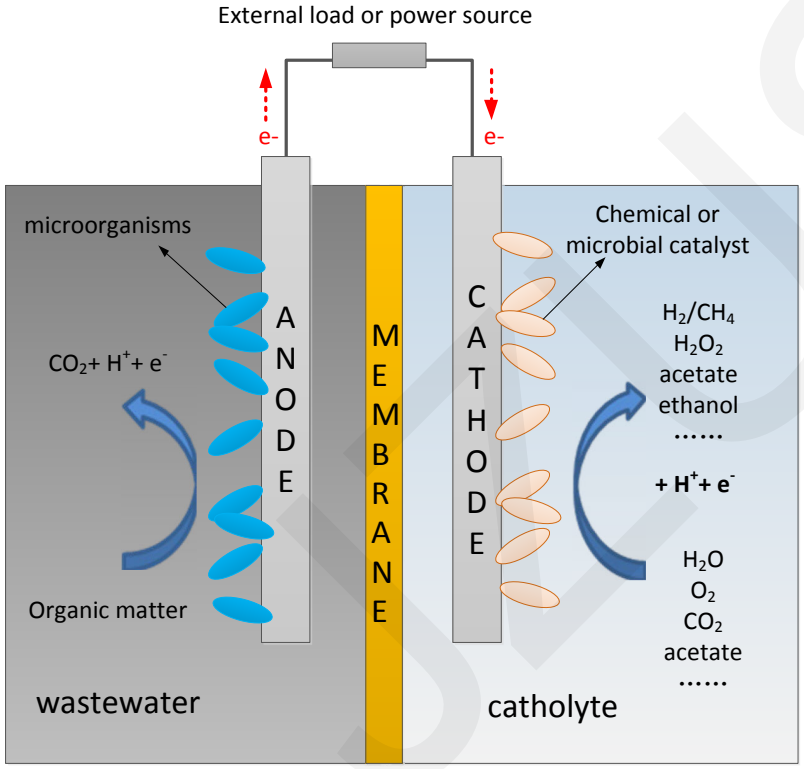
***(1) For a higher effluent quality--- Integrate MFC with***

- with anaerobic digestion: for high-strength wastewaters
- with membrane or algae process: to reduce the effluent COD to a low level
- with electrodialysis technique: to  treat wastewaters with high salinity



# Synergies of MFC and other treatment technologies

***(2) To extract more commercial value-- Integrate MFC with electrochemical reduction technologies***




**Produce $H_2$, methane, $H_2O_2$, caustic soda, acetate, 2-oxobutyrate , ethanol……**

# Synergies of MFC and other treatment technologies -----critical challenges

- How to reduce the high cost and improve the low performance of large scale MFCs
- How to optimize the  design and operation of complex synergic systems
- how to monitor and control the performance of the function unit of the system
- how to increase the system's shock-resistance toward sudden changes in pollutant components, temperature and organic loading
- how to increase the long-term stability of the synergic system
- How to increase the rate of chemical production
- How to produce chemicals of high purity