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Water Reuse in the State of Kuwait: Successes and Hopes

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Contents

- Reuse Experience in the State of Kuwait
- Selected Wastewater Treatment Technology cases

Environmental and Social Stresses

Current Environmental and Social Stresses	Main Impacts	Secondary Impacts
Population increase, development needs, climate change, aridity, limited renewable water resources	(1) Water stress (H) (2) Increase in water demand for various uses; (H)	(1) Increased wastewater generation rates (L); (2) Change and variability of wastewater flow (H) (3) Increased demand for water reuse (M)

Water Resources in Kuwait

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- Desalination (1.5 M m3/day)
- Groundwater
- Treated wastewater

- Treating Wastewater reuse reduces risk of pollution and avails water for various uses

Social, Legal, and Regulatory Issues

- Policies, Regulations and Guidelines, affect the ability of water authorities to expand reuse of wastewater.
- Enhanced public knowledge of water supply and treatment are important to informed decision making and to inform public debate on water reuse.
- Infrastructure

Hopes

- Industrial and produced water
- In-situ and decentralized systems
- Ecological restoration and rehabilitation
- Recharge to combat seawater intrusion-climate change
- Grey water and small scale systems

What is sustainable?

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a sustainable water resource is defined as a "**flux of water** that is **managed** with the objective of maintaining the **availability and quality** of water for as long as the **current climate** prevails", Eltahir (1999)

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Is Water Reuse a sustainable water resource

Water reuse is a sustainable water source if properly managed

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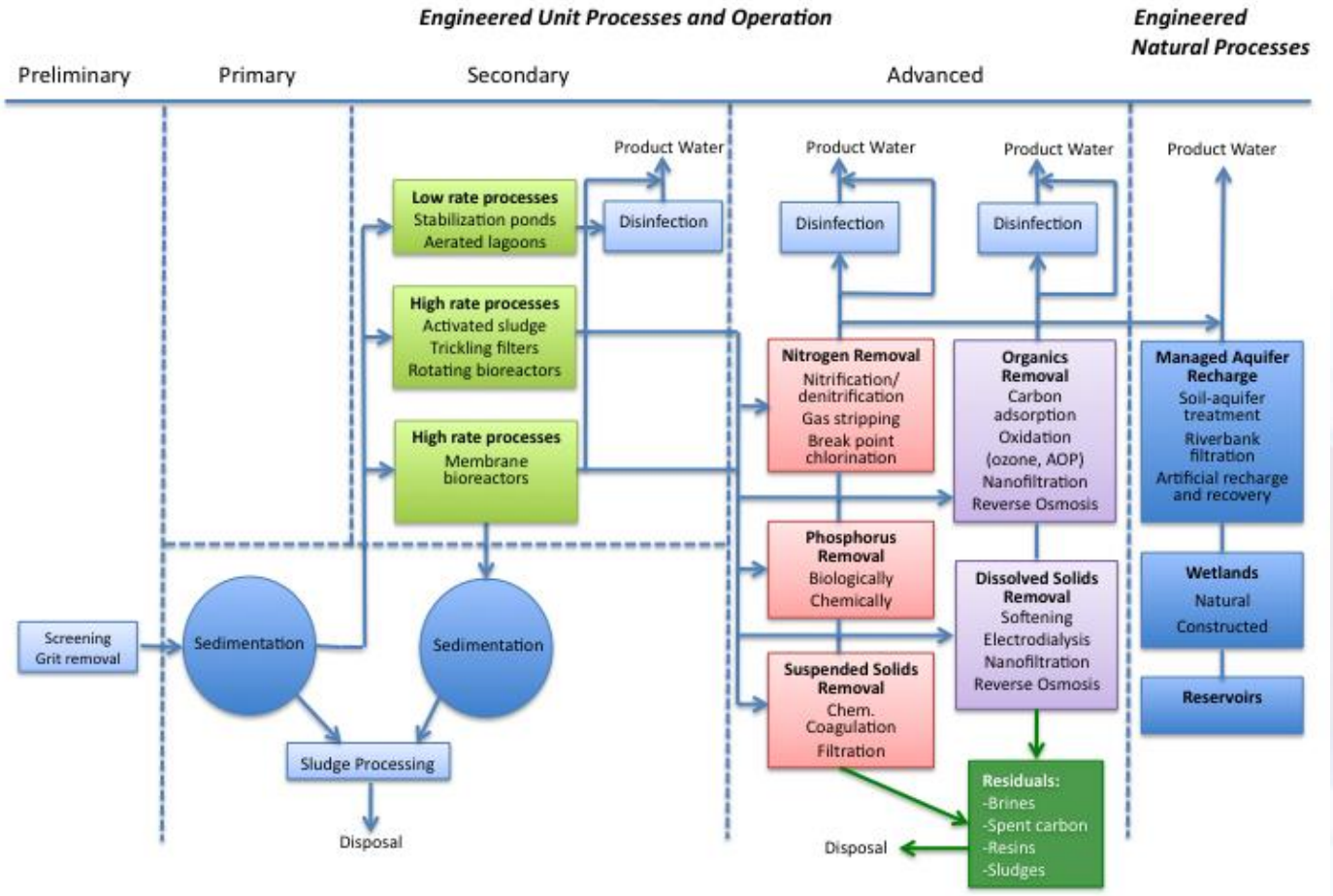
Water Reuse Treatment Technology



A portfolio of treatment options exists to mitigate microbial and chemical contaminants in reclaimed water.

KISR Efforts

- Improve wastewater treatment plant performance, municipal and industrial
- Innovative technologies for wastewater treatment, municipal and industrial
- Produced water treatment

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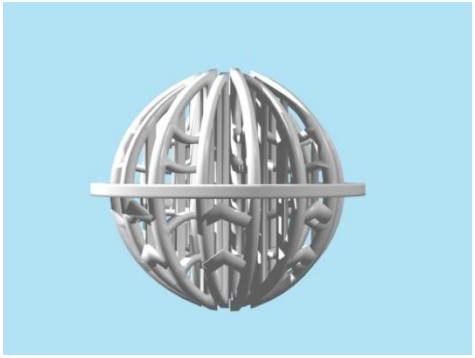
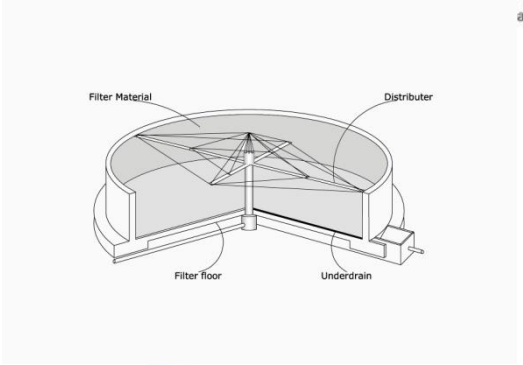
Hybrid Biological Process for Industrial Wastewater Treatment

IFAS

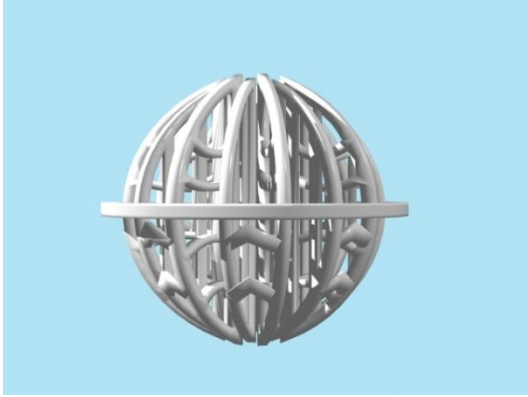




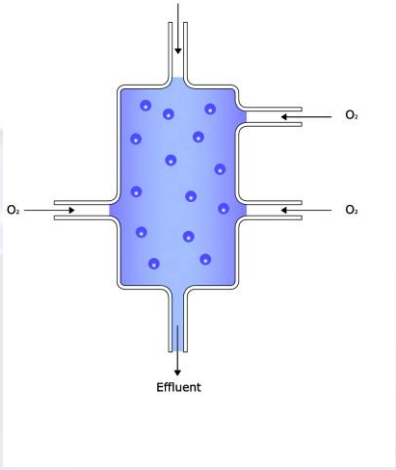
It is process capable of giving a cost-effective solutions at industry level is the hybrid biological treatment process. This process utilizes free-flowing plastic media as surface area for bio-films growth. Can be operated within a traditional suspended-growth activated sludge system, or as a separate treatment process. Additional benefits of the system include:

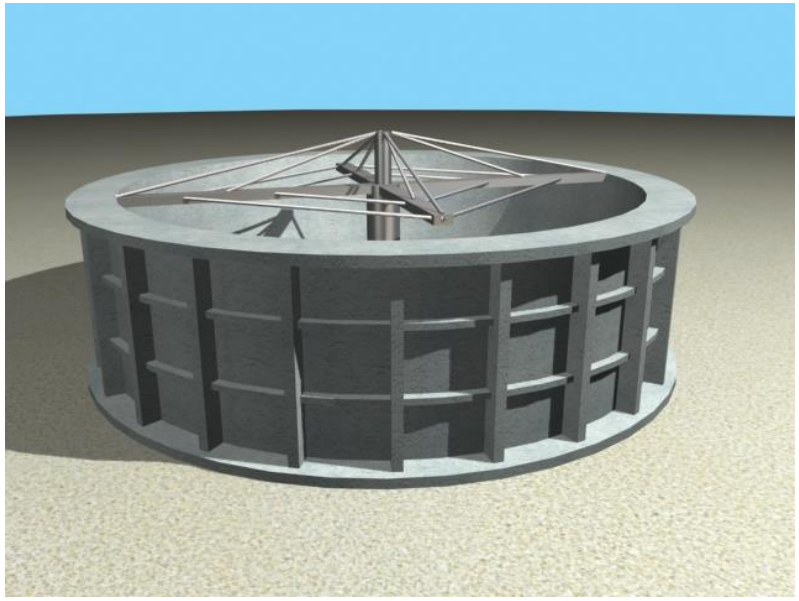
- Reduction of HRT required for CBOD removal
- Operational flexibility due to the relative simplicity of adding biomass carriers in response to growing loads

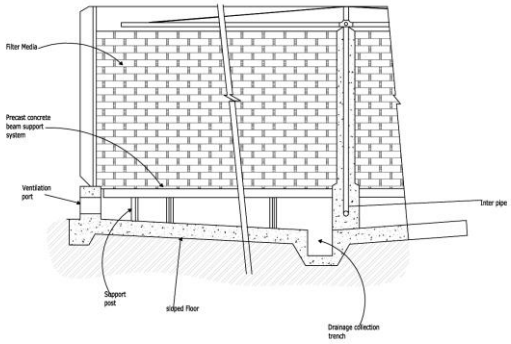
Hybrid IFAS



Design output parameter	Value
Degradation rate (mg/l/s)	$1.55*10^{10}6$
Number of hybrid reactors	6
Area (m^2)	7540
Residence time(hrs)	21.84
Effluent substrate concentration (mg/l)	1.37







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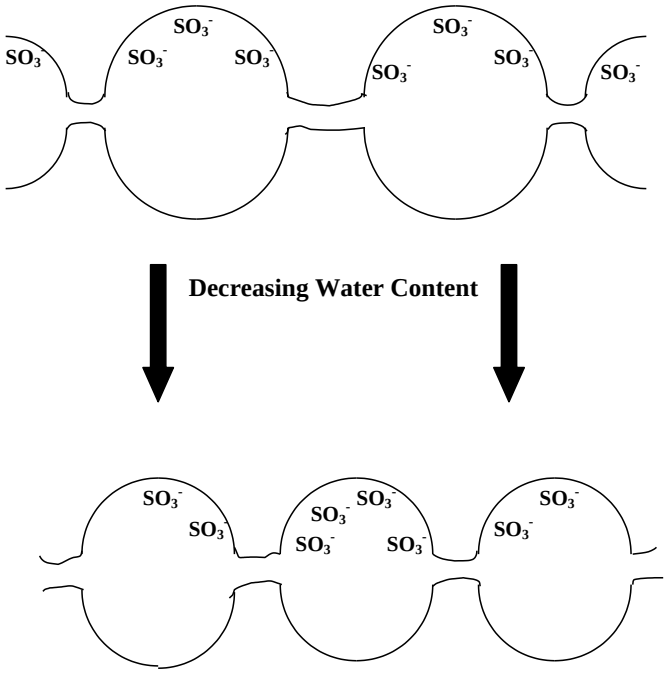
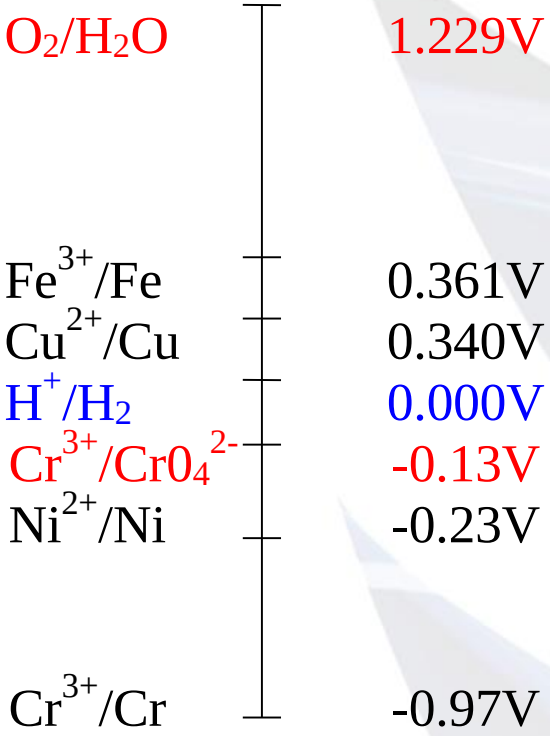
Metallic Impurity Removal from Acidic Metal Finishing Process Water

Nafion Ion-cluster Network



$$[(CF_2CF_2)_nCFCF_2]_x$$
$$|$$
$$(OCF_2CF)_mOCF_2CF_2SO_3H$$
$$|$$
$$CF_3$$

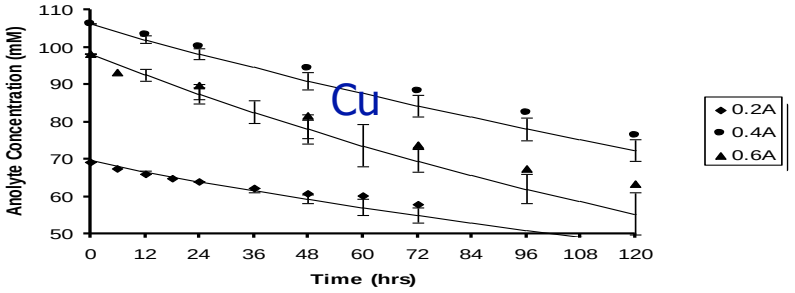
Cell Thermodynamics

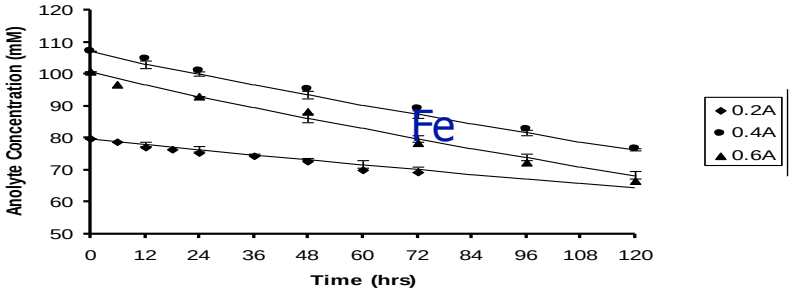


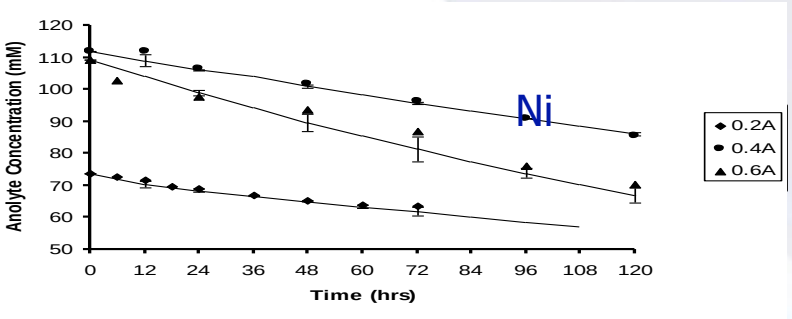
Standard Potentials at 25°C (Allan J. Bard, "Electrochemical Methods.")

Mathematical Model

Fitting of Anolyte Concentration







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Thank You