Tiny Little Helper for Textile Wastewater Treatment
Cultivation of Special Microbes for Enhancing Wastewater Treatment Performance

HKPC TechDive – Green Living
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HKPC Wastewater Projects in PRC
Current Situation in Textile Industry

GB4287-2012
“Discharge Standards of Water Pollutants for Dyeing and Finishing of Textile Industry”

- PRC has implemented new stringent discharge standard that aniline compounds concentration down to below detection limit (i.e. 0.03 mg/L) in 2015.
- Most textile dyeing wastewater treatment facilities cannot remove aniline compounds effectively to meet the limit.
- Even though some textile dyeing factories have eliminated all aniline compounds discharge in the production processes, aniline compounds were still found in the effluent discharge.

Discharge Concentration

Detection Limit (i.e. 0.03 mg/L)
Existing Wastewater Treatment Method in Industries

Textile Dyeing Wastewater → Chemical coagulation → Hydrolysis → Aerobic → Decolorisation → Effluent Discharge

- Coagulation tank 物化
- Anaerobic 厌氧
- Contact Aeration 接觸好氧
- PAC 聚硅鋁鐵
- Bleaching 漂水
- Decolorizing agent 脫色劑
Existing Wastewater Treatment Method in Industries

- High chemical cost in Physiochemical Treatment
- High operation cost in frequent replacement of carbon filter
- High energy cost in aeration in biological process with typical biomass composition
- Biomass is not selective for target pollutants removal
Conventional Bioreactor Design and Cultivation Process
Our Approach

Know-how of DNA identification, Cultivation, Enrichment and Immobilisation of specialised microbes developed.
Our Approach

Identification

Electronic Microscope
(Bacteria: 2.5 µm long)

Light Microscope
(Colony: ~2.5mm diameter)

Traditional Sequencing
(DNA: 2.5 nm diameter)

Next Generation DNA Sequencing
(whole genome)
Our Approach

Isolation and Cultivation

Studies on aniline-degrading activity and decolorising activity of the specialised microbial strains

Taxonomic identification of isolated microbial strains

Lab-scale Cultivation & Enrichment
Our Approach

Enrichment

Selection Process:

✓ By providing favourable driving force
✓ Removal of undesirable species
Our Approach

**Immobilisation**

- Immobilisation at controlled conditions
- Biofilm of specialised microbes can be formed in around 10 days
Our Approach

Application in Existing Wastewater Treatment

Bioreactor with Specialised microbes

Influent Tank  Anoxic  By-pass  Aerobic  Sedimentation  MBBR
Cultivation and Enrichment of Specialised Microbes

Major Factors:

- Specific nutrient utilisation ability and specific metabolic properties
- Driving force
- Selective intensification
- Immobilisation as biofilm on carriers
Aniline compounds in textile dyeing wastewater can be treated solely by biological process.

Acclimisation of bacteria can be enhanced by not only engineering approach but also DNA approach.

Treatment process can be enhanced by improving the microbial population in the wastewater treatment units.
Currently, no similar application of DNA identification and offline cultivation system to provide specialised microbes;

Conventional cultivation approach is time-consuming which leads to long start-up period of new establishment and long system stabilisation period of existing factory in plant upgrading;

Skilled and experienced workers are required to be deployed to the location of new factories for testing & commissioning.
Cultivation and Enrichment of Specialised Microbes - Potential Applications

1. Industrial Scale-up
   • Shorten start-up time
   • Less labour intensive
   • Less disturbance to plant operation

2. Prototype
   • Offline Cultivation System of Specialised Microbes for WWTP
   • Factories in other countries like Vietnam and Cambodia

3. Self-Recovery
   • Changes in Biological Treatment Unit

Semi-automated unit
Manual Cultivation
Scale-up
Factory in PRC
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