

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

HKPC TechDive – Green Living

8-12-2020

HKPC Wastewater Projects in PRC



Current Situation in Textile Industry



**Discharge
Concentration**



**Detection Limit
(i.e. 0.03 mg/L)**

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.

Existing Wastewater Treatment Method in Industries

Textile Dyeing Wastewater

Chemical coagulation

Hydrolysis

Aerobic

Decolorisation

Effluent Discharge



Coagulation tank 物化



Anaerobic 厭氧



Contact Aeration 接觸好氧



Bleaching 漂水

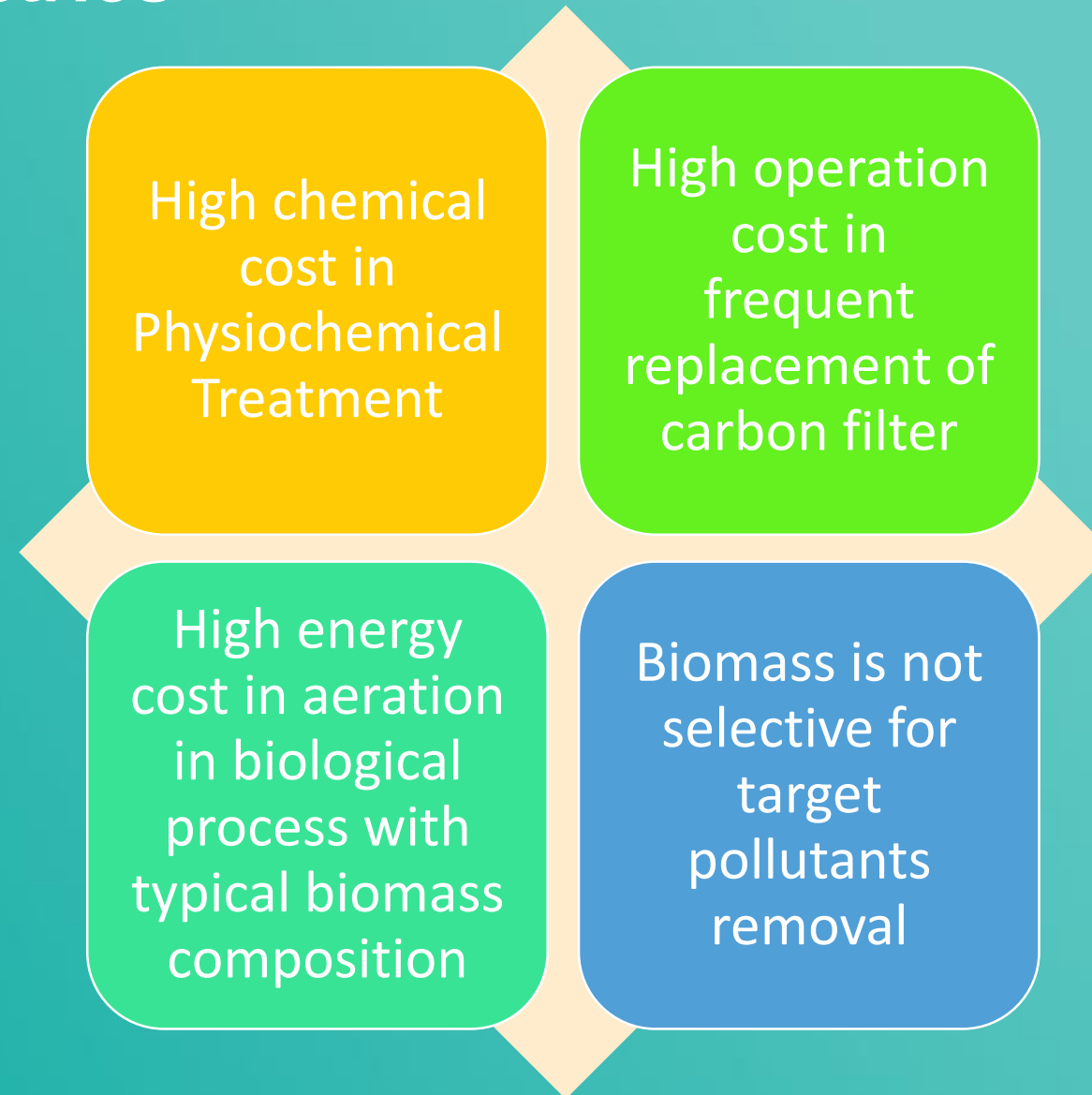


PAC 聚硅鋁鐵

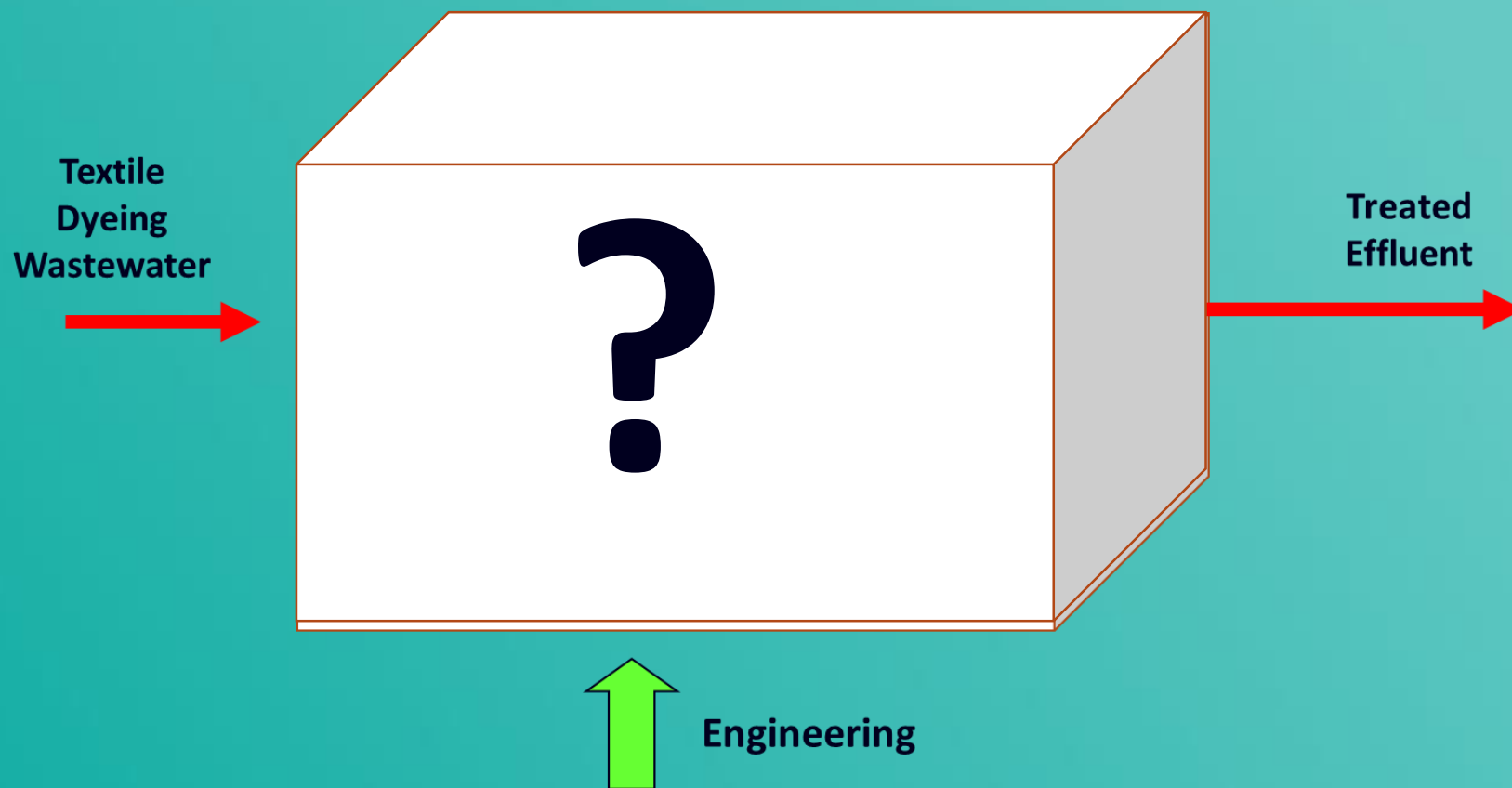


Decolorizing agent 脫色劑

Existing Wastewater Treatment Method in Industries



Conventional Bioreactor Design and Cultivation Process



Our Approach

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



Our Approach

Identification



Traditional Sequencing
(DNA: 2.5 nm diameter)



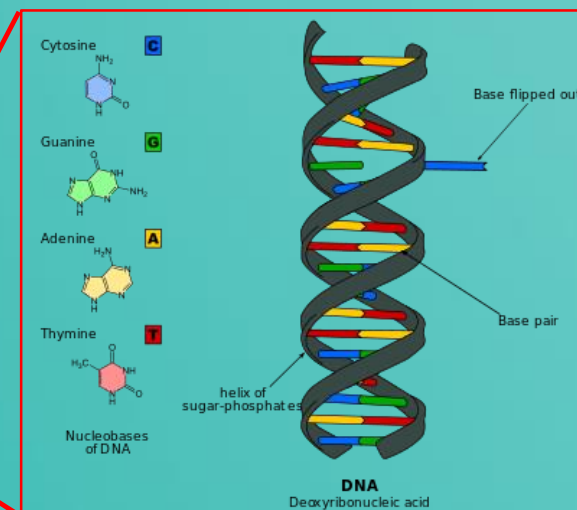
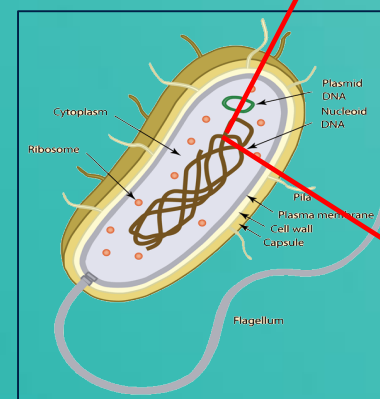
Next Generation DNA
Sequencing
(whole genome)



Electron Microscope
(Bacteria: 2.5 μm long)



Light Microscope
(Colony: $\sim 2.5\text{mm}$ diameter)

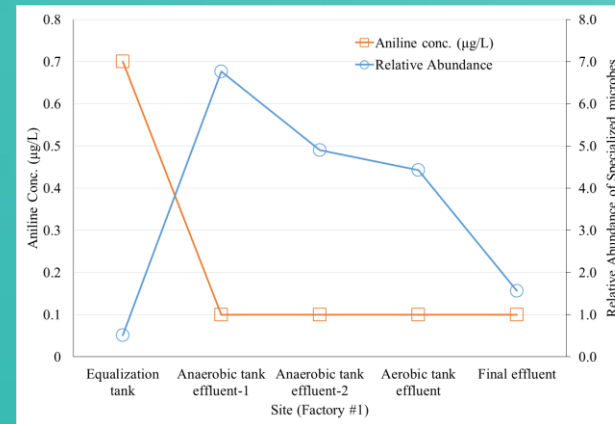


Our Approach

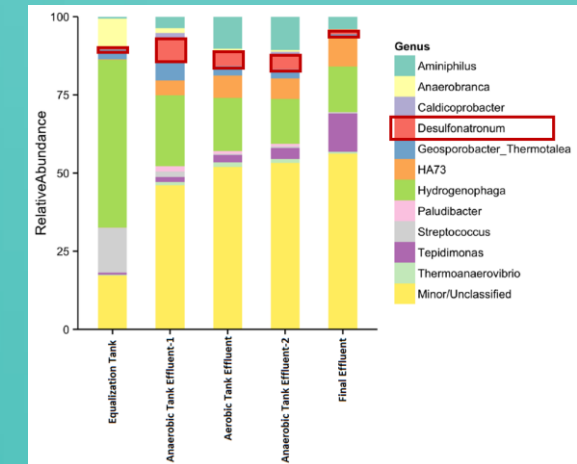
Isolation and Cultivation



Lab-scale
Cultivation & Enrichment



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



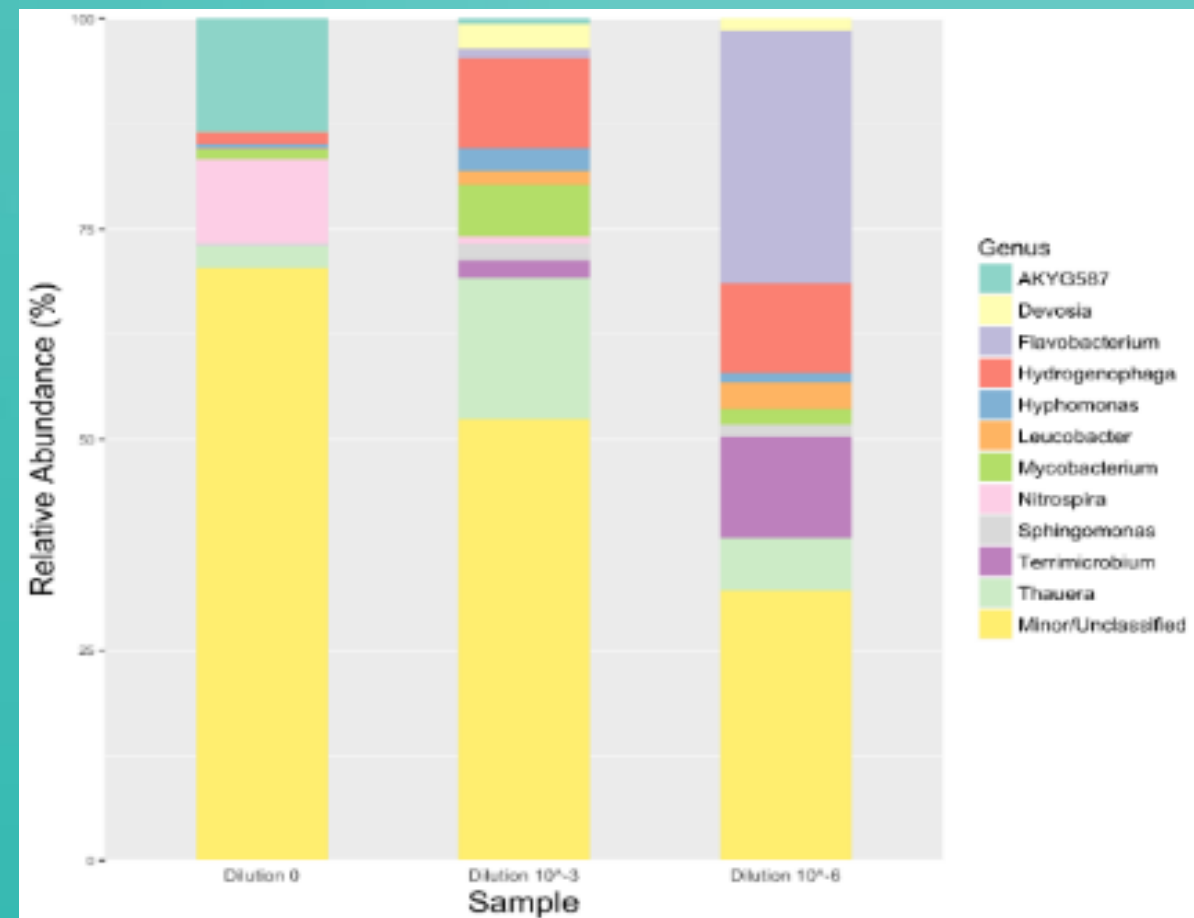
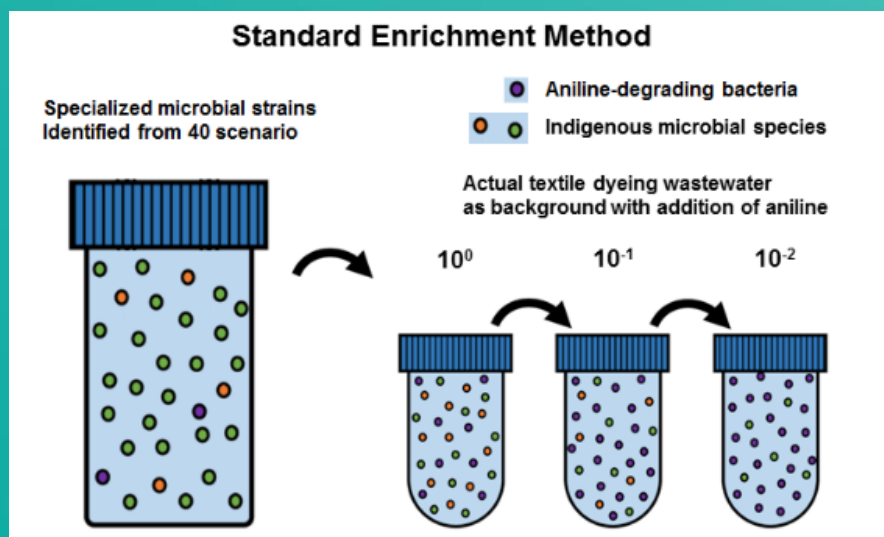
Taxonomic identification of isolated microbial strains

Our Approach

Enrichment

Selection Process:

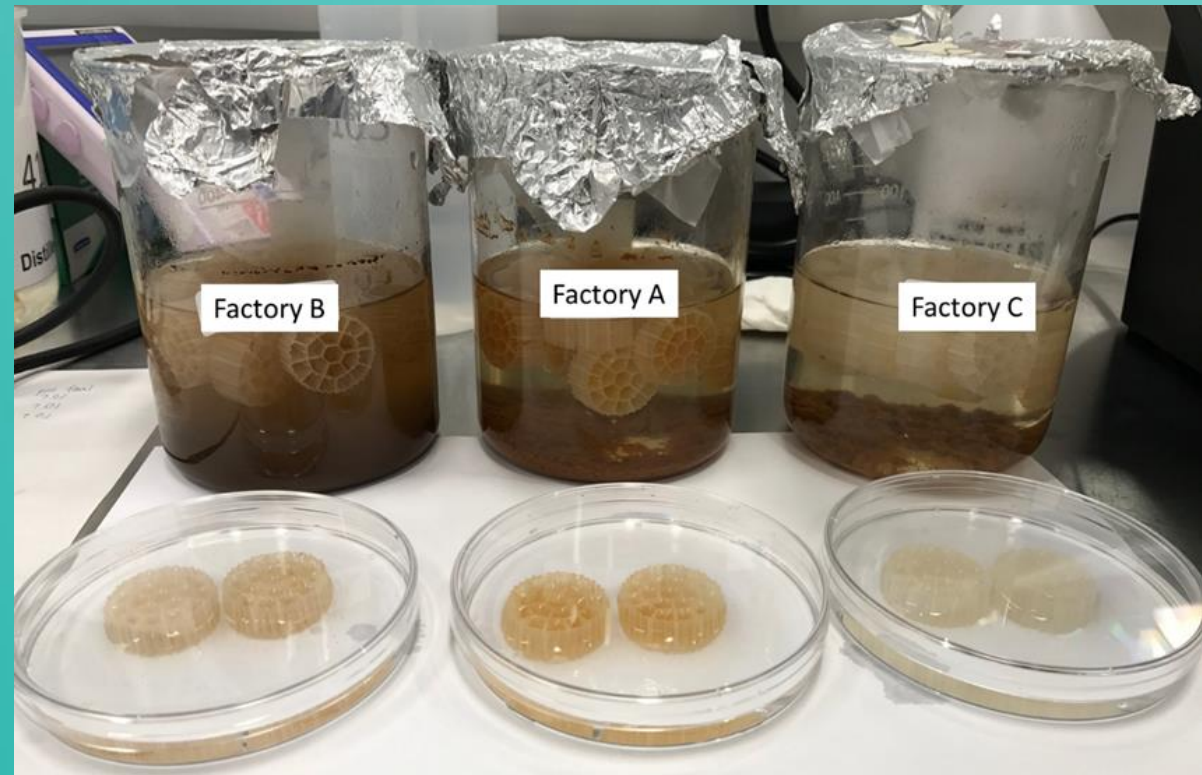
- ✓ By providing favourable driving force
- ✓ Removal of undesirable species



Our Approach

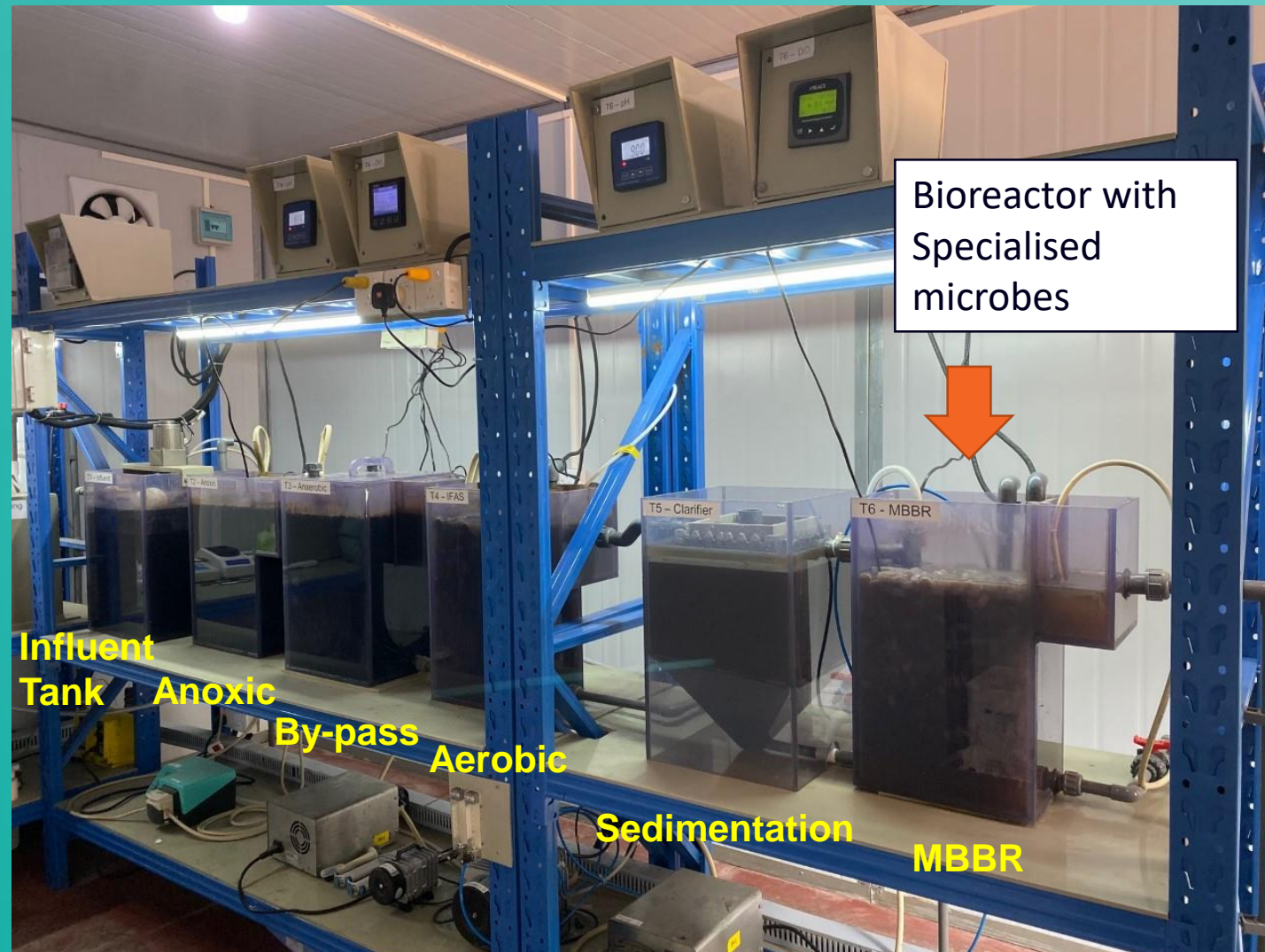
Immobilisation

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



Our Approach

Application in Existing Wastewater Treatment



Cultivation and Enrichment of Specialised Microbes

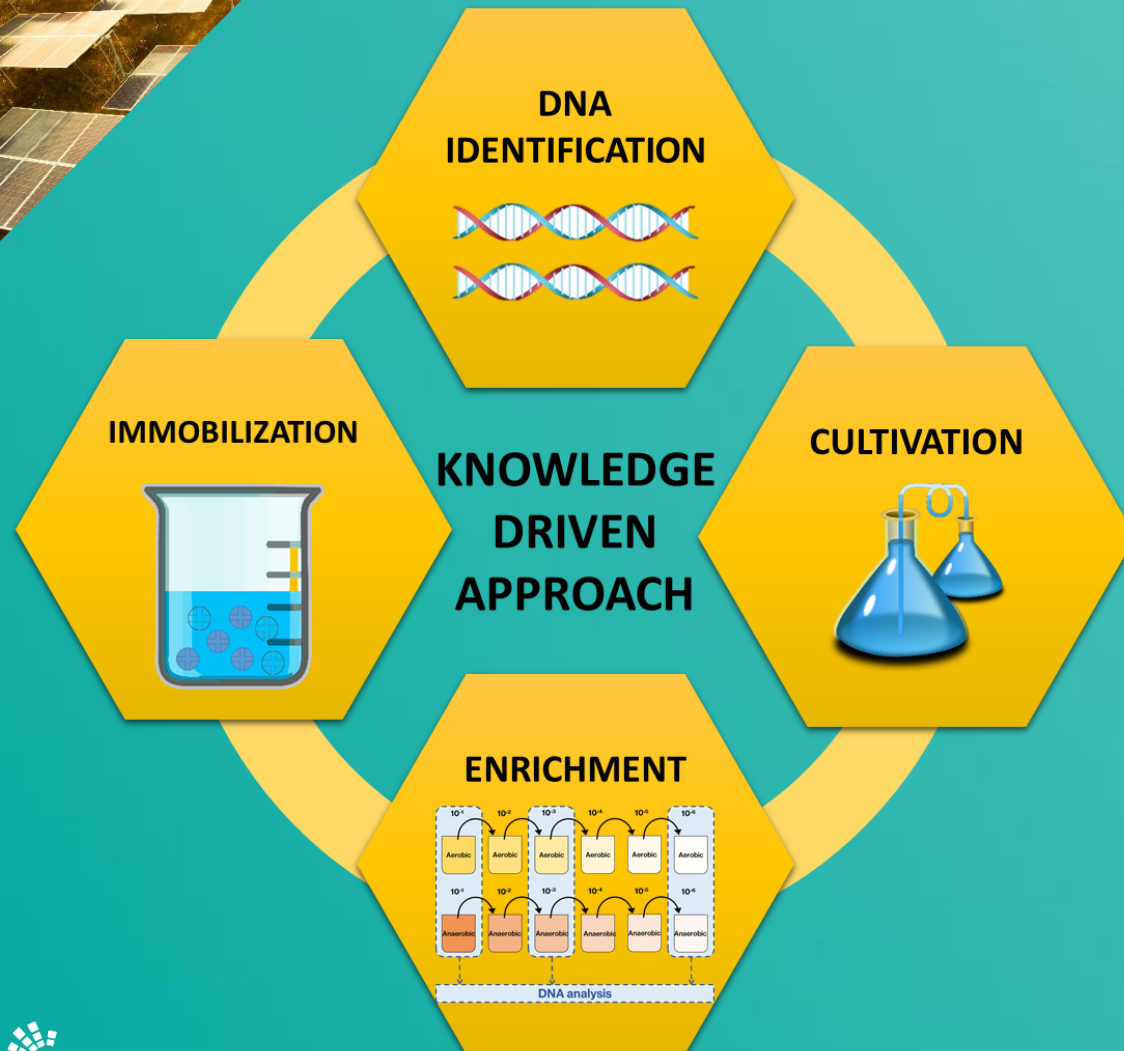
Major Factors:

- Specific nutrient utilisation ability and specific metabolic properties
- Driving force
- Selective intensification
- Immobilisation as biofilm on carriers



On-site Bulk
Cultivation & Enrichment

Cultivation and Enrichment of Specialised Microbes



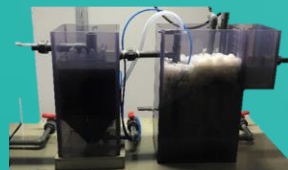
- Aniline compounds in textile dyeing wastewater can be treated solely by biological process
- Acclimisation of bacteria can be enhanced by not only engineering approach but also DNA approach
- Treatment process can be enhanced by improving the microbial population in the wastewater treatment units

Cultivation and Enrichment of Specialised Microbes

- 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



Semi-automated unit



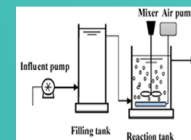
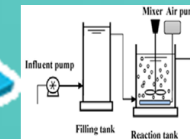
Manual Cultivation

Scale-up

2. Prototype

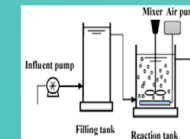
- Shorten start-up time

Offline Cultivation System of Specialised Microbes for WWTP



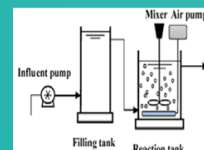
Factory in PRC

Specialised Carriers



Factories in other countries like Vietnam and Cambodia

3. Self-Recovery



Changes in Biological Treatment Unit

- Less labour intensive
- Less disturbance to plant operation

Acknowledgement

This work was supported by ITF project grant from **ITC** via **Hong Kong Research Institute of Textiles and Apparel (HKRITA)** (2017 – 2019).



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