CHEMILINK
ZERO WASTE ENGINEERING

Chemilink Brand

- Green and Effective Engineering Solutions & Materials

Chemilink Technologies Group
Singapore

Content

Cert No. 80091 Cert No. 90002

1. Corporate Position

Philosophy

Towards a zero solid waste society

Vision

The leading standard in Zero Waste Engineering.

Mission

To construct environmentally friendly and sustainable infrastructure by investing in zero waste businesses, creating zero waste processes, employing and developing people with zero waste mindsets.

Value Proposition

Fast construction of cost effective, eco-friendly and durable infrastructure through very innovative and sustainable engineering solutions.

Corporate Values

Innovation & Passion, Process & Quality Driven Integrity & Honesty.

2. Product Series

--- We Provide Green & Effective Engineering Solution Comprising Supply of Engineering Compound and Provision of Technical Services ---

2.1 Chemilink **SS-100 Series** for Civil/Road/Pavement Construction

- **SS-108 series** for Soil Stabilization/Rehabilitation/Recycling
- **SS-110 series** for Stone Stabilization/Rehabilitation and Re-cycling of Construction Wastes
- **SS-120 series** for Road Surface Quick Repairing
- **SS-130 series** for Road Surfacing/Resurfacing
- **SS-140 series** for Semi-Rigid Pavement

2.2 Chemilink **SS-200 Series** for Building Construction

- **SS-210 series** for Wall Finishing
- **SS-220 series** for Floor/Car-park Surfacing
- **SS-230 series** for Concrete/Mortar's Repair/Bonding and Water-Plug
- **SS-240 series** for Grouting

- **SS-250 series** for Waterproofing (floor, roof, …)
- **SS-260 series** for Tile-Adhesive

2.3 Chemilink **SS-300 Series** for Solid Waste Management

- **SS-310 series** for Slurry/Sludge Treatment
- **SS-320 series** for IBA/IFA Treatment
- **SS-330 series** for Land Reclamation
- **SS-340 series** for Landfill Liner & Capping
- **SS-350 series** for Coal Binding

A Glimpse of Chemilink Singapore Central Plant

3. Essences of Innovative Solutions

--- Premier, Unique & Innovative Solutions to Address Civil Engineering's Challenges ---

- ***"Floating" Semi-Rigid Platform*** over swampy and soft ground.
  (15-year highways/roads in swampy areas without major repairing)

- ***Anti-Cracking Performance*** for high-grade flexible pavements.
  (Examples: airport runways and taxiways with stabilized base & sub-base courses)

- ***Excellent Workability*** for quick build and repair airport infrastructures under heavy operational limitations.
  (Iconic project: Singapore Changi International Airport runways widening, featured by Discovery Channel in "Man Made Marvels" program and broadcasted since 2008)

- ***Semi-Rigid Pavement*** with highest performances for heavy loadings *(Examples: airport parking aprons, heavy traffic roads and junctions in Singapore)*

- ***Reduce, Reuse & Recycle (3R)*** *local soils and solid construction wastes for various sustainable pavement construction*
  (Almost all Chemilink pavement projects internationally)

4. Major Projects

--- A Selection of Chemilink Projects for Past 20 Years Is Testament of Our Superior Engineering Solutions ---

Airfields

- Singapore Changi International Airport Runway Widening (2005)
- Singapore Changi International Airport Parking Apron (2007)
- Malaysia Senai International Airport Runway & Taxiway Widening (2007 & 2008)

(An iconic project featured & broadcasted by Discovery Channel in "Man Made Marvels" Program worldwide since 2008)

Singapore Changi International Airport Runways Widening, 2005

After Filling

After Hardening

Singapore Changi International Airport Parking Apron, 2007
(A latest pavement solution)

Seaports

- Indonesia Batamas Shipyard (1997)
- Malaysia Port Klang Container Yard (2010)

Port Klang Container Yard, Malaysia, 2010
(A typical "3R" project)

Highways/Roads

- Jalan Tutong Phases II &III, Brunei (1997&1999)
- Brunei City Road Maintenance (2000)
- China Low Cost Roads (e.g. Tibet Public Roads, 2002~2011)
- Caltex Oil Field Access, Indonesia (2002)
- South-East Asia Public Roads in Swampy Areas (2004)
- Sri Palani Murugan Industrial Growth Centre, India (2010)
- Heavy Traffic Junctions, Singapore (2010~2011)

Jalan Tutong, Phases II & III, Brunei, 1997&1999
(A durable "Floating" Semi-Rigid Platform in swampy areas)

Road in Swampy Area, South East Asia , 2004

Road in Tibet, China with Severe Cold & Circumpolar Latitude, 2007

Rural Road in South East Asia, 2005

Singapore Heavy Traffic Junctions, 2010 - 2011

Buildings

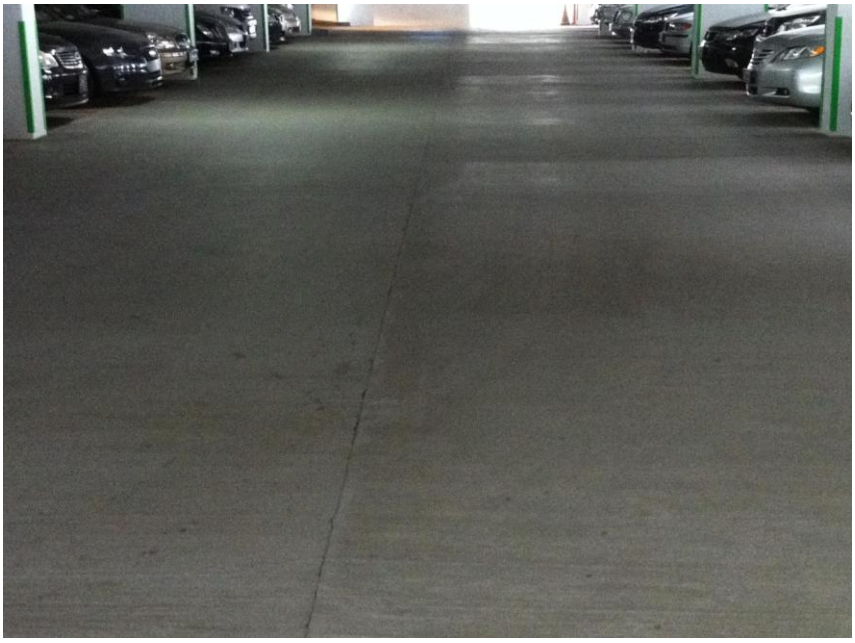
- Jiangyan Secondary School in Jiangsu, China (1999)
- Nanzhen Building in Shanghai, China (2000)
- Upgrading of Swimming Pool for Westin Stamford Hotel, Singapore (2000)
- NTU Hostel Redevelopment, Singapore (2001)
- Airport & Aviation Services in Colombo, Sri Lanka (2004)
- National Hospital in Colombo, Sri Lanka (2004)
- Kuala Belait Hospital in Brunei (2004)
- Reconstruct of Maktab Sains College, Jalan Muara Phase II, Brunei (2004)
- Waterproofing for Superior Court in Colombo, Sri Lanka, (2006)
- The Sail at Marina Bay, Singapore (2007)
- Singapore HDB Aprons (2007~2011)
- Multi-Storey Car Park at Chin Swee Road, Singapore (2011)

Upgrading of Swimming Pool for Westin Stamford Hotel Singapore, 2000

Flooring System for The Sail at Marina Bay, Singapore, 2007



Singapore HDB Aprons, 2007~2011



Multi-Storey Car Park at
Chin Swee Road, Singapore, 2011

R&D Projects for Solid Waste Management (Funded by Singapore Government)

- ETRP - Environment Technology Research Program with NEWRI of NTU (2009)
- IES - Innovation for Environmental Sustainability (2010)

Geotechnical Lab

Environmental Lab

Material Lab

Chemilink R&D Center

Landfill Site Visit

Chemical Lab

R&D Project - ETRP

NANYANG TECHNOLOGICAL UNIVERSITY

Nanyang Environment & Water Research Institute

CHEMILINK ZERO WASTE ENGINEERING

ENHANCED BIOLOGICAL AND PHYSICAL STABILIZATION IN LANDFILLS

Project Scope

Objectives

The target of the project is to develop a method for accelerated landfill stabilization, and to transform the landfill into a source of energy and a site for carbon sequestration. The developed method may be test-bedded at one of Singapore's landfill sites.

Brief Background

Landfilling is expected to be the most commonly employed waste disposal method worldwide since it is seemingly simple and economical. Poorly designed and operated landfills can, however, compromise human health and environmental quality with uncontrolled emissions of gas and leachate.

Even when properly operated, sanitary landfills can still potentially cause environmental difficulties because the natural decomposition process occurring within these landfills is slow and hence a long period of time is needed for stabilization. Given their widespread application and large land footprint, the environmental impacts from landfills may last for decades and likely into centuries. Nevertheless it is noted that the waste materials in the landfill are typically high in carbonaceous content – i.e. a potential source of energy

Description

The project seeks to mitigate the impact of a landfill site by using novel techniques to recover biogas through enhanced biological means by controlling the acidogenic and methanogenic microbial consortia and to sequest carbon dioxide (CO_2) which is produced during the process. To enhance the biogas recovery, the completed landfill cells shall be operated with bias towards acidogenesis. The generated fatty acids is then extracted to produce methane (CH_4) and CO_2 under methanogenesis condition. CO_2 is harvested and converted into polysaccharides with microbial intervention.

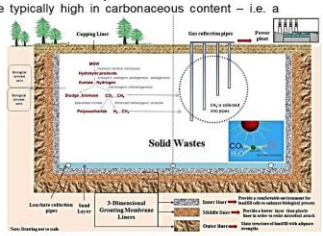


Illustration of sanitary landfill structure

The project also seeks to address another potential solid waste management challenge faced by Singapore which is the disposal of incineration ash. The ash can, however, possibly have pozellanic activity and it may be compatible with a carefully selected membrane liner material for the landfill. The project will look into the development of a landfill membrane material incorporated with incineration ash and hence address the issue of ash disposal.

Principal Investigator (PI), Co-PI & Collaborator:

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Prof Yehuda Cohen
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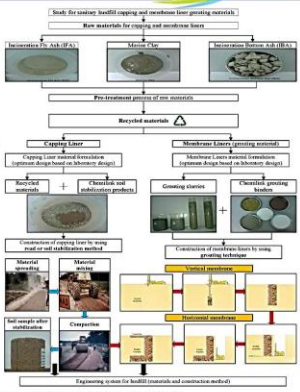
Dr Wu Dong Qing
Managing Director / CEO,
Chemilink Technologies Group

AEBC-NEWRI is a member of the NEWRI Ecosystem; Chemilink Technologies Group is a subsidiary of Chemilink International Holdings.

Contributions to Singapore's Environmental Sustainability

The project outcomes allow for an enhanced solid waste management system based on the developed landfill technique and also provides a useful application for incineration ash. The accelerated stabilisation of closed landfills would enable early return of the land for other useful applications. The enhanced biological process converts the landfill into a source of energy and such waste to energy effort represents resource reclamation. The conversion of CO_2 into polysaccharides to be used as landfill binder represents a method for carbon sequestration. A business model which can arise from the preceding would include landfill construction or remediation, landfill operation, energy recovery, carbon sequestration technology and higher value use of the remediated landfill site because of better ground condition.



Key Deliverables

- Operating protocol for fatty acids production.
- Enhanced methane and polysaccharides production process.
- An engineered system based on the above.
- Membrane liner formulation.
- Construction method for utilization of the membrane liner.

A research project supported by the Environment Technology Research Programme (ETRP)

Ministry of the Environment and Water Resources

National Environment Agency
Our Environment - Sustain and Enjoy

Environment Technology Research Program with NEWRI of NTU, 2009

R&D Project - IES

CHEMILINK ZERO WASTE ENGINEERING

CREATING A MARINE CLAY MATRIX WITH INCINERATION BOTTOM ASH (IBA) FOR LAND RECLAMATION

Project Scope

Objectives

To develop a novel integrated engineered system using IBA-marine clay formulations for land reclamation

Value Proposition

a. Use of IBA and marine clay to significantly substitute imported sand as the primary fill in land reclamation
b. Practical solutions with time-, energy- and cost-savings
c. Provide a platform for further R&D works on the transforming Incineration Fly Ash (IFA) for reuse

Description

Module 1	• Develop chemical additives to stabilise the IBA
Module 2	• Study the use of marine clay to encapsulate the stablised IBA • Study the pozzelanic and other properties in the IBA-marine clay mixture
Module 3	• Develop a 3D non-linear finite strain (NFS) consolidation model of the mixture • Predict leaching potential and consolidation process of the mixture
Module 4	• Investigate the use of marine clay and liner thickness as additional liner to prevent potential leaching
Module 5	• Study the long-term stability of the mixture
Completion	• Integration of above into a complete engineering system for land reclamation using IBA and marine clay

Principal Investigator (PI), Co-PI & Advisor:

Dr Wu Dong Qing
Principal Investigator
Managing Director / CEO,
Chemilink Technologies Group

Dr Kam Yin Fah
Co-Principal Investigator
Director
Chemilink Technologies Group

Prof Ng Wun Jern
Advisor
Executive Director
Nanyang Environment & Water Research Institute (NEWRI)
Nanyang Technological University (NTU)

Brief Background

Solid Waste Challenges in Singapore

Scope of Project

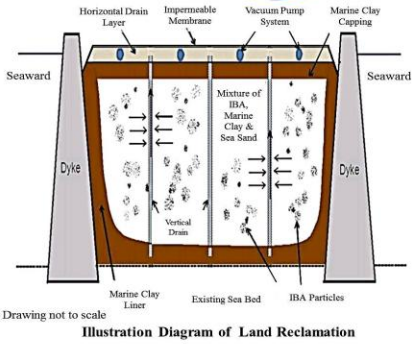
Application of IBA and Marine Clay for Land Reclamation

Contributions to Singapore's Environmental Sustainability

a. To transform IBA into "Singapore New Sand" which will reduce its dependence for importing raw materials for land reclamation.
b. Assist NEA to achieve its vision of "Towards Zero Landfill & Zero Waste".
c. To develop an engineering technology to transform two waste materials- IBA and marine clay into valuable civil construction resources for land reclamations in both Singapore and exportable to other coastal countries.

Key Deliverables

Treatment technologies for IBA	• Leachate compliance • Enhancing the self weight consolidation of the IBA-marine clay
IBA-marine clay formulations	• Appropriate chemical and physical properties
NFS consolidation system	• Higher accuracy of mechanical and chemical modeling
Capping and liner system	• Minimising leaching
Integrated engineering system	• Complete engineering system for land reclamation using IBA and marine clay



• Drawing not to scale

Illustration Diagram of Land Reclamation

A research project supported by the Innovation for Environmental Sustainability (IES) Fund

National Environment Agency
Our Environment - Sustain and Enjoy

Innovation for Environmental Sustainability, 2010

5. Customer Services

1) Green and effective materials & products

2) Sustainable R&D / Project R&D with Customization and Localization.

3) Consultancy services including Pavement Design, Material Design and Construction Design.

4) Project Management (for SS-100 series)
   a. Construction Management
   b. Quality Control
   c. Site Supervision

6. International Market of Projects / R&D Works

(Asian countries mainly including South-East Asia, North-East Asia, South Asia and Middle-East Region; Australia and Pan-Pacific Region; Europe like UK; some of Africa; and America like Brazil & USA)

International Market Network

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