

## E2S2-CREATE Phase II

### 2nd Scientific Advisory Committee (SAC) meeting (1-3 Nov, 2021)



E2S2-CREATE Phase II 2nd Scientific Advisory Committee (SAC) meeting was held in 1-3 November 2021. Due to the covid-19 situations, similarly to the last SAC meeting, the meeting was arranged in the form of both recorded presentation review session and on-line discussion session. E2S2 team prepared recordings for all of the presentations as well as the site videos of field study and laboratory activities for SAC panel members' viewing. The live meeting (via ZOOM) was held over three days 1-3 November 2021, during 7-10pm at Singapore time, which consisted of Q&A sessions, project discussions, interactions with young scientists, SAC panel internal discussion and debrief. There were around 80 attendees participating the three-day SAC live discussion meeting. During the live meeting session, E2S2 Director Prof Peng Yinghong and Co-Director Prof Tong Yen Wah briefed on the overview of E2S2 Phase II programme. Principal Investigators presented on the detailed progress about the ES-1 and ES-2 project. In addition, E2S2 team had discussions with SAC panel members by answering their concerns and enquiries as well as seeking the comments and suggestions from SAC members regarding the project. At the end of the SAC meeting, SAC panel members acknowledged that E2S2 team has made good progress on both ES-1 and ES-2 project. Prof Tan Thiam Soon, the Chair of Scientific Advisory Committee, expressed his expectations for the team to maximize synergies among different sub-projects and establish more collaborations with governments to extrapolate the findings to different areas.

# E2S2 Pilot study @ East Coast Lagoon Food Village



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## Pilot project to use hawker centre food waste to generate electricity, produce fertiliser



Kurt Ganapathy

17 Nov 2021 12:53 PM (Updated: 17 Nov 2021 03:47 PM)



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新加坡国立大学 (NUS) 的一个团队创造了一种消化器，可以将食物垃圾分解成沼气和营养丰富的消化物。沼气可用于发电，而消化物可用作植物肥料。

在国家公园委员会 (NParks) 和国家环境局 (NEA) 的支持下，消化器将在东海岸泻湖村进行试点。NParks 和 NEA 签署了一份谅解备忘录，以在该试点项目上进行合作。该试点项目研究了使用厌氧消化作为现场处理解决方案以从源头关闭厨余循环的可行性。

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## Pilot project at East Coast Park hawker centre turns food waste into electricity and fertiliser



BY BRYAN NG

Published November 17, 2021

Updated November 17, 2021



THE STRAITS TIMES



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## East Coast Lagoon Food Village in trial to generate electricity from food waste

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## Food waste at East Coast Lagoon Food Village to be used to produce electricity & fertiliser in pilot project

Trash to treasure.

Fiona Tan | November 19, 2021, 03:44 PM



For more information, please find

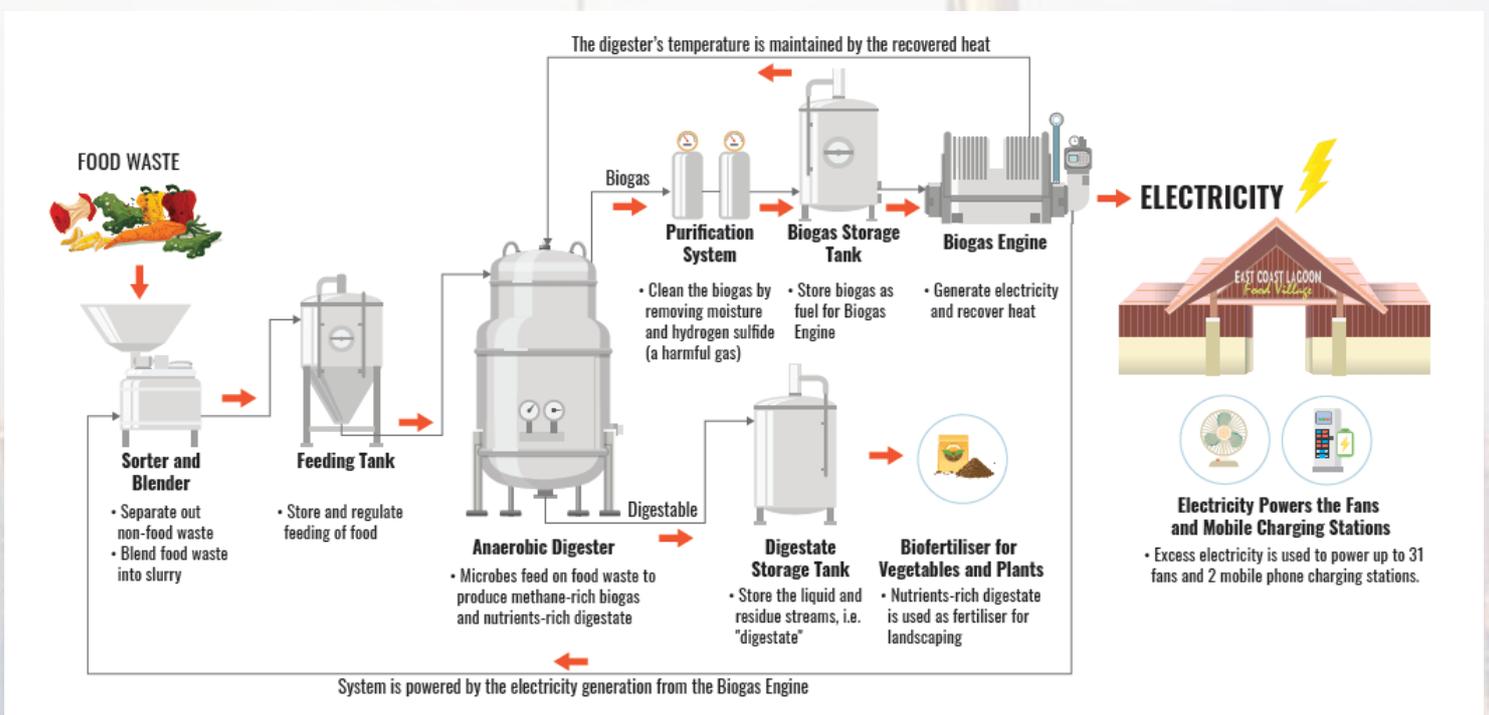
1. <https://www.channelnewsasia.com/singapore/food-waste-nea-nus-nparks-east-coast-park-electricity-fertiliser-2319196>
2. <https://www.straitstimes.com/singapore/environment/east-coast-lagoon-food-village-in-trial-to-generate-electricity-from-food>
3. <https://www.todayonline.com/singapore/pilot-project-east-coast-park-hawker-centre-turns-food-waste-electricity-and-fertiliser>
4. <https://motherhip.sg/2021/11/east-coast-food-village-food-waste-pilot/>
5. <https://mp.weixin.qq.com/s/TTMnrRnsVnBrH0Hv8D2Rjw>

# E2S2 Pilot study @ East Coast Lagoon Food Village

E2S2 pilot study at East Coast Lagoon Food Village to generate electricity and fertiliser from food waste with the support of National Environment Agency (NEA) and the National Parks Board (NParks) was reported by various media outlets, such as CNA, The Straits Times, TODAY and some local forums (i.e., mothership, sgc).

E2S2 Co-Director, Associate Professor Tong Yen Wah will lead the team to oversee the operation and maintenance of the anaerobic digestion system. This novel system is used to treat food waste by converting food scraps and leftovers into biogas and bio-fertiliser. A biogas engine will then help convert the biogas into electricity, while the bio-fertiliser will be used for landscaping applications.

In addition, the team will leverage on human psychology and behavioural factors to encourage hawkers, diners and cleaners to participate in this food waste recycling initiative.

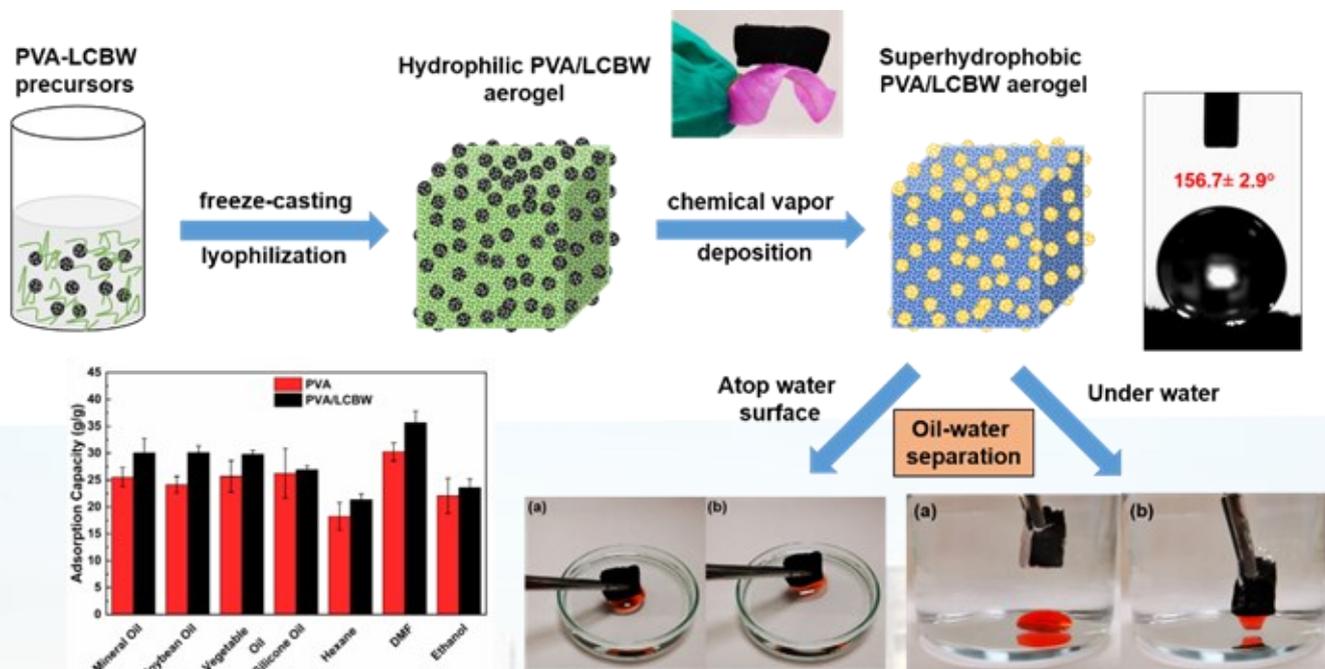


For more information, please find

<https://www.channelnewsasia.com/singapore/food-waste-nea-nus-nparks-east-coast-park-electricity-fertiliser-2319196>

## Recent accepted/published papers from E2S2:

### 1 Superhydrophobic Leached Carbon Black/Poly(vinyl) Alcohol Aerogel for Selective Removal of Oils and Organic Compounds from Water



**Journal:** Chemosphere

**Authors:** Ming Hang Tai, Babu Cadiam Mohan, Zhiyi Yao, Chi-Hwa Wang

**Keywords:** carbon, adsorption, nanoparticles, aerogel, polyvinyl alcohol, superhydrophobicity

#### Author's words:

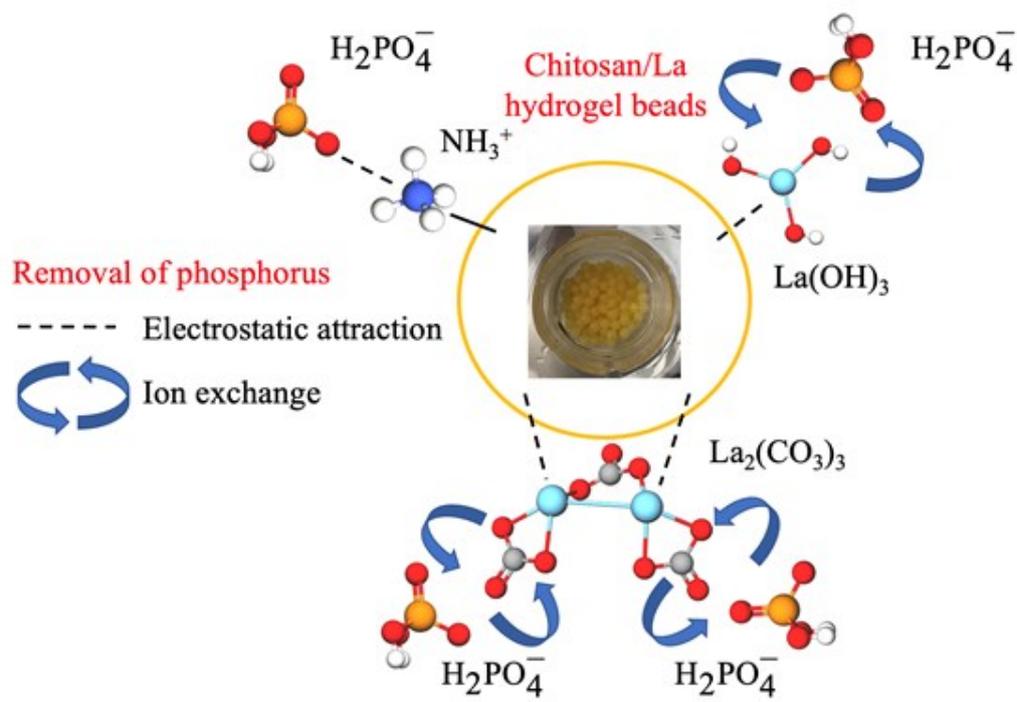
The remediation of oil spills and treatment of oily wastewater remains challenging to cope with nowadays. This has caused a surge in demand on adsorbent materials with multi-functionalities to effectively separate oils and nonpolar solvents from water. A superhydrophobic composite aerogel prepared from industrial waste-derived leached carbon black waste (LCBW) and polyvinyl alcohol (PVA) was developed in this work via conventional freeze-casting followed by surface coating. The composite aerogel was ultralight and porous with porosity > 85 % and tunable density ranging between 0.015 – 0.065 g/cm<sup>3</sup>. It was found that the embedded LCBW in the PVA network is crucial to impart superhydrophobicity and superoleophilicity to the aerogel as it enhances the surface roughness. Wettability test showed that composite aerogel prepared from 0.5 wt% PVA at PVA/LCBW ratio of 1 exhibited the highest water contact angle ( $156.7 \pm 2.9^\circ$ ). LCBW also improved the thermal stability of the composite aerogel. With its superior selectivity, PVA/LCBW aerogel was used as selective adsorbent for a variety of oils and organic solvents. The adsorption test showed that the composite aerogel exhibited an adsorption capacity up to 35 times its original weight and could be re-used repeatedly and easily recovered through a simple drying method.

#### Highlights

- 1) A highly porous PVA/LCBW aerogel is prepared by conventional freeze-casting.
- 2) Superhydrophobicity of aerogel is resulted from carbon black waste.
- 3) Carbon black waste reduces aerogel's shrinkage and improves thermal stability.
- 4) Aerogel exhibits sorption capacity of ~30 g/g for oils and organic solvents

## Recent accepted/published papers from E2S2:

### 2 Cost effective phosphorus removal from aqueous solution by a chitosan/lanthanum hydrogel bead: Material development, characterization of uptake process and investigation of mechanisms



**Journal:** Chemosphere

**Authors:** Kok Yuen Koh, Zhihao Chen, Sui Zhang, J. Paul Chen

**Keywords:** Adsorption; Eutrophication; Ion exchange; Intraparticle diffusion model; Material optimization

#### Author's words:

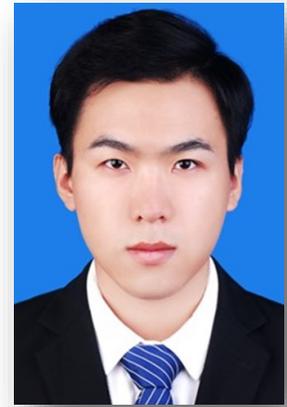
In this study, lanthanum (La) was incorporated into chitosan hydrogel bead for an effective and efficient phosphorus removal. The synthesis of the bead was optimized through the variation of La content and cross-linker amount. The addition of La improved threefold the adsorption capacity of chitosan for the phosphorus removal. The bead can remove phosphorus completely in 6 h at pH 4.0 with an observed maximum adsorption capacity of 108.2 mg/g under batch condition. Furthermore, it removed the phosphorus effectively in the pH range of 2 to 7. The removal of phosphorus would only be affected by the existence of high-concentration fluoride and sulfate ions in the water. After use, the bead can be regenerated and reused for at least five cycles of adsorption-desorption operation. The removal of phosphorus was attributed to the electrostatic attraction and ion exchange. Apart from phosphorus, the bead can remove heavy metals such as copper, zinc and lead. This study provides a multifunctional adsorbent which is not only eliminate phosphorus for the prevention of eutrophication, but also treat heavy metal-contaminated wastewater.

#### Highlights

1. Chitosan/lanthanum hydrogel bead can remove phosphorous effectively.
2. It can remove cationic heavy metals: Cu, Pb and Zn.
3. A rapid phosphorus removal is completed at contact time of 6 h.
4. The uptake is due to electrostatic attraction and ion exchange.

## E2S2 joint PhD student

- Liu Jianrui

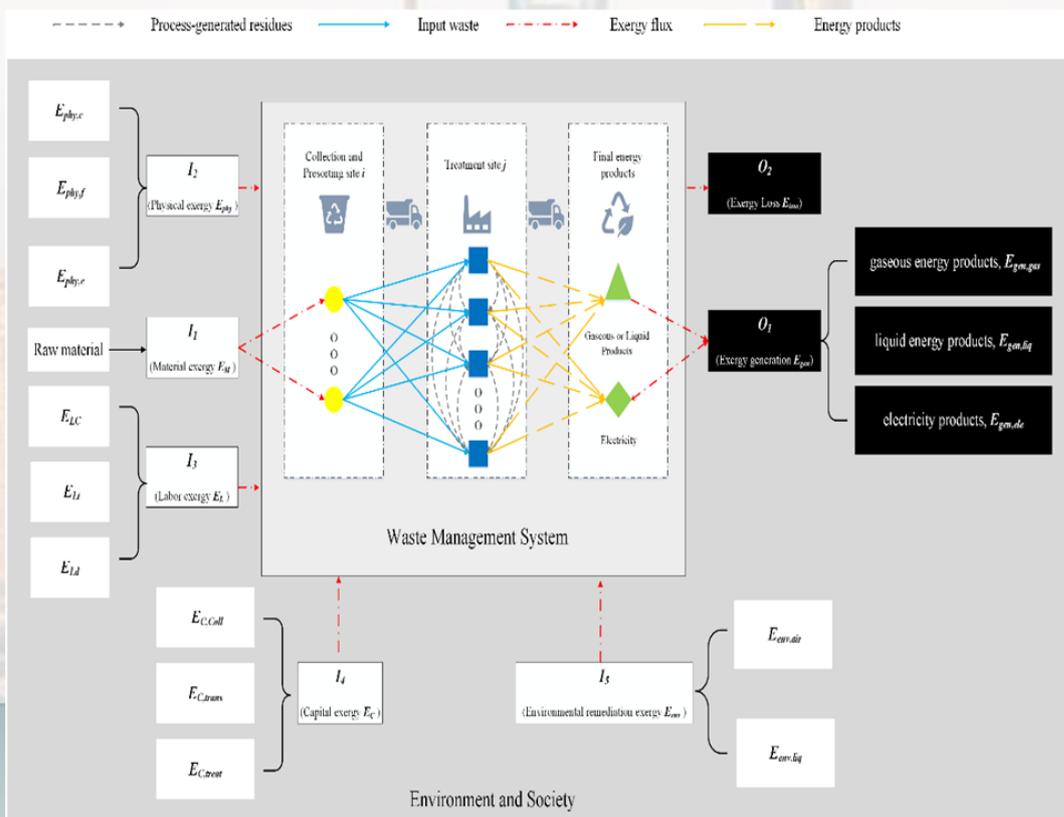


Liu Jianrui obtained his Bachelor (2016) and Master (2019) of Engineering degree in Mechanical design and manufacturing from Central-South University. Then joins in the E2S2 project as a joint PHD student of Shanghai Jiao Tong University and national university of Singapore now.

His main research field is the modeling of urban metabolism of megacity. Under the E2S2 program he is focusing on the research for the extended exergy accounting (EEA) of municipal solid waste management system of Shanghai and Singapore. Up till now, the first phase of EEA has finished. In the first phase, Extended Exergy Accounting was adopted to develop an accounting model to evaluate the performance of a Municipal Solid Waste Management System. Furthermore, urban metabo-

lism sustainability index for waste was proposed to represent the unified society-economy-environment impacts of the MSWMS under the framework of a comprehensive sustainability evaluation. A detailed analysis of wood and horticultural waste treatment scenarios in Singapore was conducted as a case study.

Now the second phase is in progress. In the second phase, the EEA method has been improved with the two stage robust optimization model to solve the waste to energy facilities assignment problem. On one hand, it will alleviate the pressure of the municipal solid waste management; on the other hand, it will improve the sustainability of megacity by recycling valuable energy and materials from municipal solid waste.



### Referred journal articles

Liu, J., et al., Evaluating the urban metabolism sustainability of municipal solid waste management system: An extended exergy accounting and indexing perspective. Applied Energy, 2021. 300: p. 117254.

