

第 68 屆英特爾國際科學與工程大獎賽(Intel ISEF)得獎作品介紹

吸油海綿寶寶

The Synthesis of High Oil-affinity Ester Macromolecule with Renewable Resources

陳景倫、程宇軒、梁鏞謙 (中五) Chan King Lun, Ching Yu Hin, Leung Pok Him Michael (S.5)

保良局顏寶鈴書院 Po Leung Kuk Ngan Po Ling College

作品簡介 Project Introduction

油無論在我們日常生活中還是工業上都十分重要。因此，處理油污在社會受到廣泛關注。例如，商家在不斷研發新型洗潔精，科學家們也在積極研究更好的除油方法。然而，如今我們使用的洗潔精含有對環境有害的化學成分，並且不可以重複利用。同樣地，在處理海上漏油事件時，一些洗滌劑的使用也對生態環境有負面影響，並且漏走的油也不可以收集再利用。我們的作品是由辛酸、檸檬酸、蔗糖和脂肪酶合成的酯，能夠吸油。吸油後可以重複利用，並且可以把吸的油吐出來再利用，擁有極高的經濟效益，並且能夠保護我們的環境，實現可持續性發展。

Oil is very important in the development of technology and human activities. In recent years, however, we hear about the news on how humans are not being able to use oil carefully. Oil is being wasted to oil leakages every year and the effect of leaked oil on different aspects, such as the economy, is detrimental. In our project, we invented an oil sponge out of octanoic acid, sucrose and citric acid. This organic compound absorbs oil and allows the oil to be reused, minimizing all impacts oil leakages on humans and the environment. The project utilizes the high oil affinity of the specific kind of sugar fatty-acid ester to attract oil and the cage-like structure to trap the oil. Since oil and ester are only attracted by Van Der Waal's force, oil can then be retrieved by centrifugation or high pressure. Our product can be utilized in different occasions such as household cleaning of oil, oil cleaning in factories and oil- retrieving in oil leakage, so as to clean oil before harm is done to any parties.



梁鏞謙(左)、程宇軒(中)、陳景倫(右)

Leung Pok Him Michael (left), Ching Yu Hin (center), Chan King Lun (right)

主要獎項 Major Awards

- 第 68 屆英特爾國際科學與工程大獎賽 –地球與環境科學組別三等獎
The 68th Intel International Science and Engineering Fair – Third Place Award in the Category of Earth and Environmental Sciences
- 香港青少年科技創新大賽 16-17 --- 最優秀項目大獎(高中)
Hong Kong Youth Science & Technology Innovation Competition 16-17 --- Best Project Award (Senior)
- 香港青少年科技創新大賽 16-17 --- 少年科學家獎
Hong Kong Youth Science & Technology Innovation Competition 16-17 – Young Scientist of the Year
- 香港青少年科技創新大賽 16-17 --- 能源及環境科學 (高中組) 一等獎
Hong Kong Youth Science & Technology Innovation Competition 16-17 --- First Place Award in the category of Energy and Environmental Science (Senior)
- 香港青少年科技創新大賽 16-17 --- 理光可持續發展特別獎
Hong Kong Youth Science & Technology Innovation Competition 16-17 –Ricoh Sustainable Development Special Award

第 68 屆英特爾國際科學與工程大獎賽(Intel ISEF)得獎作品介紹

航空螺母緊固力監察介子 Aircraft Nut Tension Monitoring Washer

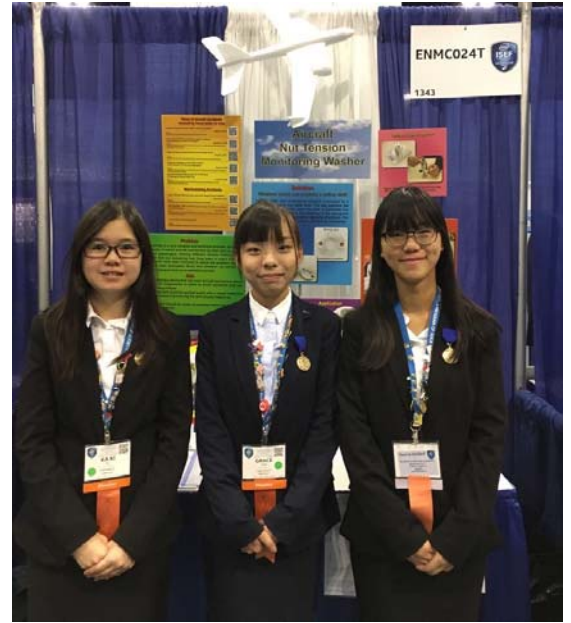
高辰霖（中五）、李佩嫻（中五）、吳家琪（中三） Grace Gao (S.5), Lee Pui Shan (S.5), Ng Ka Ki (S.3)

聖公會李炳中學 S.K.H. Li Ping Secondary School

作品簡介 Project Introduction

作品根據飛機意外個案而設計，因現時螺絲防鬆產品仍未能防止這類意外發生，便啟發我們去解決以上問題。作品以彈簧原理創作，結構簡單，成本低及可重複使用，及可擴展至所有使用螺絲或螺母的地方，方便維修人員以目測檢查，及早作出維修，避免發生意外。

‘Aircraft Nut Tension Monitoring Washer’ is designed with the intention to help reduce aircraft accidents. Many serious aircraft accidents were caused by loose bolts and nuts. Although there are a large variety of preventive products available in the market, they failed to put an end to the related accidents. Hence, we have focused on how to examine the loosening of bolts and nuts, which could facilitate visual inspection by the aircraft maintainers. The problem can be fixed as soon as the loosened bolts and nuts are noticed in order to avoid the accidents.



吳家琪(左)、高辰霖(中)、李佩嫻(右)
Ng Ka Ki (left), Grace Gao (Center), Lee Pui Shan(Right)

主要獎項 Major Awards

- 第 68 屆英特爾國際科學與工程大獎賽 --- 奧科寧克基金專項獎 “可持續運輸設計”組別一等獎
The 68th Intel International Science and Engineering Fair – Arconic Foundation Special Award – First Place Award in the Category of Sustainable Design In Transportation
- 香港青少年科技創新大賽 16-17 --- 數理及工程 (初中組) 一等獎
Hong Kong Youth Science & Technology Innovation Competition 16-17 --- First Place Award in the category of Mathematics, Physics and Engineering (Junior)

第 68 屆英特爾國際科學與工程大獎賽(Intel ISEF)得獎作品介紹

納米銀炭輕容 Eco-flex Lite Capacitor

冼浚霆、鄒景勳、周冠群 (中四) Sin Tsun Ting, Chow King Fun, Zhou Guanqun (S.4)

中華基金中學 The Chinese Foundation Secondary School

作品簡介 Project Introduction

隨着電子垃圾的問題日益嚴重，環境污染也日漸增加。為了減少對環境的影響，我們便研發了一個擁有高效能，而且對環境零污染的綠色電容器。

我們的電容器是由植物纖維，銀杏葉等材料製成，可見使用的物料是天然的，推廣可持續發展。為了配合近年納米技術的發展，我們更使用了碳納米球，從而增強電容器的儲電能力，務求能達致，甚至超越一般市面上的電容器的各項能力。

我們的電容器有多項好處，適合成為未來各種產品的配件。例如它是可屈曲的，能抵禦大概 200°C 的高溫，能使用 7 萬次才換新的，可被生物分解的，在極端酸鹼值情況下也能正常運作。絕對切合未來電子產品可屈曲的發展。

Due to the severe land pollution problem caused by the discarding of electronic wastes, we have invented a green flexible capacitor, to alleviate pollution problems.

Our product does not contain any toxic chemicals like the other capacitors do, instead, we make use of materials like ginkgo leaf and cellulose etc., which are natural products and will not cause any pollution to the environment. Besides, we used carbon nanospheres and genistein to increase the charging performance of the capacitor as well, finally reaching a value of 260F/g of specific capacitance, which is competitive with the products available on the market.

Our capacitor can also withstand extreme pH condition and a wide range of temperature until 200°C. It is also biodegradable and flexible. It retains 98% of its performance after 70,000 times of usage. All these properties favorable for the capacitor to serve as a component in future electronics products.



周冠群(左)、鄒景勳(中)、冼浚霆(右)

Zhou Guanqun (left), Chow King Fun (center), Sin Tsun Ting(right)

主要獎項 Major Awards

- 第 68 屆英特爾國際科學與工程大獎賽 – 入圍獎
The 68th Intel International Science and Engineering Fair -- Finalists
- 香港青少年科技創新大賽 16-17 --- 化學及材料 (高中組) 優異獎
Hong Kong Youth Science & Technology Innovation Competition 16-17 --- Merit in the category of Chemistry and Materials (Senior)

第 68 屆英特爾國際科學與工程大獎賽(Intel ISEF)得獎作品介紹

葉葉生輝

Chlorophyll Cysteine Co-catalyzed Biodegradable Poly(methyl 2-methylpropenoate)

鄭毓俊 (中六) Cheng Yuk Chun (S.6)

英皇書院 King's College

作品簡介 Project Introduction

聚甲基丙酰胺甲酯 (PMMA) 成功地被葉綠素引發及被半胱氨酸催化後而生產出來。葉綠素及半胱氨酸共催化聚甲基丙酰胺甲酯的硬度, 分解溫度和耐化學性與商業購買的聚甲基丙酰胺甲酯相近。此外, 葉綠素及半胱氨酸共催化聚甲基丙酰胺甲酯在酶降解後表現出理想的生物降解性。

Poly(methyl 2-methylpropenoate) (PMMA) was successfully yielded under photo-initiation of chlorophyll and the catalytic effect of cysteine. The hardness, decomposition temperature and chemical resistance of chlorophyll cysteine co-catalyzed PMMA are comparable to those of commercially purchased PMMA. In addition, chlorophyll cysteine co-catalyzed PMMA exhibits outstanding biodegradability after enzymatic degradation.



鄭毓俊 Cheng Yuk Chun

主要獎項 Major Awards

- 第 68 屆英特爾國際科學與工程大獎賽 –入圍獎
The 68th Intel International Science and Engineering Fair – Finalists
- 香港青少年科技創新大賽 15-16 --- 能源及環境科學 (高中組) 優異獎
Hong Kong Youth Science & Technology Innovation Competition 15-16 --- Merit in the category of Energy and Environmental Science (Senior)

第 68 屆英特爾國際科學與工程大獎賽(Intel ISEF)得獎作品介紹

混然光電 A Cocktail of Natural Dyes as Photosensitizers for Dye-sensitized Solar Cell

何啟睿 (中五) Ho Kai Yui (S.5)

伯裘書院 Pak Kau College

作品簡介 Project Introduction

這份研究目的是利用混合天然染料來提高混然光伏電池 (DSSC) 的轉換效能。我們從菠菜葉和烏龍茶葉中提取了色素，並以 1:1 的比例混合，作為 DSSC 的光敏劑。實驗結果顯示，混合天然染料的 DSSC 出現協同效應，其性能比單一染料的 DSSC 提高了 1.7 - 4.7 倍。由納米塗層及混合染料等組成的可撓性 DSSC，能產生 45mV 和 69 μ A 最大電壓和電流。

This paper examines the possibilities of using a mixture of natural dye pigments as the sensitizer in order to improve the performance of DSSCs. The natural pigments extracted from spinach leaves and oolong tea leaves were mixed in the ratio of 1:1 (v/v). DSSCs with this mixed dyes showed the synergic performance of 1.7-4.7 times increase in short-circuit current than that sensitized with any individual dye. Flexible DSSCs fabricated by 10nm TiO₂, ITO-PET electrodes and the mixed dyes produced a maximum voltage and current of 45mV and 69 μ A. Because of the simple preparation technique, widely available and low-cost natural dye as an alternative sensitizer as well as the bendable and transparent properties of ITO-PET films, the application of these DSSCs is promising.



何啟睿 Ho Kai Yui

主要獎項 Major Awards

- 第 68 屆英特爾國際科學與工程大獎賽 –入圍獎
The 68th Intel International Science and Engineering Fair –Finalists
- 第 31 屆全國青少年科技創新大賽 (2016) --- 能源科學項目 (高中組) 三等獎
The 31st China Adolescent Science & Technology Innovation Contest (2016) – Third Place Award in the category of Energy Science (Senior)
- 香港青少年科技創新大賽 15-16 --- 能源及環境科學 (高中組) 二等獎
Hong Kong Youth Science & Technology Innovation Competition 15-16 ---Second Place Award in the category of Energy and Environmental Science (Senior)

第 68 屆英特爾國際科學與工程大獎賽(Intel ISEF)得獎作品介紹

光敏自拍全景裝置 Photosensitive Panoramic Photography Device

林衍宏 (中六) Lin Hin Wang (S.6)

元朗商會中學 Yuen Long Merchants Association Secondary School

作品簡介 Project Introduction

市面上普遍內置於智能手機中的全景功能均需要用戶手持手機緩慢轉動以拍攝全景圖像。然而，由於用戶有手震的可能，這些照片的質量往往不是很高，亦難以自拍，更嚴重的是，相機不能從不同的角度有效地調整環境的亮度，從而導致接合位斷裂或模糊的照片。本項目的研發目的是開發一個用戶友好、高品質的全景攝影設備，可以自動調節亮度，拍攝清晰銳利的圖像。在單晶片微控制器中寫入的程序用於分析在不同照明情況下接收到光敏電阻（LDR）的數據。根據收集的數據，設備可以自動調整旋轉速度，從而拍攝足夠亮度的全景照片。這種光敏全景攝影設備的成本低於 20 美元，遠低於具有類似高質量圖像的專業全景相機。

In recent years, panorama function is built into smartphones which required the user to turn slowly with the phone to capture the panoramic image. However the quality of these photos are often not very high due to the unsteady hands of the user and more seriously the camera is not able to adjust effectively the brightness of the environment from different angles which then lead to over-exposed or blur photos.

The aim of this project is to develop a user-friendly, high-quality panoramic photography device which can produce smooth images with auto adjustment of brightness. The program written in the device is used to analyze the data from a photoresistor (LDR) received under different lighting situations. Based on the data collected, the device can automatically adjust the rotating speed so that panoramic photos of adequate brightness can be taken.

The cost of this Photosensitive Panoramic Photography Device is less than US\$20 which is much lower than the professional panoramic cameras with similar high quality images produced.



林衍宏 Lin Hin Wang

獎項 Awards

- 第 68 屆英特爾國際科學與工程大獎賽 – 入圍作品
The 68th Intel International Science and Engineering Fair –Finalists
- 第 31 屆全國青少年科技創新大賽 (2016) --- 工程項目(高中組) 二等獎及茅以升科學技術獎
The 31st China Adolescent Science & Technology Innovation Contest – Second Place Award in the category of Engineering (Senior) and Special Award
- 香港青少年科技創新大賽 15-16 --- 數理及工程 (高中組) 二等獎
Hong Kong Youth Science & Technology Innovation Competition 15-16 --- Second Place Award in the category of Mathematics, Physics and Engineering (Senior)