

Annex:

Hong Kong Student Science Project Competition 2006

List and Brief Descriptions of Winning Projects

(A) Invention Project Type:

Champion

Project Title	Indoor Carbon Dioxide Filter
School	S.K.H. Bishop Mok Sau Tseng Secondary School
Description	<p>The concentration of carbon dioxide is high in many crowded indoor areas due to poor ventilation. In such circumstances, health can be affected. Mugginess caused by poor ventilation and high carbon dioxide concentration often makes people turn on air-conditioning even when the temperature is not very high. As a result, a large amount of electricity is wasted (according to the EPD, 60% of electricity is used in air conditioning). In Hong Kong, electricity is mainly generated from burning coal and natural gas. Wasted electricity causes serious air and thermal pollution, as well as producing greenhouse gases (like carbon dioxide) and radioactive waste.</p> <p>We have therefore designed a device that can absorb carbon dioxide indoors, thus reducing carbon dioxide concentration and the use of air conditioners.</p>

First runner-up

Project Title	Edible Cleaning Agent
School	Tsuen Wan Public Ho Chuen Yiu Memorial College
Description	<p>When washing, children sometimes try to taste the detergent, but most detergents currently available on the market are inedible. Some of the components are harmful so an edible cleansing agent with good cleansing properties would be much safer, especially for children.</p> <p>Our edible cleansing agent contains mung bean powder, distilled water, vinegar, food colouring and lemon/orange flavoring essence, all of which are safe to eat. As part of the investigation, a hamster was fed the cleansing agent for a week and no negative effects were observed. The cleansing agent was also tested on 42 people in different age groups. After two weeks, none of them showed any allergic response. The cleansing properties were also investigated. About the same amount of the cleansing agent is needed to remove the grease from an oily hand as would be needed using a commercial detergent. When rinsed the hand smells and feels refreshed.</p>

Second runner-up

Project Title	Distant Control Cable System
School	Queen Elizabeth School
Description	<p>The Distant Control Cable System (DCCS) enables everyone to control the switches of appliances in a more convenient way with the use of sockets. Power lines can conduct electricity and also transmit signals. By inserting the DCCS plug into any socket in a main circuit, it will transmit on/off signals to appliances. You can control more than one appliance at the same time without walking to the switch to turn on the appliance.</p> <p>Some wireless control techniques exist already, infrared and mobile phones for example. However, DCCS creates little interference and is more stable and reliable. It does not require</p>

technical skills to install or use. In addition, it is cheap to make and therefore affordable for everyone. It is particularly useful for the elderly and the disabled who have limited mobility. It can also be used in large areas such as schools and offices. In the long run, DCCS will allow us to save time and enhance efficiency, thus improving living standards.

Project Title School	Bluetooth Q, the Guide Dog – The Guide System for Blind People at Home S.T.F.A. Yung Yau College
Description	<p>People who have recently become blind can be hurt easily when moving around, so we developed this system to help them adapt. The guidance system works via wireless communication on Bluetooth devices with a Smartphone and the software we designed.</p> <p>First, the user needs to turn on the Bluetooth and tell the Smartphone his/her present position and destination. The Smartphone sends control signals to the hardware system and turns on buzzers along the user's way to guide him/her to his/her destination. When the user passes through each turning point, the PIR motion sensor is triggered and the corresponding buzzer turns off so the user can hear the next buzzer. When the user arrives at his/her destination, the last buzzer turns off and a control signal is transmitted to the Smartphone, which plays a recorded message to inform the user.</p>

Honorable Mentions

Project Title School	The Bluetooth Declaration Systems for Customs S.T.F.A. Yung Yau College
Description	<p>In this project, we developed an automatic system for truck drivers to complete customs declarations. It is convenient and can ease heavy congestion at customs clearance. To use the Bluetooth Declaration System users need to register online. They can enter all their personal information as well as details of the items. When they pass through customs, the system automatically and wirelessly detects users' Smartphones and receives the information via Bluetooth technology, making the process smooth and quick.</p> <p>The system can also be used to register for seminars and workshops, or to exchange personal information for social purposes. Participants' information is automatically stored on the database thus greatly reducing delays in information exchange.</p>

Project Title School	EF Cockroach Trap Sha Tin Methodist College
Description	<p>Isn't it terrible when a cockroach crawls across your dinner? But you cannot use insecticide to kill it because that would pollute your food. To solve this problem, we designed the EF Cockroach Trap.</p> <p>This trap looks like a drink, but actually contains something else. When three sides of the container are open you can see chewing gum inside. Once the cockroach enters the trap it can't get out. Then we use detergent to dissolve the outermost oily skin of the cockroach so that it drowns in the liquid. Then the detergent enters the cockroach's body and kills it. By using such a trap, we can use fewer chemicals.</p>

(B) Investigation Project Type

Champion

Project Title School	Ginger Milk Curd D.M.H.C. Siu Ming Catholic Secondary School
Description	<p>Ginger milk curd (薑汁撞奶) is a Chinese dessert, which is made with heated milk and fresh ginger juice. It has been suggested that this coagulation of milk is caused by an enzymatic</p>

reaction. However, this is contradictory to our understanding of the effects of boiling of milk, where most enzymes would be denatured because of the high temperature.

Experiments were conducted to investigate the coagulation of ginger milk curds and the result supported the presence of an enzymatic reaction. The optimum procedures and conditions for milk treatment were also investigated. It was found that boiling was necessary for successful milk coagulation and stretching of milk contributed to the heat loss of the process. The optimum temperature and pH were also found. It was discovered that ginger milk curds actually have a range of hardness. The hardness can be increased by the acid in the ginger juice. Based on the conditions and factors found, a refined recipe was suggested with a high percentage of successful coagulation. At the same time, new flavours of milk bean curd have been designed and a pilot test is now in progress.

First runner-up

Project Title	Electricity Generated by Micro-organisms
School	Heep Yunn School
Description	<p>We have investigated microbial fuel cells as an alternative environmentally friendly energy source in our project. They serve the purpose of providing electricity by converting seemingly useless material into something valuable. A microbial fuel cell, by definition, is a cell that converts a chemical to electric power by means of bacteria in the anodic compartment. In fact, when bacteria oxidize food (glucose) to provide them with energy, electrons are produced in the process. The potential difference caused by the oxidation of a substrate at the anode and reduction of a substrate at the cathode allows current generation. Since this theory can be applied to wastewater treatment, microbial fuel cells can purify wastewater while generating electricity. After the wastewater is purified, it can be released into the ocean with less adverse impact on marine organisms.</p> <p>With substantial development of microbial fuel cells, wastewater treatment can also be a means of generating electricity and help our world step into a new era of sustainability.</p>

Second runner-up

Project Title	The Enemy of Enzyme - Tannin
School	Pui Tak Canossian College
Description	<p>Teas contain many different kinds of polyphenols. One of them is tannin, which is the earliest of all plant polyphenols discovered. The polyphenol structure contributes specific chemical properties of tannin. It precipitates protein and certain minerals and reacts with polysaccharides. It also has reducing properties for free radicals.</p> <p>Tannin is commonly found in drinks like tea and coffee. It is well known as having positive health effects such as anti-aging, anti-allergy and bacterial infection reduction. It is also believed that it reduces the chance of getting cancer. However, is it also a demon that can attack our health given its specific chemical properties? The aim of our project was to investigate the effect of tannin on our digestive enzymes. First, the effect of tannin on the enzymatic activities of amylase, protease and lipase was investigated. Then lemon juice, sugar or milk was added to see whether they affected the previous results. Last, the tannin content in different drinks was identified. This suggests that we should really have our coffee or tea while dining.</p>

Honorable Mentions

Project Title	Green Saviour - Chitin and Chitosan
School	St. Paul's Convent School

Description Chitin and chitosan can be used to treat water pollutants. Chitin was extracted from 19 crustaceans, mollusc and mushroom stalks, and the chitin of lobster, red crab, shrimp, mantis shrimp, needle inkfish and mushroom was converted into chitosan by alkaline deacetylation. Then we used chitin from lobster, Chinese mitten crab, red crab, shrimp and mushroom to adsorb eight dyes. Chinese mitten crab and shrimp chitins were generally most effective. Also, the longer the chitin stood, the more dye was adsorbed. Similar results were obtained for ink from bubble jet printers and fountain pens. Various chitins and chitosans were used to remove seven metal ions (Cu^{2+} , Cr^{3+} , Ni^{2+} , Co^{2+} , Fe^{3+} , Zn^{2+} , Pb^{2+}) from their inks. The percentage of transmission of the solutions was compared with the control using a colorimeter. Also, the amount of metal ions left in the solutions was determined by measuring the mass of metal hydroxide or carbonate precipitated out. We then used chitin and chitosan of lobster, red crab and shrimp to emulsify grease. We designed a filtration device from these experimental results. Various chitins and chitosans were placed in the upper compartment, and wastewater passing through it became cleaner on reaching the lower compartment. Bio-degradable, non-toxic chitin and chitosan are suitable for removing pollutants in wastewater. Further research should make the recycling process more economical.

Project Title **Plastic Fuel**
School **Carmel Pak U Secondary School**

Description Plastic fuel is a mixture of alkanes. In the catalytic cracking of plastics, using sand brick as a catalyst, plastics can be turned into alkanes and alkenes. Fractional distillation can be employed to separate the mixture of alkanes into different fractions of plastic fuels. In this project, we investigated the production of plastic fuels from plastic waste. We compared the cost of production of plastic fuels and fossil fuels and the characteristics of different fractions of plastic fuels with fossil fuels.

Plastic fuel recycles plastic waste and so alleviates the burden on landfill sites. It is more environmentally friendly as it burns with significantly less soot. A switch from fossil fuels to plastic fuels does not require modification of engines. Besides, the working conditions of catalytic cracking are milder and production costs are lower. Unlike fossil fuels, the price of plastic fuels is stable as they are not subject to political and climatic change.

Project Title **Which Brand of Dry Cell Can Last Longer at Reasonable Voltage?**
School **Kwok Tak Seng Catholic Secondary School**

Description Many advertisements claim that their dry cell batteries have the longest life. Regardless of price, the life of a battery is a very important factor. By using the concept of parallel circuit connection and overloading, we measured the life of 2A and 3A dry cells and compared different brands in terms of time taken to consume energy in the same circuit.

The life of a dry cell battery in our experiment was defined as the time taken to maintain output voltage above 0.8V by using the same overloading experiment with a parallel circuit in different brands. By comparing the relative length of life of different brands, the test provided data to allow us to choose the right dry cell and be smart consumers. However, the life of a battery is not the only factor to be considered. Price is a main concern and, for some people, brand image.