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Message from the President

Welcome to the second issue of the newsletter. The next Annual General Meeting of the Association will be held in June this year and new council members will be elected. It is my honour to have the opportunity to serve the council for the past two years and I would like to thank for the council's tremendous effort in contributing to the development of the air conditioning and refrigeration industry. Meanwhile, I would like to encourage all our members to join our upcoming AGM and to vote for the new council members.

ACRA will be co-organising a seminar with HKFSD and Hong Kong Registered Ventilation Contractors Association regarding the proposed demerit point system of the ventilation works. This seminar aims to provide an opportunity for the registered specialist contractors in ventilation category to have a better understanding of the proposed requirement. The time and venue of this seminar will be announced later and I would recommend all our members who carry out ventilation works to join this seminar.

In April 28, a team of seven ACRA council members including myself was invited to join the inauguration ceremony dinner of Macau Air Conditioning And Refrigeration Chamber of Commerce. I would like to give my sincere gratitude for their warm hospitality and wish them all their best in the coming years.

Best regards to all of you.

Raymond Synn
President

New Technology

Photocatalytic Oxidation (PCO) Air Purification

Michael K.H. Leung, PhD, CEng, RPE
Department of Mechanical Engineering
The University of Hong Kong

Recently, the general public has become aware of the importance of indoor air quality in relation to our health. The demand for air purification systems has been increasing accordingly. Besides conventional high efficiency particulate air (HEPA) filters, air cleaners featuring other innovations and technologies become available in the market. Photocatalytic oxidation (PCO) is one of the most popular technologies applied to air purification because it is robust, safe, and cost-effective.

Principle of photocatalysis

In this PCO air purification, titanium dioxide (TiO_2) is commonly used as the photocatalyst. When TiO_2, in presence of water vapor, is irradiated with photons (hv) of less than 385 nm and band gap energy above 3.2 eV, electrons from the valence band (vb) are promoted to the conduction band (cb). In other words, the excitation of TiO_2 by UV radiation produces reactive electrons (e_{cb}^-) and holes (h_{vb}^+). The reaction of h_{vb}^+ with absorbed hydroxyl ions (OH^-) or absorbed water molecules yields reactive hydroxyl radicals ($OH^\bullet$). The e_{cb}^- are free to participate in the absorption of oxygen and, subsequently, hydroperoxyl radicals ($HO_2^\bullet$) may be formed. In the series of photochemical reactions, oxygen acts as the electron acceptor while available OH^- and water are the electron donors.

$$TiO_2 + h\nu \rightarrow e_{cb}^- + h_{vb}^+$$
$$h_{vb}^+ + OH^- \rightarrow OH^\bullet$$
$$h_{vb}^+ + H_2O \rightarrow OH^\bullet + H^+$$
$$e_{cb}^- + O_2 \rightarrow O_2^{\bullet-}$$
$$O_2^{\bullet-} + H_2O \rightarrow HO_2^\bullet + OH^-$$

The photogenerated hydroxyl radicals are powerful oxidizing agents. They are the primary chemicals responsible for PCO detoxification and disinfection of air as they can destroy microorganisms, destruct volatile organic compounds (VOC), and eliminate odors. The products of complete oxidation are carbon dioxide (CO_2), water vapor (H_2O), and other harmless simple basic compounds. All the photocatalytic activities take place on the surfaces of TiO_2 and no reactive hydroxyl radical is released to the ambient air. Therefore, PCO is safe.

SUMMER 04

Contents

PCO applications

There are numerous applications of photocatalytic oxidation to improve our environment. They are summarized in Table 1. Presently, research on photocatalytic air purification is very active because this application is of great promise and commercial value.

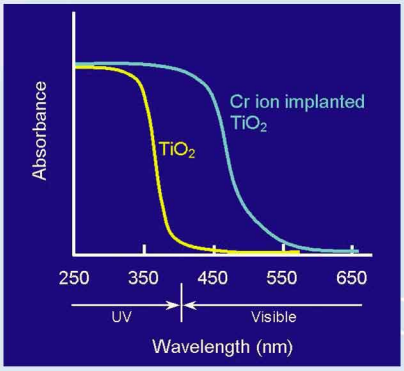

Figure 1. Metal ion implantation effect on UV absorption spectrum

Table 1. Applications of PCO

Type	Details
Air purification	▪ Air cleaning to improve indoor air quality ▪ Air disinfection in hospitals ▪ Defense against biological warfare
Water purification	▪ Decontamination of polluted groundwater ▪ Purification of industrial wastewater
Self-cleaning surfaces	▪ Self-cleaning glass windows/panels, tiles, lamps, traffic signs and reflectors, and others

TiO_2 photocatalyst

Besides TiO_2, other semiconductors, such as SiC, ZnO, ZnS, and CdS, exhibit similar catalytic behaviors and produce hydroxyl radicals upon absorption of photons. Still, TiO_2 is most commonly used because it has shown to be the most active catalyst. It is also safe and inexpensive. The commercial anatase and rutile TiO_2 powders have high absorption of the UV spectrum. For this reason, many existing PCO devices are equipped with UV lamps to activate the photocatalytic reactions.

The absorption band can be shifted towards the visible light if the TiO_2 photocatalysts are implanted with metal ions, such as chromium (Cr) and vanadium (V) ions. The absorbance profiles of TiO_2 and Cr ion implanted TiO_2 are illustrated in Figure 1. Such modification enables efficient photocatalytic reactions under exposure to visible light. Thus, artificial fluorescent lamps and natural solar irradiation can be used as effective light sources. Hence, the equipment, operating, and maintenance costs can be reduced as UV lamps can be omitted.

Coating methods

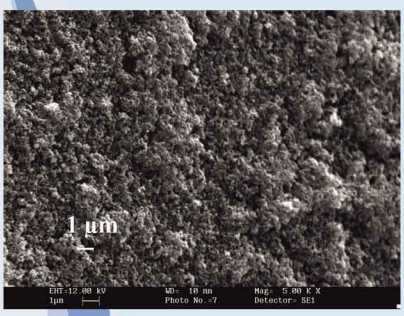

Figure 2. SEM image of TiO_2 slurry coating

In PCO water decontamination, the uses of TiO_2 in both slurry and coating have been investigated and found successful. In PCO air purification, TiO_2 should be immobilized on a substrate. In the early development, slurry coating method was commonly used to produce a layer of Degussa P25 TiO_2 particles sized in microns. Recently, nanostructured TiO_2 thin films produced by sol-gel deposition method are receiving more attention as the thin films have exhibited higher photonic efficiency. Figures 2 and 3 show the scanning-electron microscope (SEM) images of a slurry coating and a thin film of TiO_2, respectively.

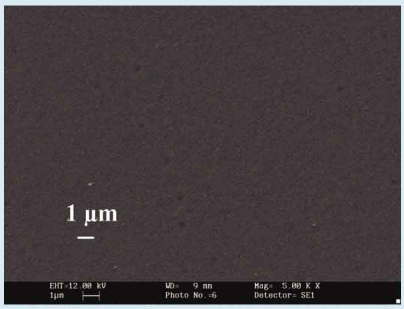

Figure 3. SEM image of sol-gel TiO_2 thin film

Photoreactors

Gaseous pollutants and airborne microbes in the air stream should be brought to the irradiated TiO_2 for PCO decomposition. Therefore, the photoreactor configuration, light source, and air flow rate should be properly designed and controlled to increase the interaction between the pollutants and irradiated TiO_2. Increasing the total area of irradiated TiO_2 coated surfaces is one of key factors to improve the PCO performance. Mesh and honeycomb photoreactors, shown in Figures 4 and 5, respectively, are designed for this purpose. Besides direct irradiation, light can also be transmitted by means of optical fibers that are coated with TiO_2.(Photograph provided by Airsopure®)

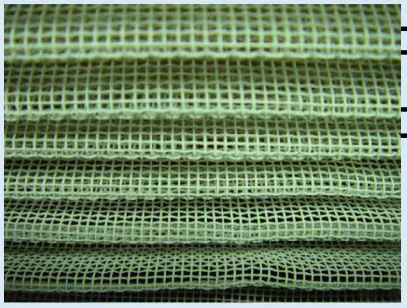

Figure 4. Mesh photoreactor

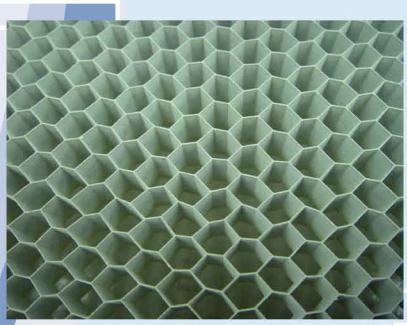

Figure 5. Honeycomb photoreactor

Humidity effect

As mentioned above, water takes part in the photocatalytic reactions. In PCO air purification, water is available in humid air. Investigations have shown that in a dry condition, little PCO decomposition effect can be obtained. On the other hand, if the air contains excessive moisture, the reaction rate decreases. The variation of humidity effect depends on the target contaminants. One study shows that the optimal reaction rate for bacteria occurs at 50% relative humidity (R.H.). Another study shows that the optimal reaction rate for VOC pollutants occurs at 20% R.H.

In a concluding remark, the existing PCO technology has already demonstrated its power in air purification and great commercial value. Still, there is enormous potential for technological advancement to improve the photonic efficiency of photocatalyst and to optimize the photoreactor design. Further research and development will be definitely fruitful.

專訪 蔡澤靈先生 (Mr. C. L. Choy)

提起蔡澤靈先生(Mr. C. L. Choy)的名字，同業必會聯想起「開利」公司。因為蔡先生在開利公司耕耘了三十五年，在產品分銷方面成績顯赫，大部份的行家均認識他。今天難得與他暢談一番，令人茅塞頓開。和蔡先生傾談，會感到他對工作的認真與熱誠，尤其是當他跟我們說：「我一輩子都沒有轉過公司，都在開利公司渡過！」都令在場小輩不禁啞口無言，唯有聽他娓娓道來。

「畢業後我便加入International Engineering Ltd (IEL)，IEL是開利的分銷商，主要銷售開利產品及承接安裝工程。當時首個負責的項目是到公司其中一個較大的客戶「半島酒店」工作，由於半島酒店的工程頻繁，可說是年中無休的，所以於酒店內設有寫字樓，方便跟其他承建商溝通及協商，中央空調系統亦是在那裡首次接觸。在此渡過了五個年頭，賺了不少實戰經驗。」

其後，由於IEL的股權轉移，蔡先生已成為開利的直接僱員。當時他已萌生去意，卻為著一個機會而留下來。「當時我本想離開開利，恰巧獲置地公司的取錄，薪水較高，令我蠢蠢欲動。但上司加以游說，希望我能留下，而且還附以一個新工程項目作利誘！那個工程是在上環永安中心採用VAV Moduline System，是我從未試過的。最後我還是選擇留下來接受挑戰。」

眾所周知蔡先生擁有多年產品分銷經驗，其成績有目共睹，無論是分銷網絡及運作系統，都令人又羨又妒，尤其是他總能捕捉客戶的心理，究竟蔡先生的成功竅門在哪裡呢？

「開利公司於八十年代曾經重組，我選擇放棄從事多年的承建商工作，毅然加入產品銷售的行列，亦是當時開利公司打算積極發展的部份。還記得當時公司只有十數個分銷商，其中大部份都是由開利的承建商轉型過來，數目不多。」及至全盛時期，開利的分銷商多達百個，內地市場佔大部份。令行內人稱奇的是開利公司總愛找一群從前是他們的舊下屬及規模較小的公司作為分銷商。開利公司有一個經營理念，就是很看重忠心，認為最可信的都是曾經合作的夥伴，所以當開利開始發展分銷市場時，我們都傾向找一些以往曾是開利的分銷商，以發展為一種合作夥伴的形式來營商。他們一般規模較小，較難接到一些大的工程項目，但透過開利的關係及支援，他們偶爾會接到一些較大的項目，因此他們都很樂意和我們合作。」蔡先生深明信任是建立長期經營生意的不二法門。

市場日漸開放，提供給分銷商的選擇也多不勝數，但為何開利的分銷商一般都以開利為先？「開利公司非常重視與分銷商的關係，我們會提供免費的培訓課程給他們，協助他們營銷，另外亦會舉辦一些聚會及郊遊活動，與分銷商的家人聯誼，大家的關係已不再局限於合作夥伴，部份分銷商與我們已有廿多年感情，由於這份感情，他們一般都會放棄外來的誘惑！期間看到一些分銷商由夫妻倆小本經營，發展至有百多名員工的規模，自己心裡也替他們高興。當然亦有一些配合不來的。」

即將功成身退的蔡先生對退休生活沒有太大憧憬，並笑稱自己保守的性格不宜創業，暫時享受一下退休生活，再作打算。對於未來工程界的發展，他抱樂觀態度。「我覺得最困難的階段已過，政府近日亦開始賣地，發展商亦因沉寂太久，應該會蠢蠢欲動。另外政府亦有多個大大小小的工程項目是必須實行的，如舊機場、中環政府總部、西九龍等等。項目增加，我相信競爭亦相對減緩，因為大家都應可分一杯羹！其實我覺得工程界艱辛的歲月經已過去，前面的路只要業內人士願意同心合力，多些溝通，一定可以走過！」

編者按：當大家看到這編專訪時，蔡澤靈先生正享受他暫時性的退休生活。

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Water-cooled Chillers $ave your Energy Cost

The owner of East Point Centre replaced their 20-year old air-cooled chillers by water-cooled type. It helps to resolve the equipment aging and deterioration problem and saves the energy tariff of the building.

The East Point Centre is an office and retail complex located at 555 Hennessy Road, Causeway Bay, Hong Kong. The building has been operated for approximately 20 years. The indoor air-conditioned space amounted to 27,423 sq. meters, distributed amongst twenty-two floors and two levels of basement. The basement two level consists of restaurants while basement one to the seventh floor are occupied by a Japanese style department store. The eighth floor is used as mechanical floor where air-handling units, pump rooms and etc. are located. The ninth to the twenty-second floor are used as offices, clinics and health centers.

Originally, five air-cooled chillers installed at the rooftop supplying chilled water to the air-conditioning system inside the building. All the chillers were in service for nearly 20 years. Aging of equipment and parts led to chillers deteriorate in performance and reliability. One of the five chillers broke down a year ago due to compressor and evaporator failures and was replaced by a new air-cooled chiller with similar capacity. The building owners of East Point Centre awarded the chiller replacement contract last year. During the installation of the new chiller, it was discovered that the other four remaining chillers might encounter similar problem in the coming years.

In recently years, the HKSAR government, Electrical and Mechanical Services Department promote the use of water-cooled air-conditioning systems, which is proofed to be more energy efficient than air-cooled systems. In December 2002, the number of pilot sites was expanded to 45 and the East Point Centre was included in the latest Causeway Bay pilot site. This presented an unprecedented opportunity for East Point Centre to capitalize this energy saving opportunity.

A study was carried out to investigate the feasibility of replacing the existing air-cooled chillers by water-cooled type. The study evaluated the building structure and space availability as additional cooling towers are required by water-cooled system, and the cooling towers will increase the structural loading of the building. After the feasibility study, it was proposed to replace the existing 4 nos. of 320-ton air-cooled chillers by 3 nos. of 500-ton water-cooled chillers and addition of 3 cooling towers with total heat rejection capacity of 6540 kW.

The contractor was engaged to perform a Preliminary Energy Audit for this retrofitting project. It was estimated that the water-cooled chillers saved 25% of the energy consumption of the original air-cooled chillers. The chillers replacement project was a performance contract where the contractor has to conduct installation work with guarantee in energy performance of the newly installed system. Finally, the contract was awarded to the contractor at total contract amount of HK$ 9 million.

As East Point Centre is located in the heart of Causeway Bay, it is a great challenge to the project team to conduct such a large scale of retrofit work without distributing the surrounding environment and maintaining the office building and department store at normal operation. The chiller replacement is planned in several phases and phase one has been already completed in April. Since there is little spare capacity in the chillers and one chiller is idle in each phase, the remaining chillers will be all in full load. Therefore, it is critical to ensure no breakdown in the remaining chillers. The contractor is also the chiller maintenance service provider for the building, it smoothes out the coordination with the retrofit project team. The frequency of preventive checking and maintenance of exiting chillers is increased and both teams are keeping close monitoring on the condition of existing chillers to ensure the normal operation of the chillers.

The completion date of the whole project will be in June this year. It will include chillers replacement, modification of pipe work and an addition of Building Management System for automatic control and monitoring of equipment, and monitoring the energy consumption of the building.

Project Summary

Project Site	: East Point Centre
Client	: The Incorporated Owners of East Point Centre
Contractor	: Johnson Controls Hong Kong Limited
Gross Air-Conditioned Floor Area	: 27,423 m^2
Original Cooling Capacity	: 4352 kW
New Cooling Capacity	: 5280 kW
New Cooling Tower Heat Rejection Capacity	: 6540 kW
Energy saving % of chillers	: 25%

Provided by: Gambi Chiang

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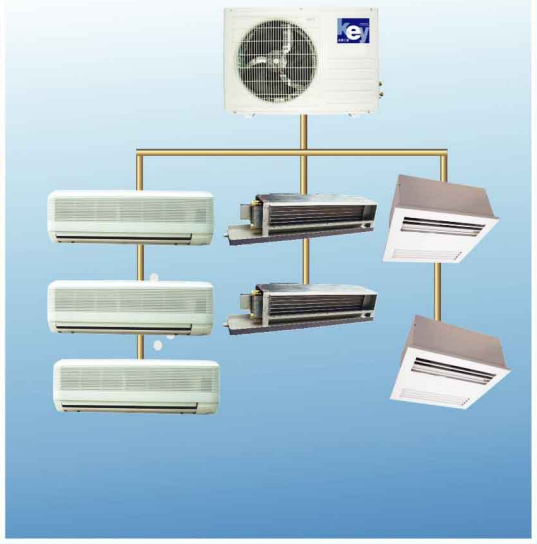


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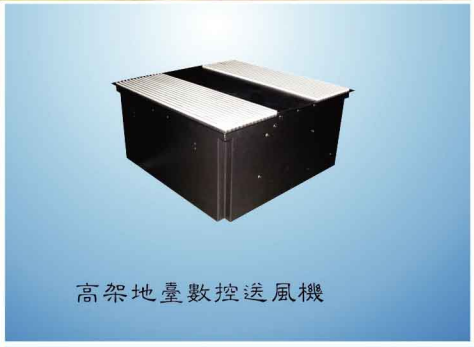
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3、中央空調末端：組合式/空氣調節箱；風機盤管；地下送風機；抽排氣箱。
4、家電類產品：抽濕干衣機；空氣淨化消毒機；干衣機等。
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ACRA Activities

During past 6 months, ACRA has successfully held a series of activities as well as internal and external events for the members. Those functions were keenly taken part by our members with highlights in the following:

ACRA council members were invited to join the first inauguration ceremony dinner of Macau Air Conditioning and Refrigeration Chamber of Commerce (MARCC) on 28 April 2004.

ACRA Bowling Competition 2004 (semi-final) was taken place on 22 April 2004 at AMF Amoy Super Bowl

Spring Dinner 2004 was held on 13 February 2004 at Tao Yuen Restaurant

Seminar for elastomertic insulation was held on 10 January 2004

Meeting with Macau Air-conditioning and Refrigeration Chamber of Commerce (MARCC) was taken place on 5 December 2003

ACRA Annual Dinner 2003 had been held at Island Shangri-La Hotel on 24 November 2003 with overwhelming response and Dr. Sarah Liao joined as guest of honour

Table Tennis Tournament 2003 was held on 16 November 2003

Golf Tournament 2003 was held on 20 November 2003

東歐札記

Let's go Eastern Europe

曾經多次到歐洲去，但從未踏足過東歐國家。今年復活節期間，與家人參加了一個八天抵玩團到東歐三國 — 奧地利、捷克及匈牙利一遊。

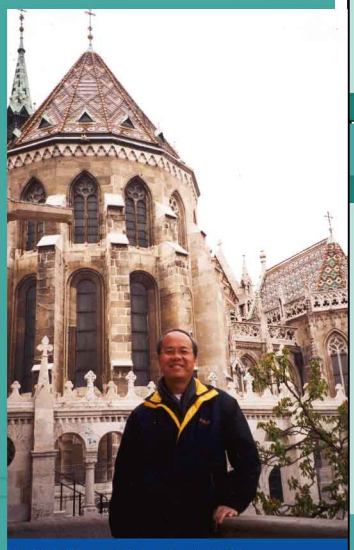
第一站是到瑞士的蘇黎世轉機至奧地利的維也納。基本上，奧地利是不屬於東歐國家，她跟其他歐洲國家分別不大，歐元在奧地利可以流通使用，但在捷克及匈牙利就不能使用。剛下機，我們先往參觀著名的維也納美泉宮及佔地達500畝之美泉宮御花園。宮內金碧輝煌，美輪美奐，花園是希臘式的建築，綠草如茵，漫步其中，煩惱盡忘。在這美麗的環境中，當然要拍照留念一番。正當我們踏上草坪，耳邊已響起刺耳的銀雞聲，忽然有一名管理員騎著單車，口吹銀雞，手指直指向我們腳旁的指示牌，張眼一看寫著「不准踐踏草地」，真令我們尷尬萬分。下午前往聖史提芬教堂及附近的購物區購物，在聖史提芬教堂附近便是國立歌劇院，每天都有不同的歌劇或演奏會舉行，有很多身穿古代裝束的年青人在廣場上及購物區推銷門票，令人有時光倒流的感覺。奧地利的水晶及朱古力是非常著名的，很多人遠道而來購買水晶，但因歐元兌換率甚高，令很多團友望而卻步。奧地利的古典音樂也是享負盛名的，許多亞洲國家(例如日本)的古典音樂愛好者，都到來取經。我們的華語導遊是從亞洲往奧地利留學音樂，閒時兼職導遊幫補生計，晚上有時還會在歌劇院表演。


維也納美泉宮的御花園


位於布拉格的天文鐘

第三天下午乘車到捷克的布拉格，坐了半天車，近黃昏才抵達目的地，剛巧在布拉格正舉行冰上曲棍球賽事，市內酒店均已爆滿。我們被安排到市郊一間酒店入住。這間酒店看似普通，原來內裡可以容納一所冰上曲棍球場，剛巧有賽事在進行中。第四天早上到布拉格古堡參觀，此古堡分為三個庭園，保存得非常完整及整潔。稍後前往聖維特教堂參觀，遊畢後，前往古代購物天堂「黃金小徑」一遊。從古堡向下望，可飽覽整個布拉格及伏爾瓦塔河的景色。在伏爾瓦塔河的觀光船上享用美味的午餐，沿途遊覽河邊秀麗的景色，真是一舉兩得。碼頭位於著名的查理五世大橋旁邊，下船後經查理大橋跨過伏爾瓦塔河進入布拉格古城，中世紀的建築比目皆是。及後參觀建於十四世紀之舊市政廳及天文鐘，當每小時正點時，鐘內之十二門徒便會敲響死神之聲，生態活現。因有大批途人停足圍觀，也正是扒手的好機會，如果大家有機會到此一遊，要份外留神。及後可沿著古城小路前往附近的新城廣場購物區，所有名牌商品，應有盡有。晚上還品嚐特色豬手餐，當然我們不會錯過布拉格醉人的夜景。

第五天，一早便乘車回到布達佩斯去，抵達時已是晚飯時間。晚飯後，我們由領隊帶領下到城裡觀賞布達佩斯的夜景，最著名的鍊橋在晚上觀看時，就如多瑙河上的一顆明珠。多瑙河可說是歐洲的搖籃，流經許多國家，東歐三國也在她的懷抱裡成長。領隊對我們說布達佩斯的夜景較日景好看，我們也不以為然。到了第六天早上，當我們開始遊覽布達佩斯時，才明白他的意思。原來匈牙利因國家開放不久，在資源上不太充裕，部份名勝未能及時收復過來，近看很多都有殘舊的感覺。先後參觀了在蓋列特山的自由女神像、布達皇宮、漁人堡及購物大道等等。下午自費前往希臘小村，在那裡有許多手工藝品及土產出售。午餐品嚐地道的匈牙利牛肉飯，跟我們在香港吃的最大分別，在於那些飯是用麵粉搓成小小的粉團，再配上地道的磨菇湯，非常滋味。晚上領隊為我們安排了別開生面的匈牙利晚宴，小提琴手會在你身邊演奏你心愛的歌曲，越奏越接近你的頸，好像要把你的頸切下來，直至你付上一美元小費，他才停止或轉向下一位客人演奏。第七天早上便乘車回維也納，黃昏時便到機場乘飛機經蘇黎世回香港。


攝於漁人堡(布達佩斯)

在這次旅程中，有兩樣東西較為難忘，一是東歐的公共廁所，大部份的地方都沒有公共廁所，如果有的都是要付錢才可使用，價錢由港幣三元至五元不等，非常昂貴；二是在航機上的電視機，它有快速搜畫及重播的功能，可以繼續選看上回未看完的電影。所謂讀萬卷書不如行萬里路，旅遊除了增廣見識外，也可以令自己輕鬆一下，何樂而不為！

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