

第三屆
永續發展與綠色科技研討會 暨
第二屆
創新發明、科學、輔導教學研討會

3rd Sustainable Development & Green Technology Symposium
2nd Innovative Invention Science & Counseling Teaching Seminar

論文集



主辦單位 南華大學

台灣永續綠色科技發展協會

協辦單位 高雄市政府都市發展局

中華民國農業教育學會

經濟部工業局環境保護中心

2019 第三屆永續發展與綠色科技研討會 & 第二屆創新發明、科學、輔導教學研討會歡迎詞



各位先生、女士，大家好：

首先本人代表南華大學，誠摯歡迎各位學術先進、企業領袖以及各篇論文發表人，在百忙之中，撥冗參與「第三屆永續發展與綠色科技研討會&第二屆創新發明、科學、輔導教學研討會」。

由於溫室效應造成氣候變遷，2015 年聯合國氣候變遷綱要公約（UN Framework Convention on Climate Change）第 21 屆締約國大會（Conference of the Parties 21, COP21）上，共同簽署了「巴黎協定」，同意將全球升溫控制在 2 度 C 以內。而 2018 年第 23 屆締約國大會（COP23）除了落實巴黎協定，更要協助脆弱度高的國家提升其氣候韌性，尤其是針對極端氣候事件及海平面上升的風險；同時提升氣候調適融資、再生能源、乾淨水資源和可負擔的氣候與災難保險之可取得性、推廣永續農業，並與公民團體、學術界、私部門以及不同層級的政府結盟，以加速氣候因應作為，藉由創新企業和投資，加速氣候解決方案的發展與推廣，以邁向零碳經濟，及強化對於氣候變遷與全球海洋關聯性的研究。

現在是一個重要的覺醒時刻，也是 21 世紀人類思考未來能否永續生存與發展，重新思考的時刻。人類生存上必須找到可持續發展的最佳模式，南華大學責無旁貸，必須承擔這個使命。因此，南華大學落實資源回收、廚餘與落葉堆肥及雨水回收再利用等節能節水措施，使得垃圾量逐年降低，有效資源回收率 47%，校園全年平均減少 843 噸二氧化碳排放。另外本校積極規劃舉辦環境保護系列活動，包括社區淨掃、淨灘服務、環境日講座、有機農業國際研討會、永續綠色科技國際研討會、紫斑蝶生態保育國際研討會，經營論壇等活動，培養社會及國際環保意識，瞭解蔬食對健康與減碳的重要性，讓環境永續。此外，南華大學在 105 年成立永續中心，推動積極落實碳盤查，並於 107 年通過 ISO14064-1 溫室氣體盤查，預計 10 年內達到全校碳中和，同時為落實南華大學社會責任，與社會接軌，106 年成立台灣永續綠色科技發展協會，推動社會之永續綠色科技發展，此外輔導斗六污水處理廠，通過全台灣第一個污水處理廠環境教育場域，目前也正輔導嘉義酒廠通過環境教育場域。而本校也於今年已送出環保署環境教育機構申

請，使南華大學成為區域環境教育中心。

此外，為培育永續發展之綠領人才，106 年成立永續綠色科技碩士學位學程，目前每年招收國內生 20 位及國際學生 10 餘位，同時辦理永續綠色科技碩士學位學程學分班及水土保持碩士學分班，已有學生考取水土保持技師，並從 106 年起，每年度辦理 International Conference on Sustainable Development and Green Technology (<http://www.icsdgt.org>)、International Conference on Sustainable Agriculture Technologies (<http://www.icsat.org>)及今年辦理的永續發展與綠色科技研討會；107 年度起接受觀光局委託，每年辦理紫斑蝶保育與永續旅遊研討會；並將於今年度創刊 Journal of Green Technology for Technology 國際期刊，推動永續綠色科技之學術發展。

過去三年來，南華大學在永續方面，也獲得國家及全球性的肯定，2016 年迄今，在「世界綠色大學 (GreenMetric World University Ranking)」評比中，本校列世界百大，其中在廢棄物處理排名更是全國第一，充分顯示南華大學對於保護環境、愛護地球的推廣與落實不遺餘力。2017 年獲得台灣永續能源研究基金會頒發企業社會責任金牌獎及 TOP50 企業獎、行政院頒發國家永續獎，2018 年獲得永續發展典範之國家品質獎。

本研討會包括專題演講、永續農業及永續國土保育論壇，總共 65 篇永續發展相關論文及議題發表，已逐漸成為國內產官學之永續綠色科技交流平台；會後將邀集先進精闢論述，彙集成冊並出版專書，作為爾後推動永續發展與綠色科技之重要文獻；此外感謝高雄市政府都市發展局、耀際實業、崇盛企業行及盟鑫工業之補助及捐款，及美食達人中國區吳金水副總經理贊助會議點心、榮洲食品廠葉坤桐廠長贊助飲料、易綠得園藝有限公司協助會場景觀佈置，讓本研討會得以順利舉辦。本次活動為減低活動之碳排放量，本次研討會活動過程考量減碳需求，盡量減少一次性使用如免洗餐具等物品，論文將以電子檔方式提供下載，並不提供紙本印刷，讓大家一起為世界之永續發展而努力。

祝福大家 諸事圓滿吉祥 一切順利如意！

南華大學 林聰明校長

敬上

主辦單位

南華大學永續綠色科技碩士
學位學程
南華大學永續中心
台灣永續綠色科技發展協會

協辦單位

南華大學科技學院
南華大學自然生物科技學系
南華大學資訊工程學系
南華大學通識中心
高雄市政府都市發展局
中華民國農業教育學會
經濟部工業局工業區環境保
護中心

贊助單位

易綠得園藝公司
崇盛企業行
盟鑫工業
耀際實業有限公司

榮譽主席：林聰明

會議主席：陳柏青

執行秘書：洪耀明

論文審查委員(依筆畫排序)

吳建民、李俊宏、林群智、洪耀明、

陳世雄、陳柏青、黃冠雄、廖怡欽、

蔡加春、蔡德謙、賴信志、魏光茗

總務組：萬雯

會場組：許珮湘、林坤翰

技術服務組：陳彥夫、謝佩君

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第三屆永續發展與綠色科技研討會 & 第二屆創新發明、科學、輔導教學研討會會議總議程

| 時間 | 議程 | 主講人 | 主持人 | 地點 |
|-------------|---------------------------|--|-------------------------------------|--------------|
| 08:10~08:50 | 報到，協會成員繳交年費、申請入會者繳交報名表及年費 | | | 雲水居 國際會議廳 |
| 09:00~09:10 | 南華大學林聰明校長致詞 | | 南華大學科技學院陳柏青院長 | |
| 09:10~10:00 | 專題演講 | 中華民國農教協會 陳世雄 理事長 | | |
| 10:00~10:20 | Coffee Break | | | 海報論文展區 |
| 10:20~11:00 | 專題演講 | 台灣大學生物環境系統工程學系 黃宏斌教授 | 水土保持局吳輝龍(前)局長 | 雲水居 國際會議廳 |
| 11:00~11:40 | 專題演講 | 高雄市都市發展局 林裕益局長 | 南華大學永續綠色科技碩學位學程主任洪耀明主任 | |
| 11:40~12:00 | 台灣永續綠色科技發展協會會員大會 | | 台灣永續綠色科技發展協會黃其斌理事長 | |
| 12:10~13:10 | 午餐 | | | 雲水居 |
| 13:10~14:30 | 永續農業發展論壇 | 台灣樂活有機農業協會 李鴻圖理事長 雲林縣自然農業發展協會莊貴枝理事長 財團法人和諧有機農業基金會 黃山內董事長 南華大學科技學院 陳柏青院長 | 中華民國農教協會 陳世雄理事長 | 雲水居 國際會議廳 |
| 13:10~14:30 | 環境永續論文發表(一) | | 水土保持局吳輝龍(前)局長 嘉義大學土木系周良勳教授 | 學海堂 S101 |
| 13:10~14:30 | 環境永續論文發表(二) | | 康技技術顧問股份有限公司陳本康博士 中興大學水土保持系鄭皆達教授 | 學海堂 S102 |

| 時間 | 議程 | 主講人 | 主持人 | 地點 |
|-------------|---------------------------|--|---|-------------|
| 13:10~14:30 | 環境永續論文發表(三) 防災科技英文論文發表 | | 台灣大學生物環境系統工程學系 黃宏斌教授 農委會水土保持局土石流防災中心 尹孝元主任 | 學海堂 S103 |
| 13:10~14:30 | 環境永續論文發表(四) | | 高雄市都市發展局林裕益局長 屏東科技大學水土保持學系唐琦教授 | 學海堂 S104 |
| 14:30~15:00 | coffee Break | | | 海報論文展區 |
| 15:00~16:20 | 永續國土保育論壇 | 台灣大學生物環境系統工程學系 黃宏斌教授 農委會水土保持局土石流防災中心 尹孝元主任 南華大學永續綠色科技碩士學位學程 洪耀明主任 虎尾科技大學休閒系 梁大慶教授 | 高 雄 市 都 市 發 展 局 林裕益局長 | 雲水居國際會議廳 |
| 15:00~16:20 | 環境永續論文發表(五) | | 南華大學資訊工程學系 黃冠雄教授 高苑科技大學電子工程學系魏吟芳教授 | 學海堂 S101 |
| 15:00~16:20 | 環境永續論文發表(六) 永續農業英文論文發表 | | 雲林縣自然農業發展協會莊貴枝理事長 中華民國農教協會陳世雄理事長 | 學海堂 S103 |
| 15:00~16:20 | 創新發明競賽論文發表 | | 南華大學永續中心吳信達研究員 虎尾科技大學機械與電腦輔助工程系邱蔓蕙教授 | 學海堂 S104 |
| 16:30~17:00 | 頒發研討會感謝狀、論文發表獎及創新發明競賽獎 | | 南華大學科技學院陳柏青院長 | 雲水居國際會議廳 |

第三屆永續發展與綠色科技研討會 & 第二屆創新發明、科學、輔導教學研討會會議雲水居國際會議廳議程

| 時間 | 議程 | 主講人 | 主持人 |
|-------------|---|---------------------|------------------------|
| 08:10~08:50 | 報到，協會成員繳交年費、申請入會者繳交報名表及年費 | | |
| 09:00~09:10 | 南華大學林聰明校長致詞 | | 南華大學科技學院陳柏青院長 |
| 09:10~10:00 | 專題演講 A model for Sustainable agriculture without waste and pollution | 中華民國農教協會陳世雄理事長 | |
| 10:00~10:20 | Coffee Break | | |
| 10:20~11:00 | 專題演講 台灣的永續野溪治理工程 | 台灣大學生物環境系統工程學系黃宏斌教授 | 水土保持局吳輝龍(前)局長 |
| 11:00~11:40 | 專題演講 高雄市國土計畫之推動 | 高雄市都市發展局林裕益局長 | 南華大學永續綠色科技碩學位學程主任洪耀明主任 |
| 11:40~12:00 | 台灣永續綠色科技發展協會會員大會 | | 台灣永續綠色科技發展協會黃其斌理事長 |
| 12:10~13:10 | 午餐 | | |
| 14:30~15:00 | Coffee Break | | |

| | | | |
|-------------|------------------------|--|--|
| 13:10~14:30 | 永續農業發展論壇 | <p>台灣樂活有機農業協會李鴻圖理事長 <i>生態有機農業成為台灣亮點-從兩三百年前最樂活富裕的台灣史說起</i></p> <p>雲林縣自然農業發展協會莊貴枝理事長 <i>自然農業、有機及友善環境耕作對於永續農業發展的新願景</i></p> <p>財團法人和諧有機農業基金會黃山內董事長 <i>台灣農產品認證體系對有機農業發展的影響</i></p> <p>南華大學科技學院陳柏青院長 <i>以層次性風險評估法評估台灣居民因土壤砷污染所導致之健康風險</i></p> | <p>中華民國農教協會 陳世雄理事長</p> |
| 14:30~15:00 | Coffee Break | | |
| 15:00~16:20 | 永續國土保育論壇 | <p>台灣大學生物環境系統工程學系黃宏斌教授 <i>生態河川治理工程</i></p> <p>農委會水土保持局土石流防災中心尹孝元主任 <i>潛在大規模崩塌地區之災害管理策略簡介</i></p> <p>南華大學永續綠色科技碩學位學程洪耀明主任 <i>應用人工降雨設施於鋪面透水率量測</i></p> <p>虎尾科技大學休閒系梁大慶教授 <i>以里山概念思考環境生態與鄉村體驗-以南投縣一新社區為例</i></p> | <p>高雄市都市發展局 林裕益局長</p> |
| 16:30~17:00 | 頒發研討會感謝狀、論文發表獎及創新發明競賽獎 | | <p>台灣永續綠色科技發展協會黃其斌理事長 南華大學科技學院陳柏青院長</p> |

第三屆永續發展與綠色科技研討會 & 第二屆創新發明、科學、輔導教學研討會會議 S101 議程

| 時間 | 議程 | 作者/講題 | 主持人 |
|-------------|-----------------|---|--|
| 13:10~14:30 | 環境永續論文發表 (一) | <p>顏浚丞、洪耀明 整合無限邊坡與滲流之深層崩塌理論之實驗驗證</p> <p>林正昌、洪耀明 應用草類於山坡地土壤沖蝕防治之研究</p> <p>陳建丞、洪耀明 台北市上游水文觀測即時系統建立之研究</p> <p>陳茂誠、洪耀明、Amit Kumar Sah 台灣中部地區地下水觀測井回填濾料設計</p> <p>吳旻芳、洪耀明 透水鋪面試驗場域施作</p> <p>陳美如、克里山、洪耀明 再生骨材對混凝土抗壓強度和滲透性的影響</p> | <p>水土保持局吳輝龍 (前)局長</p> <p>嘉義大學土木系 周良勳教授</p> |
| 14:30~15:00 | coffee Break | | |
| 15:00~16:20 | 環境永續論文發表 (五) | <p>洪明振、洪耀明 應用溯源管理提高食品安全研究</p> <p>吳金水、洪耀明 美食達人公司物流中心揀貨效率研究</p> <p>黃郁琦、陳萌智 應用機器人數字教學提升重度自閉症幼童專注力之行動研究</p> <p>簡嘉韋、陳萌智 客服機器人應用於設備維護與系統管理之研究-以台南市某醫院為例</p> <p>吳信達、賴湑蓉、楊玉琳、林雅其 創新結構型儲氫牆技術發展之研究</p> <p>魏勇盛、沈建全、蕭卜仁 人工濕地空心菜(<i>Ipomoea aquatica</i>)碳吸存量與不同營養鹽關係之初步研究</p> <p>陳永宗、洪耀明 輔導觀光休閒漁場申請環境教育設施場所認證之要件分析</p> | <p>南華大學資訊工程學系黃冠雄教授</p> <p>高苑科技大學電子工程學系魏吟芳教授</p> |

第三屆永續發展與綠色科技研討會 & 第二屆創新發明、科學、輔導教學研討會會議 S102 議程

| 時間 | 議程 | 作者/講題 | 主持人 |
|-------------|-----------------|--|-------------------------------------|
| 13:10~14:30 | 環境永續論文發表 (二) | <p>李繼源、洪耀明 馬祖地區海水淡化廠系統適性之評估</p> <p>平 民、洪耀明 應用監測設施於頭份工業區雨水下水道水質及水量即時監測</p> <p>林元馨、洪耀明 超鹼性離子水去除廢水中氮氮之可行性評估</p> <p>吳惠君、洪耀明 台中工業區生活污水處理計價方式簡化之可行性評估</p> <p>陳淑玲、洪耀明 應用機械式蒸汽再壓縮技術於廢水回收方法之研究</p> <p>張麗慧、洪耀明 南崗工業區工業鍋爐改善於空氣品質之成本效益評估</p> | 康技技術顧問股份有限公司陳本康博士 中興大學水土保持系鄭皆達教授 |
| 14:30~15:00 | coffee Break | | |

第三屆永續發展與綠色科技研討會 & 第二屆創新發明、科學、輔導教學研討會會議 S103 議程

| 時間 | 議程 | 作者/講題 | 主持人 |
|-------------|-----------------------------|---|---|
| 13:10~14:30 | 環境永續論文發表 (三) 防災科技英文發表 | <p>Atul Kumar、洪耀明 <i>Using the Seepage Erosion and Infinite Slope Method on the Critical Groundwater Level Estimation of Landslide</i></p> <p>Vivek Kumar、洪耀明 <i>Using Finite Element Method and Laboratory Experiment on the Deep Seated Landslide Modelling</i></p> <p>Amit kumar sah、洪耀明 <i>Backfill Filter of Various Soil Types for Groundwater Monitoring Well</i></p> <p>Krishan Pareek、洪耀明 <i>Effect of recycled aggregate on compressive strength and permeability of concrete</i></p> <p>Anil kumar sah、洪耀明 <i>Application of Recycled Material on the Construction of Previous Pavement</i></p> <p>Ravi Shankar Kumar、洪耀明 <i>A Novel Experiment Method for the Infiltration Rate Measurement of Permeable Pavement</i></p> | 台灣大學生物環境系統工程學系黃宏斌教授 農委會水土保持局土石流防災中心尹孝元主任 |
| 14:30~15:00 | coffee Break | | |

| | | | |
|--------------------|--------------------------------------|---|--|
| <p>15:00~16:20</p> | <p>環境永續論文發表 (六) 永續農業英文發表</p> | <p>S M Nahid Hasan、陳柏青 <i>Comparative Assessment of Tomato Quality by Sun and Multi commodity Solar Dryer</i></p> <p>Cheska Aujero、陳柏青 <i>Seasonal Differences of Nitrate and Nitrite Level in Vegetables and Subsequent Human Health Risk Assessment</i></p> <p>Marilyn Aldamar、陳柏青 <i>Assessing Human Health Risk on Nitrate and Nitrite Content in Vegetables Grown under Organic and Conventional Farming in Taiwan</i></p> <p>Chhorn Chamroeun、陳柏青 <i>Zinc Concentrations in Grapevines and Vineyard Soils in Central Taiwan</i></p> <p>Chrecel Mae M. Lasquite、 Chun-Chih Lin、Shih-Shiung Chen <i>Varietal Test of Lettuce (Lactuca sativa) Applied with Bokashi</i></p> <p>Md. Nazmul Aunsary、陳柏青 <i>Sustainable Water Treatment Management</i></p> <p>S M Salahuddin Morsalin、賴信志 <i>Electroencephalography (EEG) signal acquisition system design</i></p> | <p>雲林縣自然農業發展協會莊貴枝理事長 中華民國農教協會 陳世雄理事長</p> |
|--------------------|--------------------------------------|---|--|

第三屆永續發展與綠色科技研討會 & 第二屆創新發明、科學、輔導教學研討會會議 S104 議程

| 時間 | 議程 | 發表人/講題 | 主持人 |
|-------------|-----------------|---|---|
| 13:10~14:30 | 環境永續論文發表 (四) | <p>葉坤桐、陳柏青 豆漿濃度對豆腐製程效益之影響</p> <p>梁大慶、高伯宗、楊文鴻 後農村再生時代之區域亮點暨 跨域整合發展-以桃園地區為例</p> <p>梁大慶、江炳辛、李彩認 農村社區發展節水保水設施之 效益：以雲林縣虎尾鎮北溪社 區（剪紙藝術村）為例</p> <p>鄧文濟、江益璋 以自然建材為主之高性能複層 牆體設計與應用初探</p> <p>邱婕鈴、洪耀明 彰化孔廟白沙書院舊址再利用 之永續發展評估</p> <p>蔡依芸、江益璋 台灣消費者對於自然建築看法 之初探-以四口之家為例</p> | <p>高雄市都市發展局 林裕益局長</p> <p>屏東科技大學水土 保持學系唐琦教授</p> |
| 14:30~15:00 | coffee Break | | |
| 15:00~16:20 | 創新發明競賽論文發表 | <p>王小璐、莫嘉敏、孙雄东、刘佳 丽、蔡博文、吳信達 再利用三農創新電子商務平臺</p> <p>黃浚炜、肖竣星、何柳斌、宋紫 东、蔡博文、吳信達 沙拉餐廳創業計畫書</p> <p>黃豪建、李睿君、陈立友、温颖 琳、蔡博文、吳信達 基於自主研发的PSD 動態曲線 技術的電池安全系統平臺</p> <p>蓝彤彤、胡文娜、生楚义、莫晓 莉、蔡博文、吳信達 "A Da 啟發創新機構" 商業 計畫書</p> <p>尤伯鯉、陳世雄、陳柏青 應用生料培養食用菌之研究</p> <p>黃靖舒 肢體拼接的即興雙人舞蹈創作</p> | <p>南華大學永續中心 吳信達研究員</p> <p>虎尾科技大學機械 與電腦輔助工程系 邱蔓蕙教授</p> |

A model for Sustainable agriculture without waste and pollution

Shih-Shiung Chen

My farm has initially reached the goal of “zero pollution, zero waste”. Planting hundreds of large trees with grassland, and using rotation, intercropping, mulching, covering, and circular economy model, almost reached the realm of zero carbon emissions. The practices are no longer polluting environments, and do not emit too much carbon dioxide. My farm raised honey bees, which not only pollinate, ensure crop yields, and serve as important indicators of ecology. I bought a hive of honey bees for fun two years ago. After a year, it has been propagated into 12 hives. After two years, it has now exceeded 53 hives. Beekeeping not only takes care of biodiversity, all the products, honey, pollen, royal jelly, beeswax, and propolis are feedback to beekeepers.

I raise organic hens and produce healthy eggs. Based on the principle of circular economy, I use soybean meal to grow black soldier fly, and then feed the chicken with BSF larvae, to replacing fishmeal and bone powder. This kind of "zero pollution, zero waste" circular economy production system is the sustainable agriculture model in the future. A black soldier fly larvae can break down 2-3 kilograms of animal waste in 18 days and gain 4000 times weight. This model of sustainable agriculture is not only benefit for young farmers; but also provide a model for retired people for health care.

我設計的農場已經達到「零污染、零廢棄物」的目標。農場種植數百棵大樹，植滿草地，利用輪作、間作、敷蓋、覆蓋以及循環經濟的生產模式，幾乎可以達到零碳排放的境界。農場養了一箱蜜蜂。過了一年，已經繁殖成 12 箱，經過兩年半，已經超過 53 箱。養蜂除了幫農作物授粉，回饋給蜂農的是蜂蜜、花粉、蜂王乳、蜂蠟、蜂膠。養蜂不只照顧地球生態，也有甜蜜豐厚的回饋，所以蜜蜂被譽為「完美昆蟲。」農場也養蛋雞。自己養雞，生健康的雞蛋，給家人吃。我以循環經濟的原理，利用生產豆腐豆花的廢棄物——豆渣，養殖黑水虻，再用黑水虻幼蟲餵養雞。用黑水虻取

代魚粉和骨粉，可免於人類 2048 年以後無魚可吃的窘境，也免除狂牛病的風險。這種「零污染、零廢棄物」的循環經濟生產體系，是未來永續的動物養殖方式。黑水蛇食性很雜，雞糞、豬糞、豆渣、酒糟、廚餘都可以當飼料，一隻黑水蛇 18 天內可以分解 2-3 公斤動物廢棄物，體重增加 4000 倍，真正「化煩惱為菩提，化腐朽為神奇。」我一向倡導生物動力農法 (Biodynamic) 理念，有機農場必須要動植物共同生產，動物廢棄物可以做為作物的肥料，作物殘株可以成為動物飼料，相輔相成，不會有廢棄物的問題。這種永續農業經營模式，不僅提供年輕農民成功經營方法，也可以做為退休人員開創生活，老人照護的模式。

台灣的永續野溪治理工程

黃宏斌*

摘 要 台灣的野溪特性為河道短促、河床坡度陡峻、底床沖淤激烈、底床粒徑分布廣泛，以及水位、流量變化快速，這些野溪特性也經常帶來了洪水和泥砂災害。因此，野溪治理工程就成為中央和地方政府的重要施政之一。野溪治理工程的硬體建設包含防砂壩、整流工程、護岸和固床工。雖然規劃設計階段有五化原則可以遵循，可是目前仍然有盲點存在。亦即施工和營運階段的野溪治理工程仍然會不經意地阻礙或破壞水、陸域物種的生態廊道。本研究從水域物種的生命周期棲地需求提出生態友善策略。

關鍵詞：野溪，野溪治理工程，生態友善策略。

Sustainable torrent control measures in Taiwan

Hung-Pin Huang*

ABSTRACT The characteristics of wild creek in Taiwan are short channel length, steep slope of riverbed, various scour-and-fill phenomena on riverbed, broad range of grain-size distribution and fast change of water depth and discharge. These characteristics results in disaster of flood and sediment happened frequently in Taiwan. Hence, the torrent control work is one of the important official businesses of central government and local agency. The hardware of torrent control includes in constructing check dam, regulation works, revetment and groundsill. Although there is five principles of torrent control as a guidance of planning and design, the blind spot is still existed nowadays. That is, the torrent control work still inadvertently obstructed or destroyed the ecological corridor for aquatic or terrestrial species during the construction or operation periods. This study collects and presents some information of ecological friendly measures from the demand of habitat for aquatic species of life cycle.

Key Words: wild creek, torrent control measures, ecological friendly measures.

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高雄市國土計畫之推動

林裕益^{*}

摘 要 中華民國之國土計畫法於 2016 年 5 月公告施行，依其規定，國土計畫將取代現行的區域計畫，國土功能分區及其分類與使用地，將取代現行非都市土地 11 種使用分區及 19 種使用地。「全國國土計畫」也依法定期限於 2018 年 4 月 30 日公告實施。實施後 2 年內，高雄市政府也應公告實施「高雄市國土計畫」，之後，可望於 2022 年 4 月 30 日前公告「國土功能分區圖」，全面實施國土計畫。近年來，全球受到極端氣候影響，各地災情頻仍，尤其台灣島嶼條件，國土體質相對脆弱。就高雄市而言，2010 年縣市合併改制後，陸域面積 2,952 平方公里，其中森林區及山坡地保育區面積約佔全市 70%，都市治理策略產生巨大轉變，不僅應持續擘劃都市核心發展藍圖，更應著重環境敏感地區的保育、復育與教育，展現高雄於環境友善的積極態度。研擬中的「高雄市國土計畫」，將依循全國國土計劃方向，落實地方自治之精神，並因應全球化、氣候變遷、國土保育、糧食安全、產業發展等之變化，評估環境敏感特性、地方發展需求、區域資源合作等因素，提出因地制宜的空間發展構想，作為全市空間發展長期性、綜合性、目標與政策導向之上位指導計畫，以有效管理土地發展方向，引導高雄市整體區域的永續發展。

關鍵詞：國土計畫法、氣候變遷、永續發展

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Director-general, Urban Development Bureau, Kaohsiung City Government

Using Traceability Management on the Improvement of food Safety

Yu-I Lin*

ABSTRACT National Land Planning Law (NLPW) of R.O.C was announced in May 2016. According the regulations, NLPW will replace current regional plan, in which the division /classification /use of NLPW will replace the existing law, including 11 kinds of use zone for non-urban land and 19 kinds of land. National Land Project also implements in Taiwan after the announcement on April 30, 2018. Within two years after implementation, Kaohsiung City Government will implement the “Kaohsiung City Land Project”. i.e. The announcement of National Land Function Zoning Map of Kaohsiung city should be announced by April 30, 2022, so as to implement the national land plan. In recent years, global warning induced the extreme weather, where disasters occur frequently. In particular, Taiwan’s island conditions are relatively fragile. After the merger of the county and city in 2010, the land area of Kaohsiung City is 2,952 square kilometers, of which the forest area and the hillside land conservation area occupied 70% area. Governance strategy has undergone tremendous changes. Urban area should not be the only focus. Development focus should emphasis on the Kaohsiung's positive attitude towards environmental friendliness, which includes the conservation, rehabilitation and education in environmentally sensitive areas. This study analyzed the requirement and the vision of Kaohsiung City Land Plan, which should follow the NLPW, implement the spirit of local autonomy, and assess environmentally sensitive characteristics to response the changes in globalization, climate change, land conservation, food security, industrial development, local development needs, and regional resource cooperation. According to above requirement, the concept of space development will be put forward to be the long-term, comprehensive, goal and policy-oriented guidance program to effectively manage the direction of land development, and to guide the overall area of Kaohsiung City sustainable development.

Key Words: national land planning law, climate change, sustainable development.

永續農業論壇

生態有機農業成為台灣亮點-從兩三百年前最樂活富裕的台灣史 說起

李鴻圖^[1]

摘要 生態有機農業就是以自然生態的力量孕育農產品，不但可以讓台灣環境美好，豐衣足食，國人健康，導引線性經濟走向循環經濟，還可以創造綠色產業的供應（價值）鏈，成為台灣的亮點。回顧樂活富裕的台灣歷史

一、 農作物收成數倍於內地，一年耕作所得足供七年食用 — 藍鼎元

二、 平民百姓不穿布衣，只穿絲綢的衣服—孫元衡〈田家〉詩

三、 「近者海內恆苦貧，斗米百錢，民多饑色，賈人責負聲日沸闐闐；臺郡獨似富庶，市中百物價倍，購者無吝色；貿易之肆、期約不愆；傭人計日百錢，趑趄不應召；屠兒牧豎、腰纏常數十金，每遇擄捕，浪棄一擲間，意不甚惜。」— 郁永河，《稗海遊記》。

台灣人民衣食之豐裕，取之於豐饒的土地，土地生產力高，又不需要花費太多時間照料，使人們有餘裕的金錢和時間作高級消費。高拱乾形容「台灣地氣和煖，無胼手胝足之勞，而禾易長畝。」黃叔璥所撰《赤嵌筆談》，則記載台灣「土壤肥沃，不糞種；糞則穗重而仆。」稻作種植後就放任其自生自長，不用鬆土、施肥、鋤草，只要坐享其成，而且產量還是內地的好幾倍。不只稻米如此，「瓜果豆菜之屬，著地即生」，可以說是菜籽撒下就等收成，且「有種必穫」，藍鼎元甚至說，一年耕作所得，足供七年食用。台灣人民當然不會把米糧屯積七年，於是「肩販舟載，不眠不休」，將多餘的米糧運往中國內地或輸出日本，台灣遂成為中國東南的穀倉。

現今典範案例說明：

一、部落有機農業輔導人才培訓的生產倍增示範

二、 質與量均超越慣行農法的生態農法。

關鍵詞：有機農業、慣行農法、循環經濟

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自然農業、有機及友善環境耕作對於永續農業發展的新願景

莊貴枝^{[1]*}

摘 要 因應貿易自由化、氣候變遷加劇及人口與消費結構改變，以及臺灣農業許多結構性的問題，包括土地、勞動力等農業基礎工程，提出「新農業創新推動方案」，提升糧食自給率達40%，強化臺灣農業實質，創新臺灣農業價值。重點執行策略如下：

- (一)建立新典範兼顧保障農民、農業生態環境及永續發展。
- (二)建構農業穩定糧食供應、提升農產品品質、確保農產品安全與消費者安心。
- (三)提升加強農業行銷推廣，促使農業成為獲利、永續發展產業。
- (四)實施有機農業促進法案
- (五)推廣有機農業教育與訓練培育青農、新農人才

總結，為追求人類生存，以創新農業促進農業永續發展為目標。

關鍵詞：永續農業發展、自然農業、有機農業、友善環境耕作

A new vision for sustainable agricultural development on natural agriculture, organic and friendly environment farming

Kuei-Chih Chuang^{[1]*}

ABSTRACT In response to trade liberalization, climate change intensification, changes in population and consumption structure, and many structural problems in Taiwan's agriculture, including agricultural and infrastructure projects such as land and labor, the "New Agricultural Innovation Promotion Program" was proposed to increase food self-sufficiency rate by 40%. Strengthen the essence of Taiwan's agriculture and innovate Taiwan's agricultural value. The key execution strategies are as follows:

- (1) Establishing a new paradigm and taking care of farmers, agro-ecological environment and sustainable development.
- (2) Constructing agricultural stable food supply, improving the quality of agricultural products, ensuring the safety of agricultural products and the peace of mind of consumers.
- (3) Enhancing the promotion of agricultural marketing and promoting agriculture to become a profitable and sustainable development industry.
- (4) Implementation of the Organic Agriculture Promotion Act
- (5) Promoting organic agriculture education and training to cultivate young farmers and new farmers

To sum up, in pursuit of human survival, the goal of innovative agriculture to promote sustainable development of agriculture.

Key Words: sustainable agricultural development, natural agriculture, organic agriculture, and friendly environment farming

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台灣農產品認證體系對有機農業發展的影響

林俊良^[1] 黃山內^[2]

摘要 舉凡世界先進國家有機農業的推動，初始為民間自發性的農民組織所發動，進而要求政府制定相關法規加以規範化及標準化，並建立對應的有機農業生產、認證及銷售體系，加以管控有機農產品市場。在現今有機農業全球化的潮流下，全球超過 87 個國家制定有機農業相關法規與標準，然而各國對有機農業的定義與相關認(驗)證標準不同，造成有機農產品的貿易障礙，所以目前國際上極需達成進出口貿易國雙方有機同等性的承認，已刻不容緩。

台灣有機農業發展已 30 年載，自 2007 年有機農產品及有機農產加工品驗證管理辦法執行到 2018 年有機農業促進法立法通過，台灣有機農業發展也循先進國家發展軌跡逐步完善。然而因起步較晚與認(驗)證體系尚未接軌完善，故世界各國有機同等性承認仍有待努力。所以本研究為探討近年台灣政府推動各項農產品認證制度、相關法規與標章對永續、友善及有機農業等產業促進的影響，藉此了解台灣有機農業的市場機遇。

關鍵詞：有機農業、有機同等性、有機農業促進法

The Impact of Taiwan's Agricultural Product Certification System on the Development of Organic Agriculture

Chun Liang Lin^[1] Shan-Ney Huang^[2]

ABSTRACT Promotion of organic agriculture in the countries of the world, initially started by private voluntary farmers' organizations, and then they claim the government to formulate relevant regulations to standardize, and establish Organic agricultural product certification systems to manage Organic agricultural products market. Under the current trend of organic agriculture globalization, more than 87 countries around the world have formulated organic agriculture regulations and standards. However, due to the different definitions of organic agriculture and related certification standards of the countries of the world, trade barriers of organic agricultural products arise. It is imperative that the organic equality needs to be recognized between the trading countries.

The development of organic agriculture in Taiwan has been for 30 years. Since the implementation of Organic Agricultural Product and Organic Agricultural Processed Product Certification Management Regulations in 2007, and Organic Agriculture Promotion Act was passed in 2018, the development of organic agriculture in Taiwan has gradually improved. However, due to the late start and the agricultural product certification system has not been integrated, Taiwan's organic agricultural certification system has not been recognized internationally. Therefore, the study is to discuss the impact of the Taiwan government's various agricultural product certification systems in recently years on development of Organic Agriculture and its market opportunities.

Key words: Organic agriculture, Organic equality, Organic Agriculture Promotion Act

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以層次性風險評估法評估台灣居民因土壤砷污染所導致之健康風險

陳柏青^{[1]*}

摘要 土壤受重金屬污染在全世界皆為嚴重的問題。因此，本研究探討台灣中部地區某受砷污染之農地，其農民於耕作時因不同暴露於砷途徑所可能產生之健康風險。此外，本研究以第三層次風險評估法，估算台灣地區居民因攝食砷污染場址所生產之稻米，所導致之健康風險。第一層次健康風險之結果顯示，在污染場址土壤平均總砷濃度為 44.96 mg kg⁻¹ 情況下，將對當地耕作農民產生致癌風險；而第三層次健康風險評估結果則顯示，食用當地生產之稻米，其致癌風險(TR)將顯著高於可接受之致癌風險。若欲有效管理因砷污染土壤所導致之農民耕作風險或消費者食用稻米風險，本研究之結果建議生產水稻農地之土壤含砷管制標準降至 15 mg kg⁻¹。

關鍵詞：砷，稻米，土壤，層次性人體健康風險評估

A Tiered Risk Assessment Approach for Assessing Human Health Risk Subjected to As-Contaminated Soils of Taiwan Residents

Bo-Ching Chen ^{[1]*}

ABSTRACT Soil contamination of heavy metals is a serious problem all over the world. This study assessed potential health risk of local farmers exposed to arsenic (As) through different exposure routes in As-contaminated sites in central Taiwan. In addition, a Tier III risk assessment method was employed to estimate health risks of Taiwan residents via rice consumption. For Tier I risk assessment of local farmers, results showed that the mean total As concentration in soil was 44.96 mg kg⁻¹, resulting in a potential carcinogenic risk. For Tier III risk assessment of Taiwan residents, the predicted target cancer risk (TR) was markedly higher than the acceptable target cancer risk. To manage the health risk of local farmers and Taiwan residents due to As exposure subjected to As-contaminated soils, our results suggested that the regulation standard of As in farmland soil should be set below 15 mg kg⁻¹.

Key Words: arsenic, rice, soil, tiered human health risk assessment.

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永續國土論壇

生態河川治理工程

黃宏斌^{[1]*}

摘 要 對照目前河川治理工程及其施工中常見的生態影響因子，生態系服務凸顯生態河川治理工程的重要性與日俱增。由不同魚種於其生命週期中，對於深潭、淺瀨、深流、淺流、岸邊緩流和濱溪植被綠帶等不同棲地需求讓我們瞭解整體性棲地結構，在規劃、施工和維護階段都需要保護生態敏感區。最後，提出生態影響減輕措施，如保育原則、河溪構造物規劃設計原則、淡水魚最適環境、魚道選擇和生態友善對策等。

關鍵詞：生態系服務，生態河川治理工程，棲地

Introduction of Ecological River Governance Project

Hung-Pin Huang ^{[1]*}

ABSTRACT Based on the high light of ecosystem services, the ecological river governance project raises up its importance state increasingly in comparison with the ecological impact factors occurred frequently during the construction and operation periods nowadays. The necessary habitats of pool, riffle, run, glide, slack and riparian green belt for different species during its life cycle let us understand the integrated habitat structure resulting in protecting the ecological sensitive zone from planning, construction to maintenance stages. Finally, this study present the principles of ecological mitigation measures of conservation principle, planning and design principle of river construction, the most feasible environment of fresh water fish, the selection of fish way and ecological friendly countermeasures.

Key Words: ecosystem services, ecological river governance project, habitat.

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潛在大規模崩塌地區之災害管理策略簡介

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摘 要 全球氣候變遷導致極端降雨事件頻傳，民國 98 年莫拉克颱風小林村事件後，更突顯大規模崩塌造成的威脅，台灣由於人口密度高，坡地及山地的土地利用及開發需求大，一旦不幸發生大規模崩塌，無論是聚落內的居民或是通行的人車，往往都會造成嚴重的災情，對社會的衝擊極大。針對大規模崩塌及其可能帶來的災害，水土保持局透過「氣候變遷下之大規模崩塌防減災策略」中程計畫，逐一針對潛在大規模崩塌之可能位置、發生機制、潛在災害規模及發生前兆等災害管理課題，進行深入的研究與探討，未來將逐步根據上述研究成果落實回饋到防災實務工作所需要之應變管理與避難疏散計畫等具體成果。

關鍵詞：氣候變遷、潛在大規模崩塌、災害管理

Introduction to Disaster Management of Potential Large-scale Landslide Areas

ABSTRACT Due to the climate change impact, the risk of potential large-scale landslide areas, such as Hsiaolin Landslide happened in 2009, has increased following with the frequent extreme rainfall events. In recent years, Taiwan is prone to catastrophic sediment disasters owing to high population density and high demand of slopeland development. Both residential areas and traffic systems will be seriously damaged by large-scale landslides and pose great threats on our society. According to Soil and Water Conservation Act, the Soil and Water Conservation Bureau is in charge of slopeland resources conservation and hazards mitigation. Therefore, the bureau has started the 4-year project - “Mitigation Strategies for Large-scale Landslide under (2017-2020) including the researched about potential areas identification, occurrence mechanism understanding, triggering indexes and run-out distance of large-scale landslides. All the above-mentioned studies will be used for large-scale landslide disaster mitigation in order to establish early warning system and evacuation plan borrowed from the current mature mechanism of debris flow disaster management.

Key Words: climate change 、Potential large-scale landslide, Disaster management

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應用人工降雨設施於鋪面透水率量測

洪耀明^{[1]*}

摘 要 透水路面可用於通過滲透減少地表積水及逕流，從而減少暴雨引起之洪水。本研究建立了標準的實驗場地來測量路面的滲透性，並採用水文連續方程式為控制方程式，人工降雨量為輸入，地表逕流為輸出，滲透為儲存變化量。首先，設計了雨量計和六種鋪路。每個鋪面長 3.5 米，寬 2 米，取決於鋪面的材料，鋪面厚度在 5 到 15mm 之間，鋪面下方設計 40cm 的碎石級配以儲存在路面下方的滲透。鋪面中間設置一根管子以觀察地下水位。路面的表面傾斜度為 3%，允許地表徑流流入外部水池，上方設置人工降雨設施，以進行透水率量測，本試驗場域將可為各種可滲透鋪路面提供準確的透水性測量。

關鍵詞：人工降雨、透水率、鋪面

Using Artificial Rainfall Facility on the Permeability Measurement of Pavement

Yao-Ming Hong ^{[1]*}

ABSTRACT Permeable pavement can be used to reduce surface water / runoff through infiltration, so as to drop the amount of flooding caused by torrential rain. This study establishes a standard experimental site to measure the permeability of permeable pavements. The hydrological continuous equation, which is the balance between the rainfall volume, the summation of infiltration and surface runoff, is used to be governing equation. Firstly, a rain gauge and six types of paving were designed. Each paved area is 3.5M long and 2M wide, and the paving thickness is between 5 and 15cm depending on the material of the paving surface. A 40cm rubble gradation was designed to storage the infiltration below the pavement. A tube is set in the middle of pavement to observe the groundwater level. The surface of the pavement is at a slope of 3%, allowing the surface runoff to flow to the outside reservoir. This module will provide an accurate measurement of water permeability for a variety of permeable paving surfaces.

Key Words: artificial rainfall, permeability, pavement.

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以里山概念思考環境生態與鄉村體驗-以南投縣一新社區為例

梁大慶

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摘 要 台灣從以里山概念在農村再生與綠色田野，譜出埔里綠色奇蹟！南投縣埔里鎮一新社區，推動台灣白魚綠保田、有機農業生產認證加值產業有成，4~10月茭白筍盛產期間，除了每日產量可達一千多公斤，還兼負復育台灣特有種「台灣白魚」的任務。埔里鎮一新社區以茭白筍為主要作物，另有絲瓜及百香果等，幾年前農民仍以慣行農法耕種，與慈心有機農業發展基金會合作跨域合作示範計畫，輔導埔里一新社區十多位農友，推動茭白筍田轉作有機耕作及進行綠色保育驗證，兼顧農民生計與生態保育，達到復育珍貴稀有保育類野生動物「台灣副細鯽」（*Pararasbora moltrechti*，俗稱台灣白魚），如今至今已有4戶取得綠色保育標章，總面積約4.5公頃。

「綠色保育標章」的綠色保育計畫，代表以友善耕作方式，促成自然環境與生態生生不息。凝聚當地一群有共同生態理念的農友們，轉型綠色保育農法，同時媒合有機農產品通路商銷售產品，以及宣傳在地生態旅遊。綠保的農友們在茭白筍田旁刻意保留一塊生態池，以友善農法善待物種，已逐漸成功復育白魚。

台灣農業小面積的生產模式，緊密連結農村居民生活與田區生產，而有機農業強調的友善耕作、重視環境生態保育、維護生物多樣性的目標，正是創造台灣農業及環境永續發展的價值與契機。

「有機農業包含了經濟、生態與社會交融的面向，傳遞了一種人與自然尊重和諧的生活態度，創造彼此共存共榮生生不息。」有機農業不僅提升生產附加價值，更具守護國人健康、安定社會的功能，還有為子孫留下美好的生態與家園的意義；而獲頒「綠色保育標章」的農友們，守護了白魚、穿山甲等保育物種，看到了永續農業發展的曙光。

環境永續論文

台灣消費者對於自然建築看法之初探-以四口之家為例

蔡依芸^[1] 江益璋^[2] *

摘 要 在氣候變遷全球倡議減碳的背景下，引起建築業強烈的關注，因為建築佔全球二氧化碳排放量將近 40%，為高碳排放產業，因此建築若能有效減碳，將有益減緩氣候變遷。自然建築具備減碳功能，為一種因應氣候變遷的解決方法，使用在地資源可降低運輸碳足跡，由自然植物纖維與礦物建構而成，植物生長過程中可固碳，礦物製程因能源消耗少故減碳，也具備功能性，如調濕隔熱等，不僅兼顧減碳與環境永續，同時協助消費者提升居住品質。又因減碳需從個人行動開始，本研究以台中花博四口之家為例，初探消費者對自然建築的看法，對於實踐自然建築生活的意願。本研究經半結構式訪談法，蒐集消費者體驗四口之家後對自然建築的看法，歸納整理後得知大部分台灣消費者經視覺體驗後認為自然建築很美，嚮往自然建築的生活。

關鍵詞：消費者、自然建築、美、減碳、半結構式訪談法。

A Study of Taiwanese Consumers' Views on Natural Building: Taking The Wheel as an Example

Yi-Yun Tsai^[1] Yi-Chang Chiang^[2] *

ABSTRACT In the context of the global carbon reduction initiative on climate change, it has aroused strong concern of the construction industry. Because buildings account for nearly 40% of the global carbon dioxide emissions, which is a high carbon emission industry. Therefore, if buildings can effectively reduce carbon, it will be beneficial to mitigate climate change. Natural Building has the function of carbon reduction, as a response to climate change solution, using in land resources can reduce carbon footprint, made from a natural plant fiber and mineral construction, in the process of plant growth can be carbon, mineral processing carbon reduction for less energy consumption, also has the functionality, such as wet and heat insulation, both carbon reduction and sustainable environment, also assist customers to improve the quality of living. Since carbon reduction needs to start from personal actions, this study takes the Taichung World Flora EXPO- The Wheel as an example to explore consumers' views on Natural Building and their willingness to practice the life of Natural Building. This study collected consumers' views on Natural Building through semi-structured interviews, and concluded that most Taiwanese consumers thought Natural Building was beautiful after visual experience and yearn for the life of natural architecture.

Key Words: Consumers, Natural Building, Beauty, Carbon Reduction, Semi-Structured Interviews.

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彰化孔廟白沙書院舊址再利用之永續發展評估

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摘 要 古蹟或歷史建築之保存，主要在於彰顯本身所具有的特色及傳遞歷史意涵，在歷史延續的過程中，無論舊建築是以何種方式保存或再利用形式呈現，都會影響它的保存歷史，或是改變與周圍環境的關係。本研究透過探討彰化孔廟原白沙書院舊址，所具有特殊場所精神之歷史性建築保存手法與地方社會發展關係，並採用聯合國永續發展指標，以經濟、社會、環境三個面向進行歷史空間再利用之永續發展評估，預期以經濟、社會、環境為基礎之再利用評估模式，延伸歷史性建築保存文化價值，並讓歷史性建築朝永續發展方向邁進。

關鍵詞：古蹟、歷史建築、場所精神、再利用、永續發展

Sustainable Development Evaluation of Old Site for the Baisha Academy of Confucius Temple in Changhua, Taiwan

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ABSTRACT The preservation of historical sites or historical buildings is mainly to highlight its own characteristics and convey historical implication. In the process of historical continuation, no matter how the old buildings are preserved or reused, it will affect its preservation history. Or change the relationship with the surrounding environment. This study explores the relationship between the preservation of historical architecture and the development of local society through the special place spirit of the former site of the Changsha Confucius Temple, and adopt the United Nations Sustainable Development Indicators to evaluate the sustainable development of historical space reuse with economic, social and environmental aspects. An economic, social, and environmentally based reuse assessment model is expected. Extending historic buildings preserves cultural values and allows historic buildings to move toward sustainable development.

KeyWords : *Historical sites, Historic building, Place spirit, Reuse, Sustainable development.*

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輔導觀光休閒漁場申請環境教育設施場所認證之要件分析

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摘要 台灣自 2011 年開始施行環境教育法，至 2018 年申請並通過認證的環境教育設施場所已有 183 處。其類型包含自然教育中心、國家公園、都會公園、風景區、遊樂區、觀光工廠、水資源單位、濕地、博物館、動物園、環保節能、文化資產、社區、休閒農場及水土保持等，但未有以漁業養殖的觀光休閒漁場申請環境教育設施場所，因此本研究將找出漁業養殖場通過環境教育之要件，作為未來相關設施通過之依據。研究方法包括進行負責人訪談及漁場的資源盤點，再以優勢、劣勢、機會及威脅（Strengths, Weaknesses, Opportunities and Threats, SWOT）分析法，找出觀光休閒漁場申請環境教育之利基，最後整理出觀光休閒漁場申請環境教育設施場所，在作業與經營管理上的建議，以利通過認證審查及永續經營之建議。

關鍵字：環境教育設施場所、環境教育學習中心、環境教育法

Requirement Factors for the Certification of Environmental Education Facilities in Tourism and Leisure Fisheries

Yung-tsung Chen [1] Yao-ming Hong [2] *

ABSTRACT Taiwan has implemented the Environmental Education Act since 2011, and 183 places obtained the certification of environmental education facilities until 2018. These places include nature education centers, national parks, metro parks, scenic areas, play areas, sightseeing factories, water resources units, wetlands, museums, zoos, environmental protection, energy conservation, cultural assets, communities, leisure farms, and soil and water conservation. However, no tourism and leisure fisheries places obtained the certification of environmental education facilities. This study identified the requirements for the environmental education certification of fishery farms as the basis for future facilities. The research methods included interviewing the responsible person and the resource inventory of the fishery, and then using the strengths, weaknesses, opportunities and threats (SWOT) analysis method to find out the niche for the environmental education certification of tourism and leisure fisheries. Finally, this study obtained the appropriate advice on the operation and management of the environmental education facilities, which will be useful for the certification review and sustainable management.

Keywords: environmental education facilities, environmental education learning center, environmental education law

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人工濕地空心菜(*Ipomoea aquatica*)碳吸存量 與不同營養鹽關係之初步研究

魏勇盛^{[1]*} 沈建全^[2] 蕭卜仁^[3]

摘 要 本研究乃在估算濕地植物在各種不同濃度營養鹽條件下水生植物的暫時碳吸存量差異，實驗場域位於屏東縣九如圳寮濕地，取自當地的植栽及土壤，並位於國立高雄科技大學大信樓之頂樓，進行實驗室規模之試驗研究。

實驗設計則是使用數個頂部開口式水桶，以五組不同水中營養鹽(硝酸鹽、亞硝酸鹽、磷酸鹽、氨氮)參數條件及量測土壤中有機質、有機碳之參數，從不同營養鹽條件參數中，計算蕹菜生長量及推估固碳量，藉由營養鹽條件參數與生長量等參數進行統計分析，並計算出營養鹽與植栽生長量之關係曲線，提供各界作為濕地保育及政府估算土地利用為濕地時碳吸收量、碳匯等之設計參考。

初步研究植栽的固碳量與生長量有顯著的相關性，而此部分亦與營養鹽之濃度約略成為正相關，並與氣候及溫度有相關性，研究顯示可藉由收割的方式將蕹菜所固得之碳移除，部分所固定之碳則以汙泥方式儲存於土壤中。

關鍵詞：濕地固碳、碳吸存量、營養鹽濃度、汙泥。

Preliminary study on the relationship between carbon sequestration at different nutrients by water spinach (*Ipomoea aquatica*) in constructed wetland.

Yung-Sheng Wei^{[1]*} Jian-Chuan Shern^[2] Pu-Jen Hsiao^[3]

ABSTRACT In this study, the difference of temporary carbon storing ability of water spinach under different conditions created by various concentrations of nutrients. This experiment was simulated in the laboratory to be the wetland-like condition to grow this plant. The soil and water spinach were shipped from Jiu-Ru Wetland in Pingtung County to use in this experiment and placed in the open square buckets. The experiment was conducted in an open space to allow the plant to reach sun-light and natural atmosphere. Nitrate, nitrite, phosphate, ammonia nitrogen in the water spinach samples were measured along the monitoring of organic matter and organic carbon in the soil. The result shows the good correlations between the carbon fixation, weather temperature and the growth of water spinach. While, the correlation between the nutrient concentration and the plant growth is relatively weak. This preliminary study suggests that the carbon fixation by water spinach through the uptaking of nutrients that are available in the wetland, and the carbon fixation ability can be also increased along the growth of water spinach. In addition, the carbon content in the wetland can be also removed easily by a harvesting of water spinach, while it will partly residues in the soil or sludge.

Key Words: wetland carbon sequestration, carbon sequestration, nutrient salt.

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透水鋪面入滲率量測之創新實驗

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摘要 氣候變化增加了全球極端暴雨的可能性，導致城市地區出現大規模洪水。透水鋪面可以提高城市地區路面的表面滲透率。傳統的滲透量測方法包括單環或雙環滲透儀測試以測量通過路面的局部滲透率。本研究建立了一項測量透水鋪面滲透的實驗。構建了六個含有各種透水鋪面，並附有儲水槽，並開發了一個人工降雨系統（Artificial Rainfall System, ARS）來模擬真實降雨。根據連續方程式，降水量等於鋪面的滲透量和地下水流動量，並採用 Horton 定律來描述滲透率，以及達西定律討論地下水流動。經由 Horton 試驗參數比較發現，ARS 之精度較雙環高，達西定律結果可反應地下材料透水性，而本研究發展之地表入滲率試驗，可以同時量測入滲及地下水流動率。

關鍵詞：氣候變遷，滲透鋪面，表面滲透率

A Novel Experiment Method for the Infiltration Rate Measurement of Permeable Pavement

Yao-Ming Hong^{[1]*} Ravi Shankar Kumar^[2]

ABSTRACT Climate change increases the probability of extreme precipitation around globe, which leads to large-scale flooding in urban areas. Implementation of Permeable Pavement Systems(PPS) can increase the Surface Infiltration Rate(SIR) of pavement in urban areas. Traditional infiltration measurement method including single ring or double ring infiltrometer test, measures the infiltration rate of water through a small limited section of the pavement surface. This study established a novel experiment to measure the SIR of PPS. Six Pavement cells containing various types of PPS attached with measuring tank were constructed. One Artificial Rainfall System(ARS) was developed to achieve the real scenario. Based on the continuity equation, the amount of precipitation is equal to infiltration plus runoff over the surface area of pavement cell. SIR is determined by the infiltration rate and the groundwater flow rate. Horton's law is adopted to describe the infiltration rate of PPS, and Darcy's law in the water flow under the ground. Parameters Comparison of Horton's law showed the ARS had better measurement accuracy than the double ring. Darcy's law reflected the material permeability. In conclusion, SIR measurement method can measure the infiltration rate and the groundwater flow rate in a same experiment.

Key Words: climate change, permeable pavement, surface infiltration rate.

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永續之水處理管理

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摘要 水為生命不可或缺之元素，佔地表 71% 的面積，然而，其中僅有約佔 3.5% 的湖水、河水及泉水，適合人類飲用及其他用途，可供吾人在生理及衛生上之需求。全球水體中只有 1% 可飲用，其餘 97.5% 水源都是海水，且因其鹽度過高而無法飲用。原水經過添加石灰、漂白粉和硫酸亞鐵之特殊處理程序後，處理過的水可供飲用。另一方面，逆滲透處理為利用薄膜的技術，用於淨化海洋中的水，不需要添加額外的化學物質。逆滲透技術主要用以去除入流水中的溶解固形物、顏色、有機污染物和硝酸鹽，此技術之成本低、節能，也產生藍色電流。只要有 1 平方公尺面積，且有 30% 的表面覆蓋納米端口，即可產生 1 兆瓦，供給五萬標準節能燈的電力。因此以逆滲透法處理，除可得到飲用水外，也產生藍色電流。目前全世界還沒有其他永續的方法可以在不需要陽光、渦輪機或化石燃料的情況下產生電流。因此逆滲透法為讓海水淡化獲取純淨水和產生電流的唯一途徑，同時成本比較低。

關鍵詞：淨化水，逆滲透水，海水淡化

Sustainable Water Treatment Management

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ABSTRACT Water, an essential element for life, makes up 71% of the planet's surface. Paradoxically, 3.5% of this water is suitable for human consumption and other use, to be found in lakes, rivers and springs to supply our physical and hygienic needs. Only 1% is available for drinking. The remaining 97.5%, located in seas and oceans, is not drinkable due to its high level of salinity. Raw water goes through a special method by dosing lime, bleaching powder and ferrous sulfate for treated water. On other hand Reverse Osmosis is a membrane-based method technology to purify water from oceans and no need extra chemical. Reverse Osmosis technology is employed to get rid of dissolved solids, color, organic contaminants, and nitrate from the feed stream. It is low costing, energy efficient also produce blue current. There is 1 square meter and with only 30% of its surface covered with Nano port we could reach 1 megawatts it's enough to run fifty thousand standard energy saving light. In this method we can get available drinkable water also producing blue current. There is no other sustainable method all over the world to produce current without sunlight, turbine, or fossil fuel. Water desalination is only way to get pure water and produce electric current both with low costing.

Key Words: Treated water, Reverse Osmosis water, Water desalination.

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後農村再生時代之區域亮點暨跨域整合發展-以桃園地區為例

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摘要 配合「農村再生 2.0」施行對區域性農村產業之亮點發展需要，調查、盤點地區性資源特色與發展潛力，選定營造主軸與區域，策劃營造重點。根據區域環境資源盤點、相關輔助計畫及活動節慶等資源套疊，歸納出範圍內資源，整合 107 年區域亮點計畫戀戀霄裡溪區域亮點之龍潭區，並擴充楊梅區，整合為 108 年綠農山海塘區域亮點計畫。透過訪談相關單位及參與農再組織，於桃園地區社區實地拜訪，瞭解社區需求，環境田野調查訪談並召開區域平台會議與居民參與式討論，透過路徑串聯達到跨區整合及發揮區域特色與效益。桃園市現有八個休閒農業區，且具有豐富山海景觀資源：觀音、新屋區有蓮花園、稻米文化、海客文化、藻礁生態等文化生態資源；楊梅、龍潭區有地景藝術、客家茶園、魯冰花節慶活動等相關資源。本規劃將分別以休閒農業區、農博及食農為主軸，並透過三大主題與市政府食農活動之結合。針對區域亮點發展之分區構想，提出以下三區主題：「山海漫遊區」、「海客花園區」、「浪漫客庄區」。並透過臺三線軸帶規劃串聯農再社區活絡周邊，運用文化、生態及產業旅遊核心策略做整體性規劃，進行相關產業經濟等基礎建設整備調查，以課題分析及因應策略，順勢扶植農村產業發展，藉由增能課程，以跨界學習、營運模擬、產業工藝、行銷推廣等主題，帶動小農、青農、導覽、休閒旅遊...等相關領域人才的在地創(就)業，辦理農村再生相關會議活動；期能促進人口回流、生態保護、產業升級及創新，達成區域共榮推產業。

關鍵詞：桃園地區、區域亮點、跨域整合

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Development Planning for Rural Zone in Taoyuan

ABSTRACT With the implementation of "Rural Regeneration 2.0", we need to investigate and inventory the characteristics and development potential of regional resources, select the main axis and region, and plan to create key points for the development of regional rural industries. According to the resources overlapping of regional environmental resources inventory, related auxiliary plans and festivals, the resources within the scope are summarized. The 107-year regional highlight plan is integrated into Longtan District, the highlight of Aixiaolixi District, and the Yangmei District is expanded into the 108-year Green Nongshan Seawall Regional Highlight Plan.

Through interviews with relevant units and participating in agricultural re-organization, on-site visits in Taoyuan District to understand the needs of the community, environmental field investigation interviews, and regional platform meetings and participatory discussions with residents, cross-regional integration and regional characteristics and benefits can be achieved through path series. Taoyuan City has eight leisure agricultural areas and rich mountain and sea landscape resources: Guanyin and Xinwu District have lotus garden, rice culture, seafarer culture, algae reef ecology and other cultural and ecological resources; Yangmei and Longtan District have landscape art, Hakka tea garden, Lubinghua Festival activities and other related resources.

The plan will focus on leisure agriculture, agriculture and food farmers, and combine the three themes with the food and agriculture activities of the municipal government. In view of the zoning concept of highlight development in this plan area, the following three zoning themes are proposed: Mountain and Sea Roaming Zone, Haik Garden Zone and Hakka Tea Village Zone. Through the Taiwanese third-line axle-belt planning, we will connect the surrounding areas of the rural areas, make overall planning with the core strategies of culture, ecology and industrial tourism, and carry out the investigation of infrastructure construction, such as related industrial economy. With subject analysis and corresponding strategies, we will foster the development of rural industries. Through the 100-hour energy-increasing course, we will focus on cross-border learning, operation simulation, industrial technology and marketing promotion. Title: Promoting small farmers, green farmers, tour guides, leisure tourism. Talents in related fields such as in-situ creation (employment), management of rural regeneration related conference activities 10 and publicity 10, and finally to promote population reflux, ecological protection, industrial upgrading and innovation, to achieve regional co-prosperity and promote products.

Keywords: Taoyuan, Agricultural Community, Hakka tea villages

以自然建材為主之高性能複層牆體設計與應用初探

鄧文濟^[1] 江益璋^{[2]*}

摘 要 氣候變遷持續影響環境，人類對建築性能的要求也隨著提高。台灣有高達 95% 的鋼筋混凝土建築構造，室內環境易受外部氣候影響，夏天悶熱、冬天濕冷，並不具備適氣候變遷功能。因此本研究初探高性能複層牆體設計與應用，讓建築適應氣候變遷的解決方案。本研究所指高性能牆體是指能夠提供居住者室內熱舒適兼顧友善環境。以自然建材為主之高性能複層牆體，著重在不影響室內空間使用的前提下進行設計與應用，透過複層的組合與善用自然建材的特性可設計出高性能複層牆體。本研究以中國文化大學綠色貨櫃模組為研究模型，該牆體系統由外飾板（遮風擋雨）、填充層（隔熱保暖）與內飾板（調濕淨氣）三大系統組成。透過和台灣一般住宅鋼構混凝土牆體進行比較後得出，善用天然泥土、木屑土等自然建材所構成之牆體，擁有更好的隔熱保暖性能和可促進環境達到永續。

關鍵詞：高性能牆體、複層牆體、自然建材、環境友善、氣候變遷。

Design and Application of High Performance Multi-layered Walls Based on Natural Building Materials

Wen-Ji Tang^[1] Yi-Chang Chiang^{[2]*}

ABSTRACT Climate change is continues affecting our life, the number of hot days will increase in the future and the requirements of occupants for the building performance are also increasing. There are up to 95% of reinforced concrete buildings in Taiwan. The indoor environment is easy affected by the external climate, it is hot in summer and cold in winter, so it does not have the function to face the climate change. Therefore, this study is to explore the design and application of high performance multi-layered walls to let building can adapt to climate change. The high performance walls in this study is refer to provide occupants indoor comfort and environmental friendly at the same time. The high performance multi-layered walls is focus on the use of natural building materials, and the design and application is without affecting the use of indoor space. It can be designed through multi-layered and the characteristics of natural building materials. In this study, the Green Box of Chinese Culture University is use as a research model. The multi-layered walls is consists three system which is exterior panel (wind and rain shield), filling layer (heat insulation) and interior panel (humidity control and air cleaning). By comparing with the reinforced concrete wall in Taiwan, the used of clay plaster and light clay on the multi-layered walls has better thermal insulation performance and more environmental friendly.

Key Words: High performance wall, Multi-layered walls, Natural building materials, Environmental friendly, Climate change.

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農村社區發展節水保水設施之效益：以雲林縣虎尾鎮北溪社區（剪紙藝術村）為例

梁大慶^[4] 江炳辛^[5] 李彩認^[6]

摘 要 依據行政院所研擬『黃金廊道農業新方案暨行動計畫』原則，以雲林嘉義之高鐵沿線以軌道中心左右各 1.5 公里範圍內，進行全面性的節水保水措施，增加土壤及地層保水，保障快速鐵路及周邊整體安全。農村社區發展節水保水，在日常生活、學習教育、觀光休閒三面向為主，整合各類型節水設施之設置方式，建立學習示範點，將設施單點延伸至線，推展至面，營造節水保水廊道及教學學習場域，建立未來節水保水學習場域推動模式。雲林縣虎尾鎮北溪社區在 2014 及 2015 年推展節水保水工作，更結合窳陋空間改善，提升社區環境品質，並加乘效益與成果。

本研究首先從農村保水節水發展之可行性及工作面向進入，瞭解農村社區進行保水節水設計規劃及施作，檢討其保水效益。透過上述方式分析困境與對策，並提出討論與建議，以提供其他社區發展節水節能經驗及自主營造之方向。

關鍵詞：節水保水、社區營造

The Benefits of Facility on Saving Water and water Conservation in Rural Communities : A Case Study of Beixi Community, Yunlin County

Ta-Ching,Liang^[1] Bing-Xin, Jiang^[2] Tsai-Ren, Li^[3]

ABSTRACT The promotion of low-carbon community and community industry is the important spirit in the rural regeneration. According to the principles of the "plan of action of the new agricultural program for gold corridor" based on the research by the Executive Yuan. In order to prevent the subsidence of the strata, ensure the overall safety of the rapid railway, and promote the concept of water saving and energy saving, we should lock the Taiwan High Speed Rail along the 1.5 kilometers of the center of the track to carry out comprehensive water conservation and water conservation measures. The implementation of the community concept of promoting water-saving water conservation, and facilities for single point extends to the linear space, build the future learning field to promote water-saving water conservation. BeiXi-community use employees purchase material in 2014 next to grandma house energy saving operation plan. Collecting the water head to the roof of the other bucket Jun, can irrigate next to the garden. Community re participation in the water saving and energy saving program in 2015, The learning experience of the water saving and energy saving plan is combined with the improvement of space to improve the quality of the community environment and add the planned benefits.

In practice, combined with case study in order to understand the water retention and water saving design planning, implementation process and benefit the community, hope that through the way to observe the dilemma and Countermeasures of water retention and water saving development in rural areas, and puts forward some discussion and suggestions, to provide the direction of community building on. Provide reference and use of water saving and energy saving in other communities.

Keywords: Water Saving and Water Conservation、Community-Building

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里山倡議於環境教育設施場所設立之可能性-以高雄美濃為例

吳宜螢^{[1]*} 徐筱倫^[2]

摘要 近年來，由於全球暖化、氣候變遷，加上對生物特性與環境之破壞、能源與糧食嚴重短缺，已經嚴重威脅人類及環境，為解決這些棘手之環境問題，政府於 2010 年實施環境教育法後，較有環境意識的地方開始申請設立環境教育設施場所，提供民眾與學生透過課程、實際體驗等相關活動來了解當地特色資源、動植物等特色，進而引發願意保護環境資源的使命感。本研究觀察到高雄美濃地區因本身保有豐富的客家文化，使得美濃地區不同於各縣市的環境利用模式，不願意重度開發造成環境資源的破壞，美濃部份人士也開始試圖參考日本里山倡議架構，使美濃資源得以永續利用。本研究發現里山概念有很多都是與環境教育的理念相符合的，因此，本研究以質性研究方法，進行田野調查以及深度訪談。以三角驗證法論證本研究之確實性，並藉由美濃環境分析，找出可以發展為環境教育的資源。其次，分析里山及環境教育的共通性，進而探討美濃里山環境教育設施場所設立之可能性。

關鍵詞：美濃、里山倡議、環境教育、三角驗證。

The Possibility of Lishan's Initiative to Establish Environmental Education Facilities - A Case Study of Kaohsiung Mino

Yi-Ying Wu^{[1]*} Xiao-Lun Xu^[2]

ABSTRACT In recent years, due to global warming, climate change, damage to biological characteristics and environment, and severe shortage of energy and food, it has seriously threatened humans and the environment. To solve these difficult environmental problems, the government implemented the Environmental Education Act in 2010. More environmentally conscious places began to apply for the establishment of environmental education facilities, providing people and students through the curriculum, practical experience and other related activities to understand the characteristics of local resources, animals and plants, and thus the willingness to protect the environmental resources. This study observed that the Kaohsiung Meinong region has a rich Hakka culture, which makes the Meinong region different from the environmental utilization patterns of various counties and cities, and is reluctant to seriously develop and cause damage to environmental resources. Some people in Meinong also began to try to the Japan Lishan Initiative Framework. To make the use of Mino resources sustainable. This study found that many of the concepts of Lishan are consistent with the concept of environmental education. Therefore, this study conducts field investigations and in-depth interviews using qualitative research methods. The validity of this study is demonstrated by the triangle verification method, and the resources that can be developed into environmental education are identified through the analysis of the environment of Mino. Secondly, it analyzes the commonality of Lishan and environmental education, and then explores the possibility of setting up environmental education facilities in Mino.

Key Words: Mino, Lishan Initiative, Environmental Education, Triangulation

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透水鋪面入滲率量測之研究

洪耀明^{[1]*} 陳清煥^[2] Ravi Shankar Kumar^[2]

摘要 透水鋪面因為表層設計及底層材料變化，而導致入滲率不同。本研究利用南華大學透水鋪面試驗場進行入滲濾量測試，試驗設備包括 ASTM C1701 規範之單筒試驗及 ASTM D3385 雙筒試驗，試驗鋪面包括碎石、JW 路面(JWR)、JW 停車鋪面(JWP)、植草磚、水泥連鎖磚五種透水鋪面，並以設計水泥連鎖磚底層材料分別為碎石(PICP-G)及碎石混合土壤(PICP-S)之試驗。表面滲透率量測設備比較結果，單筒試驗滲透率較雙筒試驗為大，係因為單筒試驗滲透至地下的水會往外側擴散，造成量測結果過大；鋪面透水性比較結果，由大至小分別為碎石、JWR、JWP、植草磚及水泥連鎖磚；底層材料影響結果，PICP-G 透水性大於 PICP-S，研究結果可作為設計者使用。

關鍵詞：透水鋪面、入滲率、單筒試驗、雙筒試驗

Measurement of Infiltration Rate for Permeable Pavement

Yao-Ming Hong ^{[1]*} Qing-huan Chen^[2] Ravi Shankar Kumar^[2]

ABSTRACT Permeable pavement has different water infiltration rate due to surface design and changes in the underlying material. This study used the Nanhua University permeable pavement test site to carry out the infiltration rate test. Test equipment includes the single ring test based on American Society for Testing and Materials ASTM (C1701) and double ring test (ASTM D3385). Test pavement includes five kinds of pavements, which are gravel, JW pavement (JWR) and JW parking pavement (JWP), Concrete Grid Pavements (CGP), Permeable interlocking concrete pavement (PICP). PICP also set up to two kinds of underlying material, including gravel (PICP-G) and gravel mixed soil (PICP-S), so as to obtain the influence of underlying material on the infiltration rate. Experimental results shows that the permeability of the single ring test is larger than that of the double ring test. Water that penetrates into the ground by the single ring test will spread to the outside, causing the measurement result to be too large. Infiltration rates from big to small are gravel>JWR> JWP>CGP>PICP. Bottom material impact results is permeability of PICP-G is greater than PICP-S.

Key Words: permeable pavement, infiltration rate, single ring test, double ring test.

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動物醫療服務之永續發展研究

鍾明志^{[1]*}

摘 要 本研究探討動物醫院服務影響顧客滿意度永續發展之重要因素，首先分別進行有關動物醫院專業度、態度與顧客滿意度之文獻回顧，以建立動物醫院服務永續發展之重要因素的主要樣貌，再透過研究架構分析，發展二個主要之研究假設；並以在台南市，有寵物或曾帶寵物至醫生處求治之民眾為研究對象，樣本資料分析前先執行一問卷調查，接著透過迴歸分析法，分析受訪者樣本資料，最後，本研究結果將可找出一些有趣之管理意涵，並對未來永續發展的方向，提供一些有用之建議。

關鍵詞：動物醫院、專業性、問卷調查。

The Research of Sustainable Development of Veterinary Hospital Service

Ming-Chih Chung^{[1]*}

ABSTRACT This study discovered the critical factors of veterinary hospital service affecting customer satisfaction for the sustainable development. Firstly, the literature review about veterinary hospital expertise, attitude and customer satisfaction was separately conducted to develop the main picture of critical factors of veterinary hospital service for the sustainable development. Through the research structure analysis, two main research hypotheses were developed. People who have pets or once take the pets to the doctors for help in Tainan City were the research objects. Before the data analysis, the questionnaire survey was conducted. Then the sample data was analyzed using the regression analysis. In the end, the research results would find out the interesting managerial implications, and reveal the reasonable suggestions for sustainable development direction in the future.

Key Words: veterinary hospital, expertise, questionnaire survey.

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水土保持論文

整合無限邊坡與滲流之深層崩塌理論之實驗驗證

顏浚丞^{[1]*} 洪耀明^[2]

摘 要 無限邊坡理論常用來推算崩塌地破壞，而滲流則用來推算邊坡土壤流失導致之破壞，洪耀明(2018)建立整合無限邊坡理論及滲流之深層崩塌破壞理論。本研究透過試驗，計算深層崩塌破壞理論參數，首先透過三軸壓力試驗，計算無限邊坡理論參數，同時以達西定律之滲透係數試驗，計算滲透係數，並設計一假設邊坡，說明參數如何帶入深層崩塌破壞理論，以推算發生崩塌之地下水位及滲流長度，提供相關實務應用之參考。

關鍵詞：無限邊坡、滲流、深層崩塌

Experimental verification for a deep landslide theory of integrating infinite slope and seepage

Yen Chun Cheng^{[1]*} Anil Kumar^[2] Yao Ming Hong^[2]

ABSTRACT Infinite slope theory is often used to estimate landslide, while seepage is used to estimate the damage caused by slope soil loss. Hong Yao-ming (2018) established a landslide theory which integrated infinite slope and seepage. In this study, the theoretical parameters of deep landslide are calculated through experiments. Firstly, the theoretical parameters of the infinite slope are calculated through the triaxial pressure test. At the same time, the permeability coefficient of Darcy's law is used to calculate the permeability coefficient, and a hypothetical slope is designed to explain the parameters usage. The theory of deep landslide can estimate the groundwater level and seepage length of the landslide, and provide a reference for relevant practical applications.

Key Words: infinite

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應用草類於山坡地土壤沖蝕防治之研究

洪耀明^{[1]*} 林正昌^[2]

摘 要 山坡地土壤容易因為降雨導致土壤沖蝕，而草類具備生長快速、養護容易之優點，且能防止土壤沖蝕保護水土資源，本研究選定五種容易栽種之草類，包括大燕、白茅、咸豐草、五節芒、甜根草，並設計透明植生箱種植，選取影響土壤沖蝕因子，包括草種之根長、根寬、根種、株高、株種、遮蓋面積，提出合適坡地水土保持之草種。

關鍵字：土壤沖蝕、草種、山坡地

Using Grasses on the Soil Erosion Control of Hillside Lands

Yao-Ming Hong^{[1]*} Zheng-chang Lin^[2]

ABSTRACT Rainfall usually induced the soil erosion on the hillslope. Grass has the advantages of rapid growth and easy maintenance, and can prevent soil erosion and protect water and soil resources. Five kinds of easy-to-plant grass, including 大燕、白茅、咸豐草、五節芒、甜根草 are selected in this study. Transparent plant box was designed to plant grass. Main influence factors of soil erosion, including root length, root width, root species, plant height, plant species and cover area of each grass species, will be compared to find the propose grass species suitable for soil and water conservation on slope land.

Key Words: Soil Erosion, Grass, Hillslope

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台北市上游水文觀測即時系統建立之研究

洪耀明^{[1]*} 陳建丞^[2]

摘 要 集水區上游水文觀測資料，可應用於下游水文量體預測及早期洪水預報之用，本研究以台北市上游山坡地為例，建立集水區降雨、水位及水量觀測系統。首先於河道已設置量水堰之處，設置水位計，並利用嵌入式系統，做資料之即時儲存，透過太陽能供電，再以無線網路將資料回傳至基地台，於基地台設置資料庫進行資料即時儲存，並與現有台北市雨量站進行資料整合，撰寫展示介面，提供即時展示功能。本即時系統建立後，提供雨量、水位及流量之即時及歷史資訊，透過使用者介面，讓使用者可以做資料之查詢、下載，並預期未來作為大數據分析之用。

關鍵詞：水文觀測、即時傳輸、大數據分析。

Establishment of Real-Time Monitoring System of Hydrological Observation in the Upper Stream of Taipei City

Hong Yuming^{[1]*} Chen,Chine-Cheng^[2]

ABSTRACT The upstream hydrological observation data can be applied to the downstream water level prediction and early flood forecasting. This study established a rainfall, water level and water quantity observation system in the upstream watershed of Taipei City. First, the water level gauge was set up in the river channel, and the embedded system was used to store the observation data, which will transport to the base station via the wireless network. The solar energy was used to supply the power energy. The database system was set up in the base station, so as to store the data and integrate with the existing Rainfall Station in Taipei City. A Graphic User Interface (GUI) was created to display instant data. After the establishment of the real-time system, the real-time and historical information such as rainfall, water level and discharge can be obtained. Through the user interface, users can query/download data and anticipate future use as big data analysis.

Key Words: Hydrological observation, Instant transmission, Big data analysis.

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台灣中部地區地下水觀測井回填濾料設計

洪耀明^{[1]*} 陳茂誠^[2] Amit Kumar Sah^[2]

摘 要 本研究收集台灣中部不同類型土壤，進行地下水監測井設計回填濾料設計。首先收集台灣中部至少 10 處之表層土壤，計算土壤粒徑 d_{10} 、 d_{60} 及 d_{90} 。再透過 Hong (2012) 之濾料設計方法，推算濾料粒徑 D_{15} ，並以線性假設，推算濾料 D_0 和 D_{100} 。然後進行壓密試驗，推算最大乾密度，以模擬土壤受壓之情況，隨後以無沖蝕濾料試驗，以高壓測試測試過濾料管湧情況。測試的結果據以修正過濾料設計，預計提供台灣中部地區不同類型土壤之濾料設計依據。

關鍵詞：回填濾料、無沖蝕濾料、管湧

Filtering Material Design of Groundwater Monitoring Wells in the west of Taiwan

Hong Yao-Ming^{[1]*} Chen Mao-Cheng^[2] Amit Kumar Sah^[2]

ABSTRACT This study designed the backfill filter for groundwater monitoring well (GMW) under the different types of soil from the middle area of Taiwan. Firstly, 10 soil samples were collected, and the grain size of soil sample d_{10} , d_{60} , d_{90} were calculated. The distribution range of filter grain size D_{15} is initially estimated based on the typical design criteria. D_0 and D_{100} can be obtained by linearity assumption. The design method of backfill filter is then tested by a practical example. The first test will be the proctor compaction test, which will be used to simulate the pressure condition of base soil under the ground. The second test is the no erosion filter test, which is adopted to deploy filter grains to prevent piping when the high groundwater pressure applies on the crack. And results of these test can be referred for backfilling filters design method into the groundwater monitoring well. The validation and appropriate upper and lower limits of D_{15} will be observed. Outcome can also supply the design criteria for the various soil types in the middle area of Taiwan.

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透水鋪面試驗場域施作

吳旻芳^[1] 洪耀明^{[2]*}

摘 要 透水鋪面透過入滲降低積水及地表逕流，可減少因暴雨帶來之洪水量。本研究施作透水鋪面之標準試驗場地，以混凝土建置所有尺寸及間隔，設置水龍頭等設施，以達到容易量測透水率為目的；首先設置雨量計及六種鋪面，每個鋪面面積為長 3.5M×寬 2M，鋪面厚度依鋪面材質介於 5 至 15cm，鋪面下方設計 40cm 之碎石級配或土壤來儲蓄入滲水體，為使所有降雨能夠進行量測，於鋪面中央設置圓管以觀測地下水位，並於下方設置水龍頭，以計算地下水體積，鋪面則以 3% 之坡度，讓地表逕流流至外側之蓄水池，透過量測蓄水池水量，以計算超滲降雨量。

關鍵詞：透水鋪面、超滲降雨、透水率

Construction of Experimental Field for Permeable Pavement

Min-fang Wu^[1] Yao-Ming Hong^{[2]*}

ABSTRACT The permeable pavement reduces infiltration and surface runoff through infiltration so as to decrease the amount of flood caused by heavy rain. This study constructed a standard test site for permeable pavement using concrete on the construction of all facilities including the interval, faucets and other elements, so as to achieve easy measurement of water permeability. Firstly, a rain gauge and six pavement cells are set up, each paving area is long. 3.5M×width 2M, the thickness of the pavement is between 5 and 15cm depending on the paving material. 40cm of gravel grading or soil is designed to deposit into the seepage body below the pavement. A circular tube is arranged in the center of the pavement to measure the groundwater level, and a tap is installed in the bottom of cell to calculate the groundwater volume. Surface water in the pavement flows to the outer reservoir at a slope of 3%. Rainfall excess was calculated by measuring the water volume of the reservoir.

Key Words: permeable pavement, rainfall excess, permeability.

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利用滲流侵蝕和無限斜坡法確定滑坡臨界地下水位

洪耀明^{[1]*} Atul Kumar^[2]

摘 要 地下水滲漏往往導致災難性的邊坡破壞。河岸，運河和水庫堤壩和山坡象徵著觀察到滲漏侵蝕的情況。在土壤侵蝕研究和與穀物顆粒運輸相關的研究中，細顆粒的分離和動員是重要的考慮因素。通過孔隙水流動引起的物理和化學效應可以分離細粘土顆粒。化學作用包括通過增加顆粒 - 顆粒排斥力將粘土顆粒粘合到砂粒上的粘合劑溶解和顆粒分散。本文描述了地下水位的上升將降低土壤濃度，增加相互平行的滲流侵蝕和滑坡的破壞。在本文中，使用理論研究探討臨界剪切應力（ τ_c 值）和內聚力（ C ）之間的關係。該研究還考慮了地表附近風化和孔隙度對土壤摩擦角變化的影響。安全係數被概念化為深度的函數。在沙質和粉質土壤上進行邊坡穩定性分析。研究了土壤樣品特徵的深入研究，併計算了一些重要數據和信息，如從監測壓實實驗中獲得的最大干密度，使用篩分分析的粒度分佈，使用常數求得的滲透率常數值（ K 值）頭和落頭的方法。這些分析表明，對於沙質和粉質土壤的坡面，在穩定入滲條件下，地下水位以上都會發生破壞，這與經典無限斜率理論無法預測的一些野外觀測結果一致。

關鍵詞： 篩分分析，監測壓實試驗，滲透係數（ k ）和直剪試驗。

Using the Seepage Erosion and Infinite Slope Method on the Critical Groundwater Level Estimation of Landslide

Yao-Ming Hong ^{[1]*} Atul Kumar^[2]

ABSTRACT Ground water seepage has often leads to catastrophic slope failure. River bank, canal and reservoir embankment and hill slope symbolizes situation where seepage erosion has been observed. Detachment and mobilization of fine particles are important considerations both in soil erosion studies and in studies related to transportation of grain particles. Detachment of fine clay particles is possible both by physical and chemical effects induced through pore-water flow. The chemical effects include dissolution of the cementing agents that bind clay particles to sand grains and dispersion of particles by increasing particle-particle repulsive forces. The present paper describes the rising of groundwater level will reduce the soil concentration and raise the damage of seepage erosion and landslide which occur parallel to each other. In this paper, the relationship between critical shear stress (τ_c value) and cohesion (C) is explored using theoretical investigations. The study also considers the effect of weathering and porosity near the ground surface on changes in the friction angle of the soil. The factor of safety is conceptualized as a function of depth. Slope stability analysis is done on sandy and silty soil. A deep study on the characteristic of soil sample is studied along with calculating some important data and information like, the maximum dry density obtained from the proctor compaction experiment, particles size distribution classified using sieve analysis, permeability constant values (K values) found using constant head and falling head method. These analyses indicate that for hillslopes of both sandy and silty soils, failure can occur above the water table under steady infiltration conditions, which is consistent with some field observations that cannot be predicted by the classical infinite slope theory.

Key Words: Sieve analysis, proctor compaction test, coefficient of permeability(k) and Direct shear test.

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應用有限元素法及室內實驗於深層崩塌之模擬

洪耀明^[1] 魏 韋^[2]

摘 要 本研究應用室內實驗及數值方法模擬深層崩塌，首先發展基於無限邊坡理論及達西定律知有限元素法，再由室內實驗推得控制方程式之相關物理參數如凝聚力、內摩擦角及滲透係數，並以砂箱進行小尺度之崩塌試驗，並紀錄了崩塌過程之位移、孔隙水壓增加及土壓力降低數據，實驗數據並用來修正數值模式，修正之數值模式，將可提供實際現場應用。

關鍵詞：深層崩塌、孔隙水壓、數值方法。

Using Finite Element Method and Laboratory Experiment on the Deep Seated Landslide Modelling

Yao-Ming Hong^[1] Vivek Kumar^[2]

ABSTRACT This study simulated a deep seated landslide by laboratory experiment and numerical model. A finite element method based on Infinite Slope theory and Darcy's law was developed. Physical parameters, including cohesion force, internal friction angle, and permeable coefficient using in the government equations of numerical model were also obtained by laboratory experiment. A sand box was setup to create a small scale of landslide. The process related to the landslide movement, the increase in pore-water pressure and the decrease of soil pressure during failure were recorded. Outcome of landslide experiment were used to calibrate the numerical methods for the future application in the field case.

Key Words: Deep seated landslide, pore-water pressure, numerical method.

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地下水監測井各種土壤類型的回填土

洪耀明^{[1]*} 阿密特^[2]

摘要 本研究建立地下水觀測井回填濾料粒徑分佈，濾料主要用途為防止基礎土壤中之粉粒及黏粒沖蝕，也就是說濾料組成決定於基礎土壤中粉粒及黏粒之比例。因此，本研究製備了6種土壤樣品，分別為10%，20%，30%，50%，70%和90%的土壤通過#200篩。回填過濾料的粒徑分佈設計依循Hong et. al.(2011)之設計。隨後進行Proctor壓實試驗，用於模擬地下基礎土壤的壓力條件，以找到最佳含水量。然後通過無沖蝕濾料試驗，並施加高地下水壓力以測試回填濾料設計。試驗的結果據以修正地下水監測井之回填濾料設計，並找出適用於各類土壤之小於或等於15%回填濾料的下限和上限。

關鍵詞：地下水觀測井、無沖蝕濾料試驗、回填濾料

Backfill Filter of Various Soil Types for Groundwater Monitoring Well

Yao-Ming Hong^{[1]*} Amit Kumar Sah^[2]

ABSTRACT This study established the grain size distribution of backfill filter for groundwater monitoring well. Backfill filter is used to prevent the erosion of base soil such as silt and clay. i.e. Formation of backfill filter is determined by the ratio of silt and clay within base soil. Therefore, 6 types of soil sample were prepared with percentage of 10%, 20%, 30%, 50%, 70% and 90% of soil passing through the #200 sieve. Grain size distribution of Backfill filter can be obtained by Hong et. al. (2011). Proctor compaction test, which was used to simulate the pressure condition of base soil under the ground was executed to find Optimum moisture content (OMC). The design method of backfill filter is then tested by No Erosion Filter Test (NEFT), which is adopted to deploy filter grains to prevent piping when the high groundwater pressure applies on the crack. Results of these test can be referred for backfilling filters design method into the groundwater monitoring well and to find the lower and upper limit of D15 (diameter smaller than 15% filter grain size) on various soil type.

Key Words: groundwater monitoring well, no erosion filter test, backfill filter.

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再生資源與應用論文

再生骨材對混凝土抗壓強度和滲透性的影響

陳美如^{[1]*} 克里山^[2] 洪耀明^[3]

摘 要 建築和拆除廢棄物可應用於混凝土，以降低骨材成本，減少其碳足跡，以有利於環境永續。本文分析以矽粉和天然纖維混合的再生膠結混凝土之以抗壓強度和滲透性。根據水灰比、混合設計和用再生骨材之比例，製作 24 個樣品。試驗結果顯示，隨著再生骨材替代率越高，抗壓強度越小但混凝土滲透性增加。但隨著再生骨材增加，混凝土滲透性增加，但當在 RAC 中混合超塑化劑時，抗壓強度提高，而滲透性隨著塑化劑填充界面過渡區而減小。

關鍵詞：再生骨料、抗壓強度、滲透性。

Effect of recycled aggregate on compressive strength and permeability of concrete

Mei Ru Chen ^{[1]*} Krishan Pareek ^[2] Yao Ming Hong ^[2]

ABSTRACT Construction and Demolition waste can be applied to concrete to reduce the cost of aggregates and reduce their carbon footprint to contribute to environmental sustainability. This study analysed the compressive strength and permeability of Recycled Aggregate Concrete (RAC), which is a mixture of silica fume and natural fiber. 24 samples were made according to the water-cement ratio, the mixed design, and the ratio of the recycled aggregate. This study found that a high ratio of the recycled aggregate will induce a small compressive strength and a high permeability. The superplasticizer can increase the compressive strength. The increase of recycled aggregate will increase the concrete permeability. If superplasticizer is mixed into the RAC, the plasticizer will fill the Interfacial Transition Zone, which will increase the compressive strength and decrease the permeability.

Key Words: Recycled aggregate, compressive strength, permeability.

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馬祖地區海水淡化廠系統適性之評估

李繼源^[1] 洪耀明^[2]

摘 要 氣候變遷導致馬祖地區2006迄2018年，湖庫水供水量減少170%，導致海水淡化水量需求增加，本研究以馬祖地區海水淡化廠為例，以效益評估方法提出海水淡化系統建議配置，成本包括設置成本及操作成本，設置成本包括取水工、前處理設備、逆滲透機組；操作成本包括2017及2018年之濾材耗損、維修費及電費，並導入季節差異因子，以產水效率為效益，收集兩種不同之海水淡化系統超微濾(Ultra Filter, UF)前處理搭配柱塞式高壓泵RO系統，產水單價成本為每公噸27.1元，砂濾(Sand Filter, SF)前處理搭配離心式高壓泵RO系統，產水單價成本為每公噸29.8元。

關鍵字:海水淡化、逆滲透、超微濾

Evaluation of System Suitability of Seawater Desalination Plant in Mazu Area

Chi-Yuan Li^[1] Yao-Ming Hong^[2]

ABSTRACT Climate change induced that water supply by reservoir reduced to 170 %, from 2006 to 2018 in the Mazu area, and increases the desalination water requirement. In this study, the desalination plant in Mazu area is taken as an example to evaluate the proposed seawater desalination system by the benefit evaluation method. The cost includes installation cost and operation cost. The installation cost includes water intake, pre-treatment equipment and reverse osmosis (RO) unit. The operation cost includes the filter material consumption, maintenance fee and electricity fee in 2017 and 2018. Seasonal difference factor is also discussed. Benefits is based on water production efficiency. Data of two different seawater desalination systems were collected. Production unit price for Ultra-filter (UF) pre-treatment with plunger high pressure pump RO system is NT. 27.1 per ton. Sand filter (SF) pretreatment with centrifugal high pressure pump RO is NT. 29.8per ton.

Key Words: seawater desalination, Reverse Osmosis(RO), Ultra filter(UF)

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混合天然纖維及回收骨材鋪面之透水性及抗壓強度量測

克里山^[1] 洪耀明^{[2]*}

摘 要 氣候變化和淡水稀少是人類的生存威脅，需要長期應對。滲透路面是解決這兩個主要問題的方法之一。滲透性路面通過地表將雨水吸收到地下，並緩慢地將其送到如滯洪池等洪水傳輸工具。建築和拆除材料如再生骨料已被證實可用於路面系統之過濾材料。本研究進行一系列實驗室試驗，以評估應用中拆建物料的透水性路面之大地工程及水力特性。包括以定水頭試驗以了解 C&D 材料的滲透能力。就透水性路面過濾層而言，添加自然纖維的 C&D 材料的大地和水力性質優於礫石材料。

關鍵詞：建築與拆除（C&D），再生骨料，外加劑。

Measurement of Compressive Strength and Infiltration Rate on the Permeable Pavement with the material pf Natural Fiber and Recycled aggregate

Krishan Pareek^[1] Yao-Ming Hong^{[2]*}

ABSTRACT Climate change and freshwater scarcity are threats to humankind survival which needs a long term response. Permeable pavement is one of solutions to these two major issues. Permeable pavements absorbed stormwater to underground through surface and slowly transport it to stormwater conveyance like detention pond. Construction and demolition materials (C&D) like recycled aggregate had been proved their suitability as filter materials in pavement systems. This study commenced a series of laboratory experiment to assess the geotechnical and hydraulic characteristics of the C&D materials in permeable pavement applications. Constant head permeability tests were carried out to examine the stormwater filtration capacity of C&D materials. In terms of usage in permeable pavement filter layer, C&D materials were found to have geotechnical and hydraulic properties superior to that of typical quarry granular materials with the use of different percentage of natural admixtures.

Key Words: Construction & demolished (C&D), Recycled Aggregate, Admixtures.

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再生材料及超塑化劑在透水路面施工中的應用

洪耀明^{[1]*} Anil kumar sah^[2]

摘要 透水混凝土是水和空氣通過的混凝土。透水性混凝土由少量或零質的細骨料組成，其產生 10-25% 的空隙以便於水的排出，考慮到其良好的抗壓強度性能的優異特性，儘管互連空隙增加，多孔互鎖塊構造在類似的時尚的傳統方法，主要目標是獲得足夠的孔隙率和良好的抗彎強度。細骨料粉末的變化百分比為 0%，5% 和 10%。本研究中使用少量的超級增塑劑。該研究發現，滲透性路面的雨水管理和環境效益是無可辯駁的，它們清楚地反映了低影響開發（LID）的原理。測試所獲得的變化用於壓縮和磨損測試。保持樣品在室溫下固化。

關鍵詞：透水聯鎖，抗壓強度，粗骨料吸水試驗，彎曲強度和滲透率。

Application of Recycled material and Super Plasticizer on the construction of Pervious Pavement

Yao-Ming Hong^{[1]*} Anil kumar sah^[2]

ABSTRACT Pervious concrete is concrete in which water and air pass through it. pervious concrete consists on little or nil fine aggregates, which create voids 10-25 % to allow the ease drain of water, considering its exceptional characteristics in terms of good compression strength performance in spite of elevated interconnected voids porous interlock blocks is constructed in a similar fashion to traditional method, the primary goal is to obtain the adequate porosity with the good flexural strength. The fine aggregate powder is varying percentage is 0%, 5% and 10% A small amount of super plasticizer is used in this investigation. The study found that the storm water management and environmental benefits of permeable pavements are irrefutable and they clearly reflect the principals of low impact development (LID). The obtained variations is been tested for compression and abrasion test. the samples are kept for curing at room temperature.

Key Words: Pervious interlocks, Compression Strength, Water absorption test for coarse aggregate, Flexural Strength and Infiltration rate.

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創新結構型儲氫牆技術發展之研究

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摘 要 近年綠色能源技術為全球開發的重點。其中燃料電池系統將是未來主要電力來源之一。本研究以創新結構型儲氫牆技術發展之研究，運用於綠能屋研究探討，製作出低成本高強度的二次結構氫能牆。探討陶瓷與鋁瓶結合之強度性質與特性分析，有助導入綠能屋結構材料牆面設計優勢。改善傳統燃料電池元件-儲氫瓶輕量化設計、低成本及整合性的問題，針對加工製造技術，解決氫氣瓶穩定與安全性之優勢有重大貢獻。本研究感謝感謝科技部(MOST107-2221-E451-001)的支持，並榮獲第九屆 IIIC 國際創新發明競賽銀牌獎。

關鍵詞：二次結構氫能牆、儲氫瓶、回收陶瓷、陶瓷非燒結技術、銲接技術、抗腐蝕技術。

Research on the Development of Innovative Structural Hydrogen Storage Wall Technology

SHINN-DAR WU^{[1]*} TIAN-RONG LAI^[2] YU-LIN YANG^[3] YEA-CHYI LIN^[4]

ABSTRACT In recent years, green energy technology is the focus of global development. Wherein the fuel cell system will be one of the main sources of electricity green energy future, including high-strength hydrogen storage bottle design is one of the important components. This study research and development used in green house hydrogen storage bottle research, and according to the maximum volume and internal pressure changes, the production of low-cost, high-strength hydrogen storage cylinders. Improve the traditional fuel cell components of the hydrogen storage bottle lightweight design, low cost and integration issues, aimed at processing technology, manufacturing technology, to solve the hydrogen bottle stability and safety of the advantages are significant contributions. Thank partially supported by the Ministry of Science and Technology, Taiwan, R.O.C. under Grant no.MOST107-2221-E451-001. And silver medal of the Ninth International Innovation and Invention Competition.

Key Words: Secondary structure hydrogen energy wall, Hydrogen storage bottle, Recycling ceramics, Non-sintered ceramic technology, Welding Technology, Anti-corrosion technology.

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多孔矽複層結構應用於提升矽基太陽能電池之光吸收效率

吳坤憲^{[1]*} 鄭傑安^[2] 姜君瑋^[2]

摘 要 藉由在陽極化過程中連續調整電化學蝕刻參數的方法，已成功地在單晶矽晶圓上製作出具不同孔隙率之三層堆疊的多孔矽複層結構，由於所製成之各層多孔矽具有不同的光學能隙大小，所以可以建構出一個類似“串接電池”之多能隙結構。以三疊層多孔矽結構為基礎所製成之光伏元件具有更匹配於太陽光譜之寬頻帶光響應特性，而且在照光下可以取得相當高的光電流。元件之光響應頻譜的改善可歸因於三疊層多孔矽的多能隙結構，這種類似串接電池的疊層組織可以吸收較大能量範圍的太陽光；而元件光電流的提升則是因為表層奈米多孔矽薄膜可增加對短波長光的吸收並且改善電極的蕭特基接觸。實驗結果顯示，經由電化學蝕刻技術所製作的多孔矽多能隙複層結構具有應用於開發高效率矽基太陽能電池的潛力。

關鍵詞： 多孔矽、複層、多能隙、光伏元件、太陽能電池。

Enhancement of the Light Absorption Efficiency of Si-based Solar Cells with Multiple-Layer Structures of Porous Silicon

Kuen-Hsien Wu^{[1]*} Chieh-An Cheng^[2] Jun-wei Jiang^[2]

ABSTRACT Porous-silicon (PS) multi-layered structures with three stacked PS layers of different porosity were prepared on silicon (Si) substrates by successively tuning the electrochemical-etching parameters in an anodization process. The PS layers in the triple-layered PS (TLPS) have different optical bandgap energy and construct a “tandem-cell” like structure with multiple bandgap energy. Photovoltaic devices based on the TLPS exhibit broadband photoresponses that are more matching to the spectrum of the solar irradiation and obtain high photocurrent under light irradiation. The improved performances of devices are owing to the multi-bandgap structures of TLPS, which are designed with a layered configuration analog to a tandem cell for absorbing a wider energy range of the incident light. The large photocurrent is mainly ascribed to an enhanced light-absorption ability as a result of applying nanoporous-Si thin films as the surface layers to absorb the short-wavelength light and to improve the Schottky contacts of devices. Experimental results reveal that the multi-bandgap PS structures produced from electrochemical-etching of Si wafers are potentially promising for development of highly efficient Si-based solar cells.

Key Words: porous silicon, multi-layer, multiple bandgap energy, photovoltaic device, solar cell.

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再生材料於透水路面建構

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摘 要 透水混凝土通常混合砂石以產生 10%~25%的空隙以便於地表水的排出，降低路面積水。本研究希望能建立孔隙率和良好的抗壓強度之透水混凝土比例。首先，細沙石的變化百分比為 0%，5%和 10%，其次加入增塑劑以增加混凝土膠結力，並經過標準養護程序之後，量測其孔隙率和良好的抗壓強度。預計找出細沙石之最佳含量比率，建立達到合乎要求之抗壓強度及透水率之最佳透水混凝土。

關鍵詞：透水混凝土、抗壓強度、透水率

Application of Recycled material on the Construction of Pervious Pavement

Wei Lin Chen ^{[1]*} Anil Kumar ^[2] Yao Ming Hong ^[2]

ABSTRACT Pervious concrete is usually mixed with sand to create a 10% to 25% porosity to discharge the surface water and reduce the road area water. This study established a ratio of permeable concrete with suitable porosity/compressive strength. First, the percent change in fine sand is 0%, 5%, and 10%, followed by the addition of a plasticizer to increase the concrete bond strength. After standard maintenance procedures, the porosity and good compressive strength are measured. Finally, the optimum ratio of fine sand is obtained to reach the balance between the permeability and compressive strength for pervious concrete.

Key Words: Pervious concrete, compressive strength, permeability.

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環境汚染防治論文

應用監測設施於頭份工業區雨水下水道水質及水量即時監測

平 民^[1] 洪耀明^{[2]*}

摘 要 頭份工業區因未設置污水處理廠，廠商經處理後之廢水直接排放至雨水下水道，衍生水質管理問題，而定期水質採樣，並不能即時得知水質及水量，因此設置即時監測系統，以量測雨水下水道水質。本研究探討即時監測系統量測雨水下水道水質之成效評估，首先收集監視資料與實際水質水量量測資料，評估監測設備量測資料之準確性，同時分析監測設施成本與實際水質量測成本之差異，最後透過準確性及成本差異，提出整體成效評估，作為爾後設置即時監測系統之參考依據。

關鍵詞：即時監測系統、廢水、水質

Using monitoring system on the real-time measurement of water quality and quantity for rainwater channel in Toufen industrial zone

Ming-Ping [1]* Yao-Ming Hong [2]

ABSTRACT Sewage treatment plant is not set up in the Toufen industrial zone. Treated wastewater from the manufacturer discharges directly to the rainwater channel, and the water quality management problem is derived. Regular water quality sampling does not immediately response the water quality and the water volume. Therefore, an real-time monitoring system is set up to measure the water quality of rainwater channel. This study discussed the effectiveness of the real-time monitoring system in measuring the quality of rainwater channel. First, the monitoring data and actual water quality and quantity measurement data were collected to evaluates the accuracy of monitoring equipment measurement data. Secondly, the difference between monitoring facility cost and actual water quality measurement cost were compared. Finally, the overall effectiveness evaluation was proposed through the accuracy and cost differences.

Key Words: real-time monitoring

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超鹼性離子水去除廢水中氨氮之可行性評估

洪耀明^{[1]*} 林元馨^[2]

摘要 本研究分析超鹼性離子水去除廢水中氨氮濃度效益評估，基於氨氮去除率與酸鹼度相關，因此首先採用超鹼性離子高 pH 特性，加入廢水以提升 500cc 廢水酸鹼度到 pH 9.0，計算所需超鹼性離子水體積及廢水中氨氮去除率，同時以液鹼(NaOH)加入 500cc 廢水酸鹼度到 pH 9.0，計算所需消耗液鹼(NaOH)用量及廢水中氨氮去除率，然後比較兩種藥劑成本及氨氮去除率，經比較發現，所需超鹼性離子水體積為液鹼之 105 倍，氨氮去除率 5%。

關鍵詞：超鹼性離子水、氨氮。

Feasibility assessment for the removal of ammonia nitrogen from wastewater by super alkaline ionized water

Yao-Ming Hong^{[1]*} Yuan-Hsing Lin^[2]

ABSTRACT This study analyzes the benefit evaluation of ammonia nitrogen concentration in wastewater treated by super alkaline ions (SAI) water. Based on the ammonia nitrogen removal rate are related to pH value, the high pH value of SAI is firstly added to the wastewater to increase the pH of 500cc wastewater to pH 9. The volume of SAI and the removal rate of ammonia nitrogen in wastewater were recorded. Secondly, liquid alkali (NaOH) is also added to wastewater until pH= 9. After the comparison between NaOH and SAI, the required volume of SAI is 105 times to NaOH, and the removal rate 5%.

Key Words: Super alkaline ionized water, ammonia nitrogen.

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台中工業區生活污水處理計價方式簡化之可行性評估

吳惠君^[1] 洪耀明^{[2]*}

摘 要 現行生活污水處理費用之計算公式包括水質及水量兩參數，因此需要生活污水水質採樣成本，若各家廠商生活污水差異性不大，可改為水量計價以降低成本。因此本研究收集 2015、2016 及 2017 年廠商每月生活污水之水質，找出代表性排放生活污水水質之之量化平均值及標準偏差，若標準偏差不大，代表廠商生活污水差異值不大，並將水量計價模式與原公式比較，了解以量計價後，對廠商收費之影響，同時推算減少採樣成本之效益，預期提供水量計價之單一費率計算公式，提供污水處理廠參考。

關鍵詞：污水處理廠、生活污水、單一費率。

Feasibility Assessment of Simplified Pricing Method for Domestic Sewage Treatment in Taichung Industrial Area

Hui-Chun Wu^{[1]*} Yao-Ming Hung^{[2]*}

ABSTRACT The current calculation formula for domestic sewage treatment costs includes two parameters : water quality and water quantity. The sampling cost of domestic sewage water quality is required. If the quality of domestic sewage for each manufacturer is similar, only water price can be used to estimate the cost. Therefore, this study collected the water quality of the monthly domestic sewage of the manufacturers in 2015, 2016 and 2017, and calculated the quantitative average and standard deviation of the representative value for the domestic sewage water quality. If the standard deviation is not large, the representative domestic wastewater difference is not large. Comparing the water pricing model with the original formula, the impact of the pricing on the manufacturer will be obtained. The benefit of reducing the sampling cost is also estimated. Finally, a single rate calculation formula for the water pricing is suggested to provide a reference for the sewage treatment plant.

Key Words: sewage treatment plant, domestic sewage, single rate

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應用機械式蒸汽再壓縮技術於廢水回收方法之研究

陳淑玲^{[1]*} 洪耀明^[2]

摘 要 濕式洗滌塔可用於焚化爐處理事業廢棄物之空氣污染防制設備，但操作過程會產生高濃度總溶解固體（Total dissolved solids, TDS）廢污水，本研究以機械式蒸汽再壓縮技術(mechanical vapor recompression, MVR)，研發廢水處理再利用之方法。首先廢污水輸送至降膜蒸發器裡，以泵浦抽污水於加熱管內循環，並用蒸汽在管外給熱，使污水沸騰產生蒸汽，並由壓縮機增壓以提高溫度，再進入加熱管循環使用。並以中部地區某廢棄物處理廠為例，該廠每年產生 35000 至 45000 噸高濃度總溶解固體廢污水，經 MVR 處理後之再生水，其 TDS 小於 500 mg/L，符合焚化爐再利用，回收率 85 %，對於水源日漸短缺之台灣，或可作為一項值得推廣之技術。

關鍵字：機械式蒸汽再壓縮技術、總溶解固體、濕式洗滌塔

Application of mechanical steam recompression technology to the development of wastewater recycling technology.

She-ling Chen^{[1]*} Yao-Ming Hong^[2]

ABSTRACT The wet wash tower can be used in the air pollution control equipment of the incinerator to treat the commercial waste. Operation process will produce high concentration of total dissolved solids (TDS) waste water. This study uses mechanical steam recompression technology (MVR) to develop the wastewater treatment and reuse methods. Firstly, the waste water was sent to the falling film evaporator, and heated by steam to generate steam, and the compressor is pressurized to increase the temperature, and then enters the heating pipe for recycle usage. A waste treatment plant, located in the central Taiwan, produced 35,000 to 45,000 tons of high-concentration total dissolved solid waste water every year. The recycled water after MVR treatment has a TDS of less than 500 mg/L, and recycling rate 85%

Key Words: Mechanical steam recompression technology, wet wash tower

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南崗工業區工業鍋爐改善於空氣品質之成本效益評估

張麗慧^{[1]*} 洪耀明^{[2]*}

摘 要 因應空氣品質惡化，政府對工業鍋爐訂定更高之空氣品質排放標準，並補助工業鍋爐改善，將燃料由重油改為天然氣。本研究討論燃料改善之效益評估，成本方面，包括由重油改為天然氣之增加燃料成本，及扣除政府補助後之改善設備之成本；效益方面，包括空氣品質改善對人體健康計量效益，及改善後之裁罰費用減免效益。並以南崗工業區為例，首先收集單一廠商相關數據，計算其成本效益，再擴大至整個工業區所有鍋爐，推估整體改善效益。

關鍵詞：工業鍋爐、空氣品質、成本效益

Cost-benefit assessment of industrial boilers improved in air quality in Nangang Industrial Zone

Li-Hui Zhang^{[1]*} Yao-Ming Hong^[2]

ABSTRACT In response to the deterioration of air quality, the government has set higher air quality emission standards for industrial boilers, and subsidized industrial boilers to change the fuel from heavy oil to natural gas. This study discusses the benefit assessment of fuel improvement. Cost includes the increase in fuel cost from heavy oil to natural gas and the cost of equipment after deducting government subsidies. Benefits include air quality improvement for human health, and the penalty fee. First, the relevant data of a single manufacturer is collected to calculate cost-benefits in Nangang Industrial Zone. Second. Estimation scale expand to all boilers in the entire industrial zone to estimate the overall improvement benefits.

KeyWords : industrial boiler, air quality, cost-benefits.

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農業與食品科學論文

豆漿濃度對豆腐製程效益之影響

葉坤桐^{[1],*} 陳柏青^[2]

摘 要 豆腐的製程中使用的豆漿濃度不同，會影響經濟效益、時間效益及製程流暢性，因此，建立豆腐製造過程中可獲致最佳效益之豆漿濃度，為豆腐生產成本效益分析之重要參數。本研究採用四種豆漿濃度 10°Bx、11°Bx、12°Bx、13°Bx，進行豆腐的標準生產製程，並分別計算每個製程中能源的損耗率、時間效益、產量效益。研究結果顯示，當豆漿濃度為 10°時，能源損耗率最高、工時最長、產量最多；而當豆漿濃度為 13°時，能源損耗最少、工時短，而產量最少。本研究的結果，將可作為節省豆腐生產企業營運成本之重要參考依據。

關鍵詞：豆腐、豆漿濃度、能源效益、時間效益、經濟效益

Effects of Soymilk Concentration on Production Efficiency of Tofu Manufacturing Process

Kun-Tung Yeh ^{[1],*} Bo-Ching Chen ^[2]

ABSTRACT The soymilk concentration used in the process of tofu manufacturing will result in different economic benefits, time efficiency and the fluency of manufacturing process. Therefore, it is necessary to establish optimal soymilk concentration for the cost-benefit analysis in the tofu manufacturing process. In this study, four soymilk concentrations of 10°Bx, 11°Bx, 12°Bx, and 13°Bx were used in the standard tofu manufacturing process. Energy consumption rate, time efficiency, and production efficiency were obtained in each process. Results of the present study showed that the highest energy consumption rate, longest working hours, and highest productivity occurred at the soymilk concentration of 10°; however, the lowest energy consumption rate, shortest working hours, and lowest productivity was obtained at the soymilk concentration of 13°. Results of this study can be used as a reference for saving the operating cost of tofu manufacturing enterprise.

Key words: tofu, soymilk concentration, energy efficiency, time benefit, economic benefit.

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應用生料培養食用菌之研究

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摘 要 本研究生料栽培為利用未經加溫滅菌處理的培養料直接進行食用菌接種栽培的方式。生料栽培由於未經過高溫處理、操作簡單易行、省工省時、培養料中養分分解損失少，若管理措施得當，產量較高。然而生料栽培很難控制病蟲害，若在料內添加農藥，會影響產品的安全性。加以生料栽培發菌慢，接種量也要增加，因此所以如何在溫度、濕度、培養基的管理與滅菌處理上下功夫，為生料栽培應用之重要關鍵。本研究以蟬花、黑木耳及香菇作為食用菌材料，探討不用高溫滅菌之下，各食用菌產量是否變異、經濟效益之差異。研究結果顯示，生料在臭氧水處理下，食用菌之品質產能（或經濟效益）最高，而在高溫處理下，則浪費能源。本研究之結果除可建構應用生料培養食用菌之最佳生產流程外，亦可作為評估以生料培養食用菌之成本效益分析重要參考依據。

關鍵詞：溫度、濕度、培養基、O₃、液體菌種

Raw material cultivation of edible fungi

Po-li yu ^{[1]*} Shih-Hsiung Chen ^[2] Bo-Qing Chen ^[3]

ABSTRACT This graduated material is cultivated in a manner in which the edible fungus is inoculated directly by using a culture material which has not been subjected to heat sterilization treatment. The raw material cultivation is not subjected to high temperature treatment, the operation is simple and easy, the labor saving and time saving, and the nutrient decomposition loss in the culture material is small, and if the management measures are proper, the yield is high. However, it is difficult to control pests and diseases in raw material cultivation. If pesticides are added to the materials, the safety of the products will be affected. The cultivation of raw materials is slow, and the inoculum volume is also increased. Therefore, how to work on temperature, humidity, medium management and sterilization treatment is an important key for raw material cultivation and application. In this study, scutellaria, black fungus and shiitake mushrooms were used as edible fungi materials to investigate whether the yield of various edible fungi was different and the economic benefits were different. The results show that under the ozone water treatment, the raw material has the highest quality capacity (or economic benefit), while under high temperature treatment, energy is wasted. The results of this study can be used as an important reference for the cost-benefit analysis of the cultivation of edible fungi by raw materials, in addition to the optimal production process for the cultivation of edible fungi.

Key Words: Temperature, humidity, medium, O₃, Liquid strain

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以陽光及多物太陽能乾燥對番茄品質之比較評估

S M Nahid Hasan^{[1]*} 陳柏青^[2]

摘要 水果和蔬菜是人類生活飲食的一部分。許多國家由於沒有能力負擔昂貴的冷凍設備成本，保存蔬果的能力比較差，無法提供淡季的消費，因此在蔬果採收後的損失達到 40%。而蔬果可以另外以使用陽光或太陽能乾燥的方式脫水以保存。對於許多發展中的國家而言，將蔬果適當的脫水至適當的水分後儲存到淡季販賣，是比較困難的。因此為了克服熱帶氣候中高濕度、間歇性的雲和霧霾，本研究乃比較以陽光及太陽能乾燥處理對番茄品質的影響，探討何種方式可在短時間內以低成本提供優質的乾燥番茄。以陽光曝曬是傳統的乾燥過程，然而此過程中溫度、濕度、空氣組成皆無法控制，此外曬乾較耗時，且品質較無法控制。而利用太陽能乾燥，前述因子皆能控制，番茄可有效乾燥至 10% 含水率。此外，利用太陽能乾燥的番茄，與新鮮番茄在 pH、酸度、糖度及顏色上較無差異，因此太陽能乾燥是保持番茄品質之有效方法。另外，由於太陽能乾燥器會使環境中的空氣溫度升高，以提高農作物的乾燥速度，同時也減少了雨水或害蟲對產品的影響，可避免露天曬乾時需要注意雨水或蟲害之問題。

關鍵詞：保鮮技術，降低成本，淡季水果可用性

Comparative Assessment of Tomato Quality by Sun and Multi commodity Solar Dryer

S M Nahid Hasan^{[1]*} Bo-Ching Chen^[2]

ABSTRACT Fruits and Vegetables are an entire part of human diet. Many countries experience post-harvest losses of 40%, and there is a little ability to preserve and store foods for off-season consumption due to expensive and a lack of access to refrigeration. Alternatively, fruits and vegetables can be dehydrated using sun or solar drying. Because many developing countries properly dehydrating fruits and vegetables to appropriate moisture levels for storage and off-season consumption can be difficult. In an attempt to overcome the challenges of high humidity, intermittent clouds and haze often present in tropical climates, this paper investigates the comparative assessment of tomato quality by sun and solar drying. This paper also identify that which process will give good quality dried tomato in short time and low cost. Sun drying is typical process, in this process temperature, humidity, and air can't be controlled. On the other hand sun drying takes time to dry the products and quality is not good in this process. But in solar drying it can be controlled. Tomatoes were considered dried at 10% moisture content. In addition, by solar drying there was no difference on pH, acidity, °Brix, color in between fresh and dried tomatoes. Therefore, solar drying method is an effective method in respect of maintaining quality of tomatoes. The solar dryer can raise the ambient air temperature to a considerable high value for increasing the drying rate of agricultural crops. The product inside the dryer requires less attention, like attack of the product by rain or pest, compared with those in the open sun drying.

Key Word: preservation technique, cost elimination, off season fruit availability

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蔬菜中硝酸鹽及亞硝酸鹽含量之季節性差異及後續人體健康風險評估

陳柏青^[1] Cheska Aujero^[2]

摘 要 硝酸鹽廣泛分佈於自然界，並存在於土壤、水及食物中。蔬菜為飲食中硝酸鹽的主要來源，且不同蔬菜之硝酸鹽含量差異極大。蔬菜中的硝酸鹽對於人類健康有危害，可能造成高鐵血紅蛋白及癌症等毒性效應。植物中硝酸鹽的潛在危害來自其在攝食前或攝食後轉化為產生高鐵血紅蛋白的亞硝酸鹽。本研究於臺灣不同地區蒐集了市佔率前五名之葉菜樣品，並分析其硝酸鹽濃度，此外並比較不同採收時間（夏季與冬季）對硝酸鹽濃度的影響。此外，本研究亦探討不同蔬菜中硝酸鹽含量不同之原因、比較硝酸鹽每日實際攝取量與每日可容許攝取量（ADI）、相關法規，並探討硝酸鹽代謝及毒理學，進行評估硝酸鹽對人體健康之危害效應。本研究之結果將可作為本地居民因攝食蔬菜而暴露於硝酸鹽之風險管理參考依據。

關鍵詞：季節;硝酸鹽;機率性人體健康風險評估

Seasonal Differences of Nitrate and Nitrite Level in Vegetables and Subsequent Human Health Risk Assessment

Chen Bo-Ching^[1] Cheska Aujero^[2]

ABSTRACT Nitrates are widely distributed in the nature and commonly found in the soil, water, and foods. Vegetables are the major source of dietary nitrate, with wide variations in nitrate content. The presence of nitrate in vegetables is often associated with harmful effects on human health, i.e. with toxic effects of methaemoglobin and cancer. The potential hazard of vegetable-borne nitrate is from its conversion to methaemoglobin-producing nitrite before and/or after ingestion. In this study, the concentrations of nitrate from the top fifteen consumed leafy vegetable samples collected from several locations in Taiwan were analyzed. The influence of harvesting time (summer vs. winter) on nitrate levels was also examined. Furthermore, the reasons for the different contents of nitrate in vegetables, the daily intakes and comparisons to the acceptable daily intake (ADI) values, legislation, metabolism and toxicology of nitrate were described as well as harmful effects of nitrate on human health. Results of the present study can be applied for risk management of local residents exposed to nitrate via vegetables consumption.

Key Words: season; nitrate; probabilistic human health risk assessment

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臺灣有機及慣行農業種植蔬菜之硝酸鹽含量及後續人體健康風險評估

陳柏青^{[1]*} Marilyn Aldamar^[2]

摘 要 硝酸鹽對植物的健康生長至關重要，因此攝食蔬菜通常被認為是硝酸鹽攝入的主要來源。然而，攝食含高濃度硝酸鹽的食物易導致高鐵血紅蛋白血症和胃癌等疾病，進而增加死亡風險。本研究之目的在探討不同農法對臺灣市佔率最高的幾種蔬菜中硝酸鹽含量的影響，並進一步估算攝食含有不同硝酸鹽含量的各種蔬菜之人體健康風險。本研究採用美國環境保護署（US EPA）所提出之人類健康風險評架構，以計算臺灣居民因攝食蔬菜而暴露於亞硝酸鹽之致癌風險。在暴露評估中，本研究選取臺灣攝食量最高的 10 種蔬菜，並分別測定有機及慣行農法下其硝酸鹽含量。本研究以蒙地卡羅模擬法描述暴露評估中某些參數的不確定性。本研究的結果預期可作為制定臺灣當地蔬菜硝酸鹽含量管制標準之參考依據。

關鍵詞：硝酸鹽，亞硝酸鹽，有機農業，慣行農業，人體健康風險評估

Assessing Human Health Risk on Nitrate and Nitrite Content in Vegetables Grown under Organic and Conventional Farming in Taiwan

Bo-Ching Chen^[1] Marilyn Aldamar^[2]

ABSTRACT Nitrate is essential for a healthy growth of plants, therefore the consumption of vegetables is generally regarded as the main source of nitrate intake. However, consuming a diet with high levels of nitrate has been linked to an increased risk of fatal conditions, such as methaemoglobinaemia and gastric cancer. The purpose of this study is to examine the relevance of farming practices on the level of nitrate in various vegetables with a highest consumption rate in Taiwan and to further estimate the health risk on human associated with the consumption of various vegetables containing different level of nitrate. The human health risk assessment paradigm proposed by US Environmental Protection Agency (US EPA) was adopted to assess the carcinogenic risk of Taiwan residents associated with vegetables consumption. In exposure assessment, top rated-highly consumed vegetables in Taiwan were taken. Nitrate contents on ten kinds of vegetable were determined on both organic and conventional farming. Monte Carlo Simulation was employed to characterize the uncertainty of some parameters Results of the present study can be applied while setting the local regulation standard of nitrate in vegetables in Taiwan.

Keywords : nitrate, nitrite, organic farming, conventional farming, human health risk assessment

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台灣中部地區葡萄及葡萄園土壤中鋅濃度調查

陳柏青^{[1]*} Chhorn Chamroeun^[2]

摘 要 本研究於台灣中部某商業葡萄園中進行，藉由實地調查，以描繪葡萄園土壤中鋅濃度之垂直分佈圖，並分析當地生產之葡萄其藤莖、葉和葡萄果實中的鋅含量。本研究於兩處葡萄園進行，分別生產金麝香葡萄（用於生產白葡萄酒的釀酒葡萄）(Golden Muscat, G)和黑后葡萄（用於生產紅葡萄酒的釀酒葡萄）(Black Queen Muscat, B)。結果顯示，各部位的鋅濃度以葉部最高，其次依序為多年生木質部、一年生枝條和葡萄果實。一般而言，鋅肥於冬末到早春施用於土壤表面，若利用滴灌施用鋅肥，則應在開花前兩到三週完成，這樣的肥培管理使葡萄有足夠的時間於開花前吸取土壤中的鋅。葡萄各部位的生物累積因子大多大於一，代表鋅容易在土壤-葡萄系統中產生生物累積現象。健康風險評估顯示農民因接觸土壤而可能導致鋅暴露之非致癌風險；然而危險指數計算結果顯示兩種葡萄品種在食用上無顯著風險。

關鍵詞：生物累積；葡萄；土壤；鋅

Zinc concentrations in grapevines and vineyard soils in central Taiwan

Bo-Ching Chen^[1] Chhorn Chamroeun^[2]

ABSTRACT This study was performed in commercial vineyard. The main purpose of the present study was to conduct a field investigation to map zinc (Zn) vertical distribution in vineyard soils and to investigate the Zn contents in shoots, leaves, and grapes of grapevines in the studied plots in central Taiwan. The study was done on two types of vineyards as G for Golden Muscat (a wine grape used to produce white wine), and B with grape variety Black Queen Muscat (a wine grape used to produce red wine). The Zn concentrations in the grapevine organs was found to be highest in the leaves that followed by the perennial wood parts, annual shoots, and grapes. Zinc fertilizer can be applied late winter to early spring for soil surface applications. If zinc fertilizer is applied via drip irrigation it should be completed two or three weeks prior to bloom. This allows enough time for vine uptake by bloom. The bioaccumulation factors in various organs of the grapevines were mostly greater than unity, indicating that a process of bioaccumulation of Zn occurred in the soil-grapevine system. Health risk assessment showed non-carcinogenic risk for farmer's exposure to the soil. The hazardous index showed that both grapevine species were safe for consumption.

Key words: Bioaccumulation, grapevine, soil, zinc

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莴苣 (*Lactuca sativa*) 的各種測試應用於 BOKASHI

雀瑞喜^{[1]*} 林群智^{[2]*} 陳世雄^[3]

摘 要 有機種植的食品和纖維在全球的生產量和銷售量呈指數級的增長，而 Bokashi 是一種含有土壤微生物和營養素的發酵有機肥料，對土壤和植物皆有益。本研究旨在確定 bokashi 對莴苣在農事中使用上的影響，如植株高度，寬度，葉片數，產量和植物數量，並推薦最適合使用的莴苣品種。四種品種將用於檢查 bokashi 的效果，包括 T1-romaine，T2-corelle，T3-red rapid 和 T4-ice-berg。使用簡單隨機分配法進行實驗。實驗中使用 7.2 平方米的實驗區域。每個品種皆進行 3 重複實驗。在實驗進行中將生菜品種種植在直徑 15 厘米和高 13 厘米的聚乙烯袋中，以 ANOVA 進行數據上的統計。實驗結果表示，bokashi 有機肥在植物長度 (cm) 上的應用有顯著差異，且對感染植株數量的影響差異極顯著。然而卻沒有觀察到植物直徑 (cm) 和植物數量上的顯著差異。研究結果表明，受感染植物數量最少以及最具適應性的品種是 Red Rapid，Corelle 和 Romaine。因此，推薦以 Romaine，Corelle 和 Red Rapid 這三個品種作為 ice-berg 的替代品，因為 ice-berg 在連續種植中皆容易死於蟲害。

VARIETAL TEST OF LETTUCE (*Lactuca sativa*) APPLIED WITH BOKASHI

Chrecel Mae M. Lasquite^{[1]*} Chun-Chih Lin^{[2]*} Shih-Shiung Chen^[3]

ABSTRACT Global production and sale of organically grown food and fiber continue to increase exponentially and Bokashi is a fermented organic fertilizer containing indigenous microorganisms and nutrients which are beneficial to soil and plants. This study had conducted to determine the effects of bokashi on the agronomic characteristics of lettuce such as plant height, width, number of leaves, yield and infested number of plants and to recommend the most adaptive variety of lettuce. Four varieties, including T1-romaine, T2-corelle, T3-red rapid and T4-ice-berg, were used to check effect of bokashi. The experiment was laid out using Simple Randomized Complete Block Design. The experimental area of 7.2 m² was used in the experiment. Each variety was divided into 3 replications. Lettuce varieties were potted in 15 cm diameter polyethylene bags with 13 cm height. The ANOVA was used as a statistical tool. After a thorough observation and based on the results presented, the application of bokashi organic fertilizer on the length of plants (cm), was significantly different, and that on the number of infected plants was highly significantly different. However, no significant difference was observed for the diameter of plants (cm) and number of plants. The result of the study revealed that the most adaptive variety with least number of infested plants were Red Rapid, Corelle and Romaine. Thus, the varieties of lettuce, Romaine, Corelle and Red Rapid, were recommended to be alternatives to the ice-berg, which had succumbed to insect pest infestation in continual planting.

Key Words: Romaine, corelle, red rapid, iceberg and bokashi

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常壓電漿對水果表面滅菌之研究

蔡政賢^{[1]*} 陳珮綺^[2]

摘 要 本研究分成三部分，分別為常壓電漿、熱水浸泡及未處理對葡萄與番茄並各別置於室溫及冷藏下，進行重量損失率、糖度、表面變化及表面滅菌分析。

以常壓電漿，於氣體總流量固定，改變電漿功率、溫度及處理時間下，葡萄經由電漿功率 1000 W 及 1400 W 於室溫及冷藏下，其重量損失率與未處理及熱水浸泡比較無明顯變化，但糖度卻較高，而因為葡萄為密封後進行總菌落數及大腸桿菌數分析，導致表面皆無細菌。

以常壓電漿，於氣體總流量固定，改變電漿功率、溫度及處理時間下，番茄經由電漿功率 1000 W 及 1400 W 於室溫及冷藏下，與未處理及熱水浸泡比較，其重量損失率較低，但糖度無明確變化，而後進行表面滅菌分析，因氣體流量過大，導致無法達到預期效果。

關鍵詞：常壓電漿、水果、滅菌。

Study on Sterilization Effect of Atmospheric-Pressure Plasma on Fruit Surface

Pei-Chi Chen^{[1]*} Cheng-Hsien Tsai^[2]

ABSTRACT The study was divided into three parts, Atmospheric-Pressure Plasma, hot water immersion and untreated grapes and tomatoes, which were placed at room temperature and under refrigeration, and analyzed for weight loss rate, sugar content, surface change and surface sterilization.

With Atmospheric-Pressure Plasma, the total flow rate of the gas is fixed, and the power, temperature and treatment time of the plasma are changed. The weight loss rate of the grape is 1000 W and 1400 W at room temperature and under refrigeration, and the weight loss rate is untreated and hot water. There was no significant change, but the sugar content was higher, and because the grape was sealed and the total number of colonies and E. coli were analyzed, the surface was free of bacteria.

With Atmospheric-Pressure Plasma, when the total gas flow rate is fixed and the plasma power, temperature and treatment time are changed, the tomato is treated with 1000 W and 1400 W at room temperature and under refrigeration, compared with untreated and hot water immersed. The weight loss rate is low, but there is no clear change in the sugar content, and then the surface sterilization analysis is performed, and the gas flow rate is too large, which may not achieve the desired effect.

Key Words: Atmospheric-Pressure Plasma, fruit, sterilization

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資訊科技論文

以藍牙 4.0 模組一對多通訊為基礎之環境感測系統設計

洪禎甫^{[1]*} 賴信志^[2]

摘 要 本研究基於無線射頻一對多傳輸來搭配感測器感知室內環境狀況，利用藍牙 4.0 的傳輸技術及短距省電的特性，能有效進行室內溫溼度等感測數值的傳遞，使其能運用在溫室或自家小型溫室。本系統將針對最下游感測器節點做一個資料彙整中心，透過藍牙 4.0 模組互相溝通，將從端感測器電路放置溫室內各個角落，或放置於多個小型溫室內，以監測室內空間的各處環境數值，實作藍牙一對多連線來主動輪詢各個從端裝置，並回傳到主端電路供管理者檢視。主端資料彙整電路架設於溫室大門口，平時從端藍牙非傳輸時處於休眠模式，在待機下電流為 50-200uA，屬於極低功耗並有效地省下耗電量，主端電路上配有 LCD 顯示面板，顯示目前輪詢到的從端數據以及時間。透過開發藍牙一對多的切換方式來應用於溫室環境監控，將有利於管理者更方便監控溫室內部的環境變化。

關鍵詞：藍牙一對多、環境感測、溫室。

Design of environmental sensing system based on Bluetooth one-to-many communication

Chen-Fu Hung^{[1]*} Shin-Chi Lai^[2]

ABSTRACT This study is based on the one-to-many transmission of radio frequency and the sensor to sense the indoor environment. Using the transmission technology of Bluetooth 4.0 and the characteristics of short-distance power-saving, it can effectively transmit the sensing values of indoor temperature and humidity, so that it can be used in the greenhouse or in your own small greenhouse. The system will be a data collection center for the most downstream sensor nodes, communicate with each other through the Bluetooth 4.0 module, and place the sensor circuit in all corners of the greenhouse or in multiple small greenhouses to monitor the indoor space. The ambient values of each place are implemented as a one-to-many connection of Bluetooth to actively poll each slave device and return it to the master circuit for the administrator to view. The main data collection circuit is installed at the gate of the greenhouse. It is usually in sleep mode when the Bluetooth is not transmitting from the terminal. The current is 50-200uA in standby mode, which is extremely under low power consumption and effectively saves power consumption. There is an LCD display panel that displays the current slave data and time. Applying Bluetooth one-to-many switching methods to greenhouse environmental monitoring will help managers to monitor environmental changes within the greenhouse.

Key Words: Bluetooth one-to-many, Environmental sensing , greenhouse.

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應用機器人數字教學提升重度自閉症幼童專注力之行動研究

陳萌智^[1] 黃郁琦^{[2]*}

摘 要 美國疾病管理局(CDC) 2015 年最新的數據指出,自閉症光譜疾患(Autism Spectrum Disorder, ASD)的流行率為 1/68 人,在這過去的 20 年間 ASD 的診斷快速成長,全球 ASD 患者不斷擴大,重度自閉症幼童普遍學習意願不高,自發性行為缺乏,常沉溺於旁人看來無目的的行為,導致學習無法專注。zenbo 機器人它們豐富的表情及能夠重複一次又一次相同的可預測反應,這種學習方式,對重度自閉症幼童至關重要,而不像人會感到沮喪或疲憊,使重度自閉症幼童更沒自信,導致惡性循環,未來依靠人工智慧、智能機器人...等先進科技治療逐漸成為學界關注的焦點之一。本研究期能透過 zenbo 機器人將治療師使用的圖卡數字學習教材寫入編輯系統並演繹,以輔助教學模式呈現於課堂情境中,作為治療師的小助理,提升重度自閉症幼童學習專注力,進而強化對數字學習的興趣,實現更多元的教學形式。研究者將與嘉義市某醫院職能治療師合作,並與 3 位重度自閉症幼童進行測試,經過為期一個月共 4 堂治療課的時間,藉由行動研究進行自我反思,思考運用其他多元方式以提升重症自閉症幼童學習專注力。

關鍵詞: 機器人、重度自閉症、專注力。

Action Research On Improving The Attention Of Children With Severe Autism With Robot Digital Teaching

Meng-Zhi Chen^{[1]*} Yu-Chi Huang^[2]

ABSTRACT According to the latest data from the U.S. Disease Administration(CDC)in 2015, the prevalence of ASD is 1/68,and the diagnosis of ASD has grown rapidly over the past 20 years. Global ASD patients continue to expand. Children with severe autism generally have low willingness to learn and lack of spontaneous behavior.Often indulge in seemingly aimless behavior,resulting in learning can not concentrate. Zenbo robots,their rich expressions,and the ability to repeat the same predictable reactions over and over again.This way of learning is critical for children with severe autism.Unlike people get frustrated or tired.Make severe autistic children less confident, leading to a vicious circle.In the future,advanced technology therapy,such as artificial intelligence, intelligent robot and so on,has gradually become one of the focuses of academic circles.This study looks forward to writing the graphic card digital learning textbook used by the therapist to the editing system and deductive it through the Zenbo robot.The assistant teaching mode is presented in the classroom situation as the assistant of therapist.Enhance the learning ability of children with severe autism,and further enhance their interest in digital learning.Achieving a more diverse form of teaching.The researchers will work with a hospital occupational therapist Chiayi City,and tested with 3 children with severe autism.After a one-month period a total of four courses of treatment.Self reflection through action research.Thinking about using other multiple ways to improve the concentration of children with severe autism.

Key Words: Robot, Severe Autism, Concentration

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客服機器人應用於設備維護與系統管理之研究-以台南市某醫院為例

陳萌智^{[1]*} 簡嘉韋^[2]

摘 要 在日常生活中，不論在於生活、工作、出遊及飲食，人們都會與朋友聊天互通情感與知識，聊天時人們會表現出個人思維、情緒與問題，僅僅聊天已經是人們生活中不可或缺的部分。隨著資訊科技的迅速成長，各種手持式智慧型裝置之社交與通訊軟體開發，頗受民眾們青睞，例如：LINE、Facebook Messenger、WeChat等等，已相繼開放機器人回覆訊息API功能，客服機器人是一種自然語言輸入後進行語意解讀並產生對話回應的代理人程式。此功能可應用於網路客服、線上問答及維修服務等等方面，甚至可以24小時不間斷取代人類從事重複性的客服工作，亦可提前保存所有訊息紀錄，節省網路客服之人力成本及時間。本研究透過客服機器人幫助使用者處理資訊問題，以台南市某醫院資訊請修申請單進行統計，並依據統計結果規畫對話流程與互動關係，設計圖文解說客服機器人，最後針對8位員工進行資訊異常叫修體驗，依照應用價值、資訊服務、員工滿意三種方面進行服務體驗模式分析，將體驗結果進行客服機器人對話修正及效益分析。

關鍵字：客服機器人、網路客服、線上問答

Customer Service Robot Applied to Equipment Maintenance and System Management- Take a hospital in Tainan City as an example

Meng-Zhi Chen^{[1]*} Jia-Wei Jian^[2]

ABSTRACT In daily life, Whether it's living, working, traveling or eating, people will chat with friends to exchange emotions and knowledge. People will express their personal thoughts, emotions and problems when chatting. Just chatting is already an indispensable part of people's lives. With the rapid growth of information technology, the development of social and communication software for various handheld smart devices, favored by the public, E.g: LINE, Facebook Messenger, WeChat, etc. Already continuously open Robot reply message API function, Customer service robot is a kind Natural language input, Interpret semantics and generate a dialogue response agent program. This feature can be applied to online customer service, online Q&A, repair service, etc. It can even replace humans for repetitive customer service work 24 hours a day, save all message records in advance, and save labor costs and time for online customer service. This study helps users deal with information problems through customer service robots, take the Maintenance request form for a hospital in Tainan City for statistics, and according to the statistical results, the dialogue process and interaction relationship are planned, design graphic explanation customer service robot, finally an information abnormality experience for 8 employees, analysis of service experience patterns based on application value, information service, and employee satisfaction. Will experience the results perform customer service robot dialogue correction and benefit analysis.

Key Words: Customer service robot, online customer service, online Q&A

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以無線通訊為基礎之環境感測系統設計

賴信志^{[1]*} 陳庭育^[2]

摘要 技術和經濟的進步已經成為對環境的重大影響，因此環境污染和氣候變化正受到很多關注。在這方面，環境感知是必不可少的。監測自然環境和室內環境感應的變化不僅對人們的舒適和健康很重要，而且對溫室種植也很重要。此外，它對作物也有幫助。因此，本文建立了一個溫室無線環境傳感系統，包括服務器，數據採集和控制，以及多個傳感節點。傳感節點設計用於監測溫度，濕度，大氣壓力，土壤濕度和 CO₂ 濃度。然後，利用藍牙協議來握手數據，數據採集和控制模塊進一步收集數據。環境感知數據可以通過 WiFi 傳輸到 SQL 數據庫存儲，Raspberry Pi 也可以作為服務器傳輸。與基於 PC 的服務器相比，成本大大降低；監控終端已經通過移動 APP 實現，該移動 APP 允許用戶即時觀察移動電話上溫室環境的變化。此外，用戶可以控制溫室設備並防止植物作物受到影響。

關鍵詞：藍牙、樹莓派、資料庫、APP。

For greenhouse environment wireless transmission monitoring system

Shin-Chi Lai^{[1]*} Ting-Yu Chen^[2]

ABSTRACT The technological and economic advances have become a major impact on the environment so that environmental pollution and climate change are receiving a lot of attention. In this respect, environmental sensing is indispensable. To monitoring changes in the natural environment and indoor environmental sensing is not only important for people's comfort and health but also for planting in greenhouses. In addition, it is also helpful for crops. Therefore, this paper establishes a wireless environment sensing system for greenhouses, including server, data acquisition and control, and multiple sensing nodes. The sensing node is designed for monitoring temperature, humidity, atmospheric pressure, soil moisture and CO₂ concentration. Then, the Bluetooth protocol is utilized to handshake the data, which is further collected by the data acquisition and control module. The environmental sensing data can be transmitted to the SQL database storage by WiFi, and a Raspberry Pi is as a server. Compared with a PC-based server, the cost is greatly reduced; the monitoring terminal has already realized by a mobile APP which is allowing users to instantly observe changes in the greenhouse environment on a mobile phone. Additionally, the users can control greenhouse equipment and prevent plant crops from being affected.

Key Words: Bluetooth, Raspberry Pi, SQL, APP.

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腦電圖 (EEG) 信號擷取系統設計

賴信志^[1]

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摘要 為了解腦電活動，腦電 (EEG) 信號記錄了頭皮間所發出的微弱信號，也提供大腦動態活動表現的波形。本研究包括電路設計、頻譜分析、和設備開發，用以實現用於腦機介面 (BCI) 應用的腦包電 (EEG) 信號擷取系統。所採集信號需要一定強度的幅度，通常以毫伏為單位表示 (millivolts)。數據擷取過程含了三個階段：1) 原始 EEG 信號的擷取可以通過有源電極和具有較小增益的儀表放大器完成；2) 使用具有 IC OPAMP 的帶通濾波器和帶斥濾波器改善信號質量；3) 將 EEG 信號透過內嵌於微控制器的類比-數位轉換器 (ADC) 來轉換成數位碼。數位碼可再儲存於記憶體中，並由藍牙模組進一步傳輸。實驗結果說明該系統可以有效地實現 EEG 信號的擷取和存儲。設計的印刷電路板 (PCB) 尺寸小於 5×5 cm²。所提出之系統將有益於所有參與使用 EEG 進行臨床診斷和監測人員，腦機介面開發。

關鍵詞：腦電圖 (EEG)，腦計算機接口 (BCI)，OPAMP，類比數位轉換器 (ADC)，印刷電路板 (PCB)，放大器和電極。

Electroencephalography (EEG) signal acquisition system design

Shin-Chi Lai^[1]

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ABSTRACT: Electroencephalography (EEG) signals are recorded for knowing the electrical activity of brain from the scalp, and the recorded waveform provides acquits into the dynamic aspects of brain activity. This study incorporates the circuit design, spectrum analysis, and device development to achieve the Electroencephalography (EEG) signal acquisition system for future Brain Computer Interface (BCI) applications. The amplitude of acquired signals should be strong enough and is usually expressed in unit of millivolts. The data acquisition procedure consists three stages: 1) The acquisition of original EEG signal can be done by the active electrode and an instrumentation amplifier with a smaller gain; 2) Improves the signal quality by using band-pass filter and band-stop filter with IC OPAMP; 3) Those EEG signals were converted into the digital code through the analog-to-digital converter (ADC) that was integrated to a micro-controller. The digital code is stored into an embedded memory, and is further transmitted via Bluetooth module. The experimental results show that the system could implement the acquisition and storage of the EEG signals efficiently. The size of printed circuit board (PCB) for the proposed deign is smaller than 5×5 cm². This system would be benefit to all involved in the use of EEG for clinical diagnosis and monitoring, or even for Brain Computer Interface.

Keywords: Electroencephalography (EEG), Brain Computer Interface (BCI), OPAMP, Analog-to-Digital Converter (ADC), Printed Circuit Board (PCB), Amplifier and Electrodes.

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以 LoRa 通訊為基礎之智能蜂箱系統設計

楊恩騏^{[1]*} 賴信志^[2]

摘 要 本研究搭建蜂箱即時監測系統，透過 LoRa 遠距離傳輸特性，將蜂箱感測器蒐集之資訊傳輸至終端節點，並將資料上傳至伺服器，再透過網頁平台顯示其節點資訊，讓使用者可以減少人力消耗，未來可以透過所蒐集資訊進行統計分析。

關鍵詞：LoRa、感測器、伺服器。

Intelligence beehive system desing base on LoRa Technology communication.

ABSTRACT In this System mainly on LoRa communication supplemented by Bluetooth communication to achieve a long range communication smart beehive system. In this system divided into 4 parts : Server side、End-node、Relay-node and Sensor-node. Ended node consist of Raspberry pi b+ and LoRa module. Ended node main function is long range communication with Relay-node ,when relay-node received request message from End-node, it will collected each beehive temperature、humidity and illuminance data record form Sensor-node by Bluetooth communication, then relay-node send all the Sensor data to the End-node and upload to Server that user can see these beehive data by App or Web.

Keyword:LoRa 、long-range communication、Bluetooth、Sensor、Raspberry pi、APP、Server

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美食達人公司物流中心揀貨效率研究

吳金水^[1] 洪耀明^{[2]*}

摘 要 揀貨效率是物流管理營運績效的關鍵性指標，本研究以美食達人物流中心為例，首先收集現有倉儲環境、貨品分佈、訂單批次與揀貨路徑，其次彙整影響揀貨效率之方法，包括訂單產生依據、相似係數計算、品項聚群、品項擺放、訂單批次及揀貨路徑方法；再以倉庫分區的情況下，以平均總揀貨距離為指標，評估方法的表現與差異，作為物流揀貨方法之依據。

關鍵詞：物流管理、儲位管理、追蹤追溯

Picking Efficiency in Logistics Center of Gourmet Daren Company

Jinshui Wu ^{[1]*}

Yao-Ming Hong^{[2]*}

ABSTRACT Picking efficiency is a key indicator of logistics management operation performance. This study adopted the Gourmet Daren logistics center as an example. Firstly, the storage environment, goods distribution, order batch and picking path were collected. Secondly, the influence factors of picking efficiency, including the order basis, similarity coefficient, item clustering, item placement, order batch and picking path method were analyzed. Finally, the indicator of average total picking distance were adopted to estimate the picking efficiency method in the case of warehouse partitioning.

Key Words: Logistics Management, Management of storing place traceability

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應用溯源管理提高食品安全研究

洪明振^[1] 洪耀明^{[2]*}

摘要 本研究透過導入倉儲管理系統，建立美食達人之原材料，半成品與成品供應之追溯追蹤系統。首先採用台灣日通日電物流股份有限公司之倉儲管理系統，導入食品安全追蹤追溯，控管所有產品之流向，其次進行定期查核來源流向、批號及庫存追蹤，提升產品流向準確度。並計算導入溯源管理對於降低過期報廢及產品誤交率，進行導入系統前後之成本效益分析。

關鍵詞：倉儲管理系統、溯源管理、食品安全。

(Warehouse Management Sys-tem, WM S)

Using Traceability on the Improvement of food Safety

Ming-Zhen Hung^{[1]*} Yao-Ming Hong^{[2]*}

ABSTRACT This study establishes a traceability tracking system for raw materials, semi-finished products and finished products, using the warehouse management system. Firstly, the warehouse management system of Nippon Express NEC Logistics Taiwan Ltd. was adopted to introduce food safety tracking and traceability to control the flow of all products. Secondly, the source flow, batch number and inventory tracking regularly was used to improve product flow accuracy. The cost-benefit analysis before and after importing the system was analyzed based on the reducing of the expired scrap and product mismatch rate.

Key Words: sewage treatment plant, domestic sewage, single rate

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應用機器人數字教學提升重度自閉症幼童專注力之行動研究

陳萌智^[1] 黃郁琦^{[2]*}

摘 要 美國疾病管理局(CDC) 2015 年最新的數據指出,自閉症光譜疾患(Autism Spectrum Disorder, ASD)的流行率為 1/68 人,在這過去的 20 年間 ASD 的診斷快速成長,全球 ASD 患者不斷擴大,重度自閉症幼童普遍學習意願不高,自發性行為缺乏,常沉溺於旁人看來無目的的行為,導致學習無法專注。zenbo 機器人它們豐富的表情及能夠重複一次又一次相同的可預測反應,這種學習方式,對重度自閉症幼童至關重要,而不像人會感到沮喪或疲憊,使重度自閉症幼童更沒自信,導致惡性循環,未來依靠人工智慧、智能機器人...等先進科技治療逐漸成為學界關注的焦點之一。本研究期能透過 zenbo 機器人將治療師使用的圖卡數字學習教材寫入編輯系統並演繹,以輔助教學模式呈現於課堂情境中,作為治療師的小助理,提升重度自閉症幼童學習專注力,進而強化對數字學習的興趣,實現更多元的教學形式。研究者將與嘉義市某醫院職能治療師合作,並與 3 位重度自閉症幼童進行測試,經過為期一個月共 4 堂治療課的時間,藉由行動研究進行自我反思,思考運用其他多元方式以提升重症自閉症幼童學習專注力。

關鍵詞: 機器人、重度自閉症、專注力。

Action Research On Improving The Attention Of Children With Severe Autism With Robot Digital Teaching

Meng-Zhi Chen^{[1]*} Yu-Chi Huang^[2]

ABSTRACT According to the latest data from the U.S. Disease Administration(CDC)in 2015, the prevalence of ASD is 1/68,and the diagnosis of ASD has grown rapidly over the past 20 years. Global ASD patients continue to expand. Children with severe autism generally have low willingness to learn and lack of spontaneous behavior.Often indulge in seemingly aimless behavior,resulting in learning can not concentrate. Zenbo robots,their rich expressions,and the ability to repeat the same predictable reactions over and over again.This way of learning is critical for children with severe autism.Unlike people get frustrated or tired.Make severe autistic children less confident, leading to a vicious circle.In the future,advanced technology therapy,such as artificial intelligence, intelligent robot and so on,has gradually become one of the focuses of academic circles.This study looks forward to writing the graphic card digital learning textbook used by the therapist to the editing system and deductive it through the Zenbo robot.The assistant teaching mode is presented in the classroom situation as the assistant of therapist.Enhance the learning ability of children with severe autism,and further enhance their interest in digital learning.Achieving a more diverse form of teaching.The researchers will work with a hospital occupational therapist Chiayi City,and tested with 3 children with severe autism.After a one-month period a total of four courses of treatment.Self reflection through action research.Thinking about using other multiple ways to improve the concentration of children with severe autism.

Key Words: Robot, Severe Autism, Concentration

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多孔矽光學微共振腔結構應用於有機溶劑之檢測

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摘 要 多孔矽由於具有獨特的光學與電子特性，已經成為發展新型光電元件的重要半導體材料；再者，因為其電性、化學以及物理特性對於外在環境的變量具有高度的靈敏性，因此也是開發化學感測器的一種優秀材料。近年來在電化學蝕刻技術的進步下，特殊結構之堆疊式多層多孔矽之布拉格反射器及光學微共振腔已經成功地被製作在矽基板上並且應用於各種化學感測器的研製。本研究，我們使用調變蝕刻參數之技術在矽基板上製作具多孔矽光學微共振腔結構之化學感測器元件，然後針對不同的有機溶劑進行元件響應的光學量測分析。實驗結果發現當元件吸附有機溶劑時，元件的響應將出現具有相當特殊的單一峰值頻譜之反射光譜；更重要的是，反射頻譜中的峰值波長偏移量與有機溶劑的折射率呈現線性關係，因此吾人可以藉由此種獨特的多參數光學特性作為檢測環境中的有機溶劑之基礎，以提高檢測的靈敏度與準確度。

關鍵詞：多孔矽、光學微共振腔、有機溶劑、化學感測器。

Detection of Organic Solvents by Optical Microcavity Structures of Porous Silicon

Kuen-Hsien Wu^{[1]*} Chieh-An Cheng^[2]

ABSTRACT Porous silicon (PS) has become an important semiconductor material for development of optoelectronic devices owing to its special optical and electronic characteristics. In addition, because its electrical, chemical and physical properties are highly sensitive to the environment variables, PS is also an excellent candidate for fabrication of chemical sensors. Recently, multi-layered porous-Si structures such as Bragg reflectors and optical microcavity have been successfully produced on Si substrates with advanced PS formation techniques and applied in the fabrication of chemical sensors. In this study, we manufactured chemical sensing devices with PS optical microcavity (PSOM) structures on Si substrates by modulating the electro-chemical etching parameters. Optical characteristics of the developed PSOM devices were measured when responding to different organic solvents. As observed from the experimental results, the PSOM devices exhibited special single-peaked reflection spectral when absorbing organic solvents. Most importantly, the shift of the peak-wavelength in the reflection spectral is linear to the refraction index of the organic solvent. Therefore, the developed PSOM devices can potentially detect organic solvents with high sensitivity and accuracy based on these optical multi-parameters.

Key Words: porous silicon, optical microcavity, organic solvent, chemical sensor.

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鼠害即時監測與防治反饋系統

謝佩君^{[1]*} 戴智泓^[2] 唐振凱^[2] 洪禎甫^[1] 賴信志^[3]

摘要 本研究主要係監測老鼠是否侵入環境及實施防治措施之反饋系統，利用紅外線技術來統計老鼠活動率，並透過在場域安裝多個監測器來達到預測老鼠進出的路線。藉由 Wifi 將每個監測器的資料傳送到資料庫儲存，使用者可透過讀取資料庫之數據及資料庫提供之圖表清楚目前老鼠出沒範圍及活動率。本研究方法除了能提升滅鼠率外亦可降低傳染病的傳播，有效的解決鼠患問題。

關鍵詞：紅外線感測器、Arduino、鼠患。

Real-time monitoring, control, and prevention feedback system design for rat and mouse damage

Pei-Chun Hsieh^{[1]*} Zhi-Hong Dai^[2] Zhen-Kai Tang^[2] Zhen-Fu Hong^[1] Shin-Chi Lai^[3]

ABSTRACT This study is mainly focused on developing a feedback system for monitoring whether rats invade the environment and implementing control measures. To efficiently count the activity rate of rats, an infrared technology with multiple monitors is applied and set up in the field to predict the route of rats. For data storage, a WiFi module is employed to transfer the real-time data of each monitor to the database, and the user can not only read the data from the database but also understand the current activity range and activity rate of the mouse. The spread of infectious diseases can be effectively inhibited and the problems extended by rodents can be also greatly solved.

Key Words: infrared sensor, arduino, rodent.

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智慧園丁監控系統

林廣育 [1] 吳上立 [2] 魏吟芳 [3]

摘 要 本研究設計智慧園丁監控系統結合定點智慧監控搭配手機應用程式控制無人載具，搭配採用 Arduino 整合系統控制履帶輪式含夾爪鋁合金架構之載具，可達到機動性更佳的監控管理。手機應用程式(APP)可控制載具到特定溫室區域並處理雲端資料庫的數據。監控範圍包含偵測各溫室的溫溼度是否需進行調節至最佳數值及各盆栽土壤濕度依照所需溼度補給水分；感測設施包括土壤溼度感測器、溫濕度感測器、攝影鏡頭，以及幫浦馬達、伺服馬達。監控系統可實現遠端監控，讓植物栽種管理與環境照顧工作可以更加便利。

關鍵詞：智慧監控、無人載具、植物栽種管理。

Smart Gardener Monitoring System

GUANG-YO Lin[1] Sun-Li Wu [2] Yin -Fang Wei [3]

ABSTRACT This study aimed to combine the wisdom of the gardener monitoring system monitoring with wisdom mobile app to control unmanned vehicles. Arduino track wheeled vehicles with the jaws of the aluminum framework can be achieved better management of mobility. The wheeled vehicle can be controlled by mobile App to any specific area of green-house, meanwhile the data of environmental parameters uploaded and processed in the cloud database. The monitoring system can detect whether the temperature and humidity of each green-house need to be adjusted or the moisture of each potting soil is replenished according to the required humidity; the sensing facilities include soil moisture sensor, temperature and humidity sensors, cameras, pump motors, and servo motors. The monitoring system can makes cultivated management and environment control more convenient.

Keywords: wisdom monitoring, unmanned vehicles, cultivated management.

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創新創業論文

再利用三農創新電子商務平臺

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摘 要 悉知三農在於農產品交易平臺為主要，本團隊亮點于再利用解決三農面臨回收之問題，主要以電商交易平臺取得所需之農業廢棄物及分佈點，經由本團隊創新材料改制再製成新生物質材料，並符合國際再利用議題及解決中國農業農村經濟問題，由電子商務平臺導入包括：電池業、DIY 科學教材、民生需求及科技業之其他通路市場，使得三農因電子商務結合物流賦予創新、創業、創優再創新的經濟增長點，不斷解放和發展生產力，符合中國碳權交易。

關鍵詞：農業、再利用、商務平臺。

Reusing the "three rural" to innovate e-commerce platform

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ABSTRACT It is known that "agriculture, rural areas and farmers" is that agricultural products trading platform is the main one. The highlight of our team is to solve the recycling problems faced by "agriculture, rural areas and farmers" through reuse. Mainly to the e-commerce trading platform acquired by the need for agricultural waste and distribution points. Through the team's innovative materials remanufactured into new biomass materials. And in line with the Conform to the international re-use of issues and to solve China's agricultural and rural economic problems. The introduction of other market channels including battery industry, DIY science textbooks, people's livelihood needs and science and technology industry through e-commerce platform enables agriculture, rural areas and farmers to create new economic growth points for innovation, entrepreneurship and excellence through e-commerce and logistics. Constantly emancipate and develop the productive , in line with China's carbon trading.

Key Words:. Agriculture, Recycle, Commerce Platform.

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沙拉餐廳創業計畫書

黃浚煒^[1]、肖竣星^[1]、何柳斌^[1]、宋紫东^[1]、蔡博文^[2]、吳信達^[3] *

摘 要 隨著社會經濟的發展，人們的收入不斷提高，在消費觀念逐漸發生改變，餐飲不再是只具有飽食功能，多數人已經開始在餐飲上追求風味型，營養型甚至是休閒享受型，這種需求將引導城市餐飲朝著休閒型，享受型方向發展，而且更加注重餐飲特色和服務水準。城市的發展必將帶動餐飲行業的發展，據考察，以沙拉為主的餐廳迄今為止是該市場上的空白，而且光顧西餐廳的顧客有七成會點沙拉。最重要的是，沙拉是最健康營養的菜肴，甚至可以用來食療補健。比爾蓋茨曾經說過：“下一個能超越我的人，一定會出現在健康行業。”在與其他餐廳尤其是西餐廳相比，我們沙拉餐廳始終主打“你無我有，你有我優”的創新推出。我們相信前景非常可觀。

關鍵詞：餐廳、飲食、生活、消費型態。

Salad Restaurant Business Plan

Jun-Wei Huang^[1] Jun-XingXiao^[1] Liu-Bin He^[1] Zi-Dong Song^[1] Po-Wen Tsai^[2] Shinn-Dar Wu^[3] *

ABSTRACT With the development of social economy, people's income has been continuously improved, and the concept of consumption has gradually changed. Food and beverage are not just for satisfying your hungry. Most people have begun to pursue flavor, nutrition and even leisure enjoyment in catering. The demand will guide the urban catering towards leisure, enjoy the shape development, and pay more attention to the catering characteristics and service level. The development of the city will certainly drive the development of the catering industry. According to the investigation, the salad-based restaurant is still a blank in the market, and 70% of the customers who visit the western restaurant will order salad. Most importantly, salads are the healthiest and most nutritious dishes that can even be used for healing. Bill Gates once said: "The next person who can surpass me will definitely appear in the health industry." Compared with other restaurants, especially Western restaurants, our salad restaurant always adhere to the title "You don't have but i do ,you have but mine is better." We believe that the prospects are very impressive.

Key Words: Restaurant, Diet, Living, Comsuming form.

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基於自主研發的 PSD 動態曲線技術的電池安全系統平臺

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摘 要 “基於自主研發的 PSD 動態曲線技術的電池安全系統平臺”主要構思是利用“雲端技術”及“大資料”分析整合，計算出電池的當前使用情況，隨時回饋給系統讓使用者查詢目前電池狀態，這平臺優勢包括：電池安全狀態、使用壽命、衰退率、充電計價、區域電池交換站位置圖、區域充電站地圖及回收等多項功能，本核心創新技術自主研發 PSD 動態曲線技術(Power, ShinnDar 開發)，並可結合市場上各家 BMS、EMS 系統外加雲端訊號接收器，訊號器可由：WiFi、中國移動、中國聯通整合互聯網的需求。而且利用電池模組管理單元之間可透過 CAN、SPI 或 UART 等通訊協定來傳送相關資訊，並且可進一步將資訊傳送到更上層之電池管理系統控制核心(Battery Control Unit, BCU)，而 BCU 再根據這些資訊來對電池作管理、警示與安全保護等控制策略的實現。

關鍵字：自主研發、PSD 動態曲線技術、電池安全、電池管理

Battery Safety System Platform Based on Self-developed PSD Dynamic Curve Technology

Hao-Jian Huang^[1] Rui-Jun Li^[2] Li-You Chen^[2] Ying-Lin Wen^[3] Po-Wen Tsai^[4] Shinn-Dar Wu^[5] *

ABSTRACT "Battery Safety System Platform Based on Self-developed PSD Dynamic Curve Technology" mainly uses "Cloud Computing" and "Big Data" analysis and integration, calculate the current battery usage, at any time feedback to the system for users to query the current battery status. The advantages of this platform include: Battery Safety Status、Service life、Decline rate、Charging pricing、Regional Battery Switching Station Location Map、Map of Regional Charging Station、Recovery, etc. his core innovation technology independently develops PSD dynamic curve technology (Power, ShinnDar development), and combines BMS, EMS systems in the market with cloud signal receivers, which can be integrated by WiFi, China Mobile and China Unicom. Furthermore, the information can be transmitted through CAN, SPI or UART protocols among the management units of battery modules, and can be further transmitted to the upper control unit of battery management system (BCU). Based on these information, BCU can implement control strategies such as battery management, warning and security protection.

Key words: independent research and development, PSD dynamic curve technology, battery

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safety, battery management

“A Da 啟發創新機構” 商業計畫書

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摘要 本計畫書針對“A Da 啟發創新機構”，主要針對青少年，根據孩子的年齡分為小學創新教育、初中創新教育、高中菁英創新教育和大學進階創新教育四個階段，注重孩子對科學的啟蒙，通過我們的課程，增加孩子對科學的興趣，灌輸一些日常生活中的科學知識。

本團隊與廣東東軟學院有密切合作，為本公司奠定先前的良好的基地及訓練場所，為本公司輸送優秀的人才。與知正有密切合作，能為本公司解決相關智慧財產權糾紛，為本公司提供強有力的法律後盾。商業經營模式主要以客戶資源行銷、管理服務行銷、合作行銷。團隊成員有工商管理、市場行銷、財務管理專業，通過所學的知識進行專案的操作以及明確的分工，形成良性的互補。

本公司將全心全意創新教育行業，帶動科技教育行業發展，為國家培養雙創人才，展示中國國際創新影響力，為新時代開創新未來。

關鍵字：創新、科技教育產業、科學知識、啟蒙。

“A Da Institution for Enlightenment and Innovation” Business Plan

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ABSTRACT This plan is aimed at "A Da Institution for Enlightenment and Innovation". It is mainly aimed at young people. According to their age, it can be divided into four stages: primary school innovation education, junior middle school innovation education, senior high school elite innovation education and advanced university innovation education. It pays attention to the Enlightenment of children to science. Through our curriculum, it can increase their interest in science and instill some scientific knowledge in daily life.

Our team has close cooperation with Neusoft Institute Guangdong, which has laid a good base and training place for our company and provided excellent talents for our company. We have close cooperation with Zhizheng, which can solve the related intellectual property disputes and provide strong legal backing for the company. The business model mainly includes customer resource marketing, management service marketing and cooperative marketing. The team members have majors of business administration, marketing and financial management. With the acquired knowledge, they can carry out project operation and clear division of labor to form benign complementarity.

Our company will wholeheartedly innovate the education industry, drive the development of science and technology education industry, cultivate creative talents for the country, show China's international innovation influence, and create a new future for the new era.

Key Words: Innovate, Science and Technology Education industry, Scientific Knowledge, Enlightenment.

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肢體拼接的即興雙人舞蹈創作

黃靖舒*

摘 要 這創新的舞蹈是藉由繪畫的經驗，將創作者的情感與意念用繪畫溝通方式放入舞蹈肢體創作之中。

在繪畫創作的過程中，經驗作品與作者之間的交織與共享，並透過創作抽象繪畫作品遠離真實世界，抽除客觀世界中的人或物的「形體」，去看線條與顏色之間的不尋常遊戲及兩者之間的平衡。思考舞蹈創作的過程是否也能以此經驗，也因在當舞者時曾體驗編舞者說不清，語言像是巨大的鴻溝，將腦中畫面經過語言化在進入另一個人的腦中已是多次轉譯，也許會是成功的化學效應，也或許遠離了創作者的想要。語言的繁複及多義，有美麗之處，也可能造成誤會。若是創作中以畫作為彼此傳遞意念的通道，將以視覺直接接收意象，是否能夠有不一樣的發酵。並也藉此實驗，研究並討論繪畫所表達的方式應用在舞蹈編舞上的可能性。除了將畫替代語言作為創作中的傳遞方式，也希望創作者在組織架構時，以繪畫的經驗去思考取捨，並以結構即興的方式讓舞者與創作者都在有機的狀態下找到此作品的樣貌。

Using the body construction in painting technique on the work of impromptu double dancing

Ching-Shu Huang

Abstract This innovative dance uses the experience of painting, which puts the creators' emotions and ideas into the body creation through painting communication, to develop new works

In the process of painting creation, creators experience their works by interweaving and sharing. Also, they create abstract paintings away from the real world, which remove the "shape" of people or objects in the objective world, and look at the unusual game between lines and colors and the balance between the two. Whether the process of thinking about dance creation can also use this experience. The author go through some difficulty to clear the interpretation of choreographer when being a dancer. Language is like a huge gap. Translating the picture in the brain into another person has been translated many times. It may be a successful chemical effect, or it may be far from the creator's desire. The complexity and ambiguity of the language, the beauty, may also cause misunderstanding. If the creator uses painting as a channel for conveying ideas to each other, it will directly receive the image visually. Is it possible to have different fermentations? Through this experiment, It study and discuss the possibility that the way of painting is applied to dance choreography. In addition to using painting instead of language as a means of communication in creation, It also hopes that creators will use the experience of painting to think about choices when organizing the structure. The structure and improvisation let the dancers and creators find the appearance of the work in an organic state.

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