☐ Abstracts

Theme 1：Ocean Law and Policy, Marine Education

主題一：海洋法政及海洋教育

編號：ME01

The Research of Taiwan's Ocean Sustainable Development Policy from the Perspective of Marine Culture and Education

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Abstract

Taiwan has a rich marine culture offering marine education resources that have promoted marine professional education since 1953. However, marine general education and marine cultural education were not fully promoted until 2007 when the Ministry of Education issued a Marine Education White Paper on marine education policies. After 14 years, marine culture and education have become a popular educational issue in Taiwan. However, since marine culture and education spans across multiple marine-related disciplines, achieving a comprehensive balance across departmental affairs, and international integration remain the biggest challenges. This research is commissioned by the Ocean Affair Commission to study the long-term governance of marine multiculturalism and sustainable education. The PEST analysis is proposed through the review of marine culture and education-related literature and the integration of domestic and international marine culture and education policies. Additionally, eight marine culture and education experts were interviewed in-depth, and four fishing village focus groups were formed for this study. Taken together, the results provide relevant research and marine committee policy references. Eight policy directions are suggested for marine culture and education.

Keywords: Marine Culture; Marine Education; Ocean literacy, Ocean Policy, Ocean Affairs Council.

編號：ME02

Exploring the University Social Responsibility on SDGs14 in Taiwan: Using a Textual Analysis

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Abstract

The idea that a University education should include and fulfill Social Responsibility (USR) has become a trend in higher education in Taiwan. Common values emphasized by Sustainable Development Goals (SDGs) are closely related to USR. In addition to disseminating knowledge and cultivating professionals, universities are required to effectively provide support and act as coordinators at both the local and global levels in the future. In other words, effective connection to SDGs is the driving factor of promoting USR in Taiwan. Of note, Taiwan is an island country and therefore surrounded by water. Therefore, ocean sustainability has a significant impact on the overall development of Taiwan.

Judging from past developments, SDGs14 has already become a key factor in the connection between the USR Program and SDGs. However, it is unclear as to whether any progress was made for synchronizing the development of SDG14 within the timeline of the USR Program. This study analyzes SDG14-based projects conducted in different phases of the USR Program to identify the corresponding targets of SDG 14 for each project and to collect data on important issues concerning the development of the marine environment in Taiwan. The results are as follows:

a. Strengthen the connection with other targets because only the connections to SDGs 14.7 and 14.2 are found.
b. Most marine projects are conducted by maritime universities and follow a trend of connecting their own features to that of local areas.
c. Most marine projects are conducted in nearby coastal areas and fishing villages, and mainly focus on ocean pollution, the development of fishery products, or fishing culture conservation.

On the basis of these results, this study presents policy recommendations and areas for future research.

Keywords: Sustainable Development Goals 14 (SDGs 14), University Social Responsibility (USR), Developing Trend, Promoting Experience, Taiwan.

編號：ME03

An Effectiveness Assessment of Marine Education in Taiwan

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Abstract

The purpose of this study is to investigate the effectiveness of contemporary marine education toward ocean literacy, based on previous engagement experience. The analyzed data were collected from self-assessment questionnaires filled out by students aged 16-17 years old in one senior high school. The students' ocean literacy was used as the outcome variable, while the students' previous engagement of marine education was used as the independent variable. The total number of valid respondents in the study was 121 with a response rate of 86%. Students' engagement was found to be a key factor influencing their self-assessed effectiveness on marine education, especially on three principles of ocean literacy: "The ocean is a major influence on weather and climate" (principle 3), "The ocean and humans are inextricably interconnected" (principle 5), and "The ocean is largely unexplored" (principle 7). Additionally, a considerable correlation was detected between the engagement experience and participants' awareness, attitude, and the effective skills they use to protect the ocean. Judging from the literature, an increased awareness and exposure helps to develop abilities gradually. Further studies about long-term impact of marine education on students' ocean literacy are needed.

Keywords: Ocean Literacy, Engagement Experience, Environmental Education, Students' Self-Effectiveness Measurement.

編號：OLP01

A Legal Analysis of the Freedom of Navigation Operations and Innocent Passage Carried out by U.S. Warships in the South China Sea

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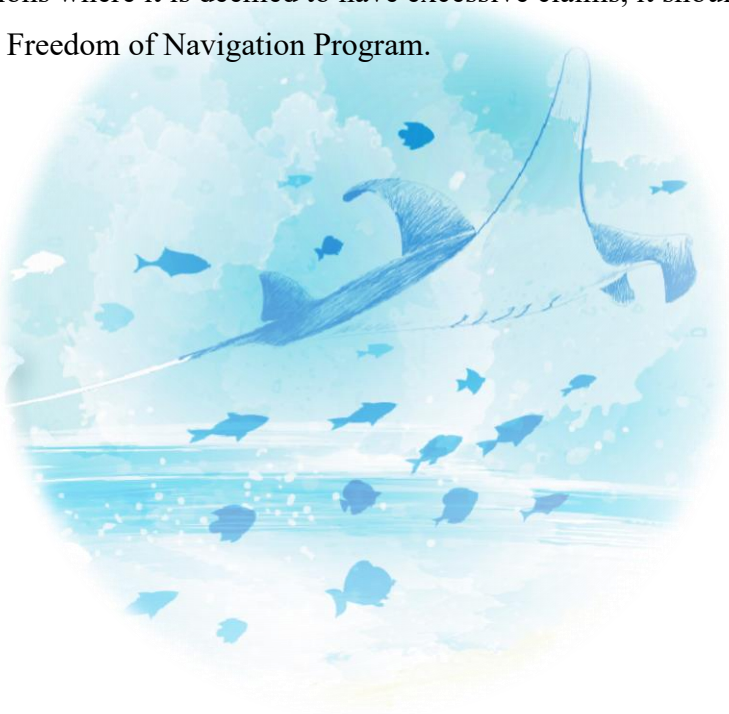
Abstract

This research starts from the history of free navigation, analyzes the content and policies of the United States' free navigation operations through the relevant provisions of the United Nations Law of the Sea Convention, and discusses possible pros and cons. Through inspections of legal documents, it can be found that the US free navigation operation is in line with the United Nations Law of the Sea Convention and the interests of the Indo-Pacific region. As far as the Republic of China is concerned, in addition to adjusting its practices to avoid continuing situations where it is deemed to have excessive claims, it should also actively work on the implementation of the Freedom of Navigation Program.

Keywords: Freedom of Navigation Program.



編號：OLP02

South China Sea Dispute: Rising Tensions in the East Vietnam Sea

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Abstract

Tensions in the South China Sea are rising. Long-standing sovereignty conflicts over the 1.2 million square miles of sea dotted with atolls, shoals, and reefs, as well as extensive overlapping claims to marine space, have been a source of considerable interstate friction over the years, particularly during the 1990s. A brief lessening of tensions occurred in the first half of the last decade, thanks in part to China's more accommodating and flexible approach, which was part of a diplomatic "charm offensive" aimed at assuaging regional concerns about the country's expanding economic, political, and military dominance. However, in the years 2016-2021, the situation in Vietnam's East Sea has grown increasingly tense.

Keywords: South China Sea Dispute, Viet Nam, UNCLOS (1982).

編號：OLP03

Comparison of the Responsibilities of Ocean Specialized Agencies between Taiwan and Other Countries

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Abstract

Due to the lack of assessment and management of the overall marine affairs in Taiwan, there appears to be a need for an ocean specialized agency in the central government. The aim of the ocean specialized agency is to efficiently coordinate lots of issues and interests concerning the implementation of marine policies and pursue an overall perception of marine policies and their structure of law. The overall marine policies could lead the country to manage the overall marine activities, such as shipping, fishing, marine science, defense, underwater cultural heritage, and marine pollution, etc.

In this study, we use three completely different types of marine specialized agencies for comparison, respectively being the Ocean Affairs Council (Taiwan), the National Oceanic and Atmospheric Administration (the United States), and the Ministry of Oceans and Fisheries (South Korea).

The Ocean Affairs Council and the National Oceanic and Atmospheric Administration are responsible for coordinating marine affairs delegated to different departments. While the Ministry of Oceans and Fisheries is classified as a ministry, and all the authorities are its subordinates.

According to the result of the comparison, the strength of coordination of the National Oceanic and Atmospheric Administration is less than that of the Ocean Affairs Council due to the concept of dominant agency in the United States. Korea has the best efficiency in executing marine policies and handling marine affairs and problems.

However, from our perspective, we accept the existing tradition of a functional division of labor, and through improving coordination, the government can still have a great efficiency in managing overall marine affairs without having to establish a unified system. We hope that the Ocean Affairs Council can lead Taiwan to become a global maritime power with "ecology sustainability, maritime security, and industrial prosperity".

Keywords: Ocean Specialized Agency, Marine Policy, Ocean Affairs Council, National Oceanic and Atmospheric Administration, Ministry of Oceans and Fisheries.

Theme 2：Marine Science & Technology

主題二：海洋科技

編號：MST01

Microplastic as Vectors for Heavy Metal Contaminants at Various Salinities

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Abstract

Microplastic (MP) is a pollutant that has received great attention nowadays. MPs are reported to interact with heavy metals. However, the interaction between the two is still poorly understood. This study aims to examine the adsorption capacity and release rate of heavy metals concerning various types of MP particles, different heavy metals, the initial heavy metal concentrations, and salinity. The results show that there is an interaction between MP particles and heavy metals in all tests with different salinities. At higher salinity, the rate of adsorption and release of heavy metals in MP particles become lower and takes a longer time to reach equilibrium. Polypropylene (PP) MP particles have a higher absorption of heavy metals compared to other types of MP particles. In all tests with different salinities, Pb was consistently adsorbed the most by MPs, followed by Cu, Zn, and Cd. Different types of MPs also affect the release value of heavy metals. The heavy metal with the highest release rate was Cd, followed by Pb, Cu, and Zn. Increasing the concentration of heavy metals causes the adsorption capacity (μg/g) of MP particles to also increase, but the adsorption rate (%) decreases. Finally, our findings show that MP particles have potential as a vector for heavy metal contaminants in both freshwater, brackish water, and seawater environments.

Keywords: Microplastics, Heavy Metals, Adsorption, Release, Salinity.

編號：MST02

Extended Finite Element Method for a Plate with Two Holes and Multiple Cracks

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Abstract

In this paper, the nonlinear behavior of contact was incorporated into the linear global equations by an iterative scheme to resolve the nonlinear boundary value problem. The combination of this method with Extended Finite Element Modeling (X-FEM) enhanced the efficiency of the contact analysis solution procedure. An algorithm which couples the level set method with the X-FEM was proposed by Stolarska et al. (2001), in which a discontinuous function based on the Heaviside step function was employed in modeling two-dimensional (2D) linear elastic crack tip displacement fields.

Keywords: Extended finite element method, level set method, holes, model 2D crack.

編號：MST03

Development of Oceanic Exploration and the Risks Faced

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Abstract

This essay discusses the development of oceanic exploration and the associated risks. It is divided into five parts: The first part introduces the background development of marine science technology, emphasizing the important contributions of Aristotle, Captain Cook, and W. Thompson in the aspects of marine ecology. Later on, explorers such as Captains Cook and Thompson also contributed to marine science and research. The second part discusses the application and breakthrough of marine technology. As early as the 8th century, the Vikings used strong ropes to measure the depth of the sea. After the 19th century, the sounding measurement was employed for the same purpose but with far better effects. In 1865, the first underwater breathing apparatus was invented. In 1946, the aqualung was invented and was used to explore the sea floor. Later on, newly invented underwater instruments were able to detect sounds from whales and the quantity of chemical elements of sea materials. Finally, autonomous underwater vehicles (AUVs) and remotely operated underwater vehicles (ROVs) were created to conduct research on the sea floor. These technological advancements now provide convenient means for deep sea exploration.

Second, the establishment of ecological observatories, such as Monterey Accelerated Research Systems (MARs), enabled researchers not only to observe sea bottom ecology but also to detect and predict earthquakes. The third part focuses on the problems and risks of off-shore explorations, which requires workers to employ heavy machinery and work in dangerous weather. It is extremely dangerous to work off-shore. Casualties are reported every year in the U.K. and many other countries. The fourth part deals with deep sea exploration. The deep sea is dark, cold, and its water pressure is about ten times higher than that of the sea surface. In order to reduce hazardous risk, researchers must not stay on the sea bottom too long, or else they must use submersibles or robots to do the work instead. These tools and equipment should be maintained often so that the researchers' safety can be guaranteed. In the last part of this essay, the author summarizes how modern marine technology offers tremendous conveniences for human exploration of the sea. Continuous studies on this subject are needed to further advance oceanic explorations. It is hoped that this essay will help those who are interested in marine exploration and science as well.

Keywords: Marine Exploration, Technology Development, Oceanic Research.

編號：MST04

Bioprospecting of Marine Microalgae from Kaohsiung Seacoast for High Value Products

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Abstract

Bioprospecting of marine microalgae isolates were carried out from seawater samples from various locations of the Kaohsiung city harbor seacoast, Taiwan. The major focus of this research was to isolate fast-growing and high yielding potential microalgae strains (biomass) for value products that find applications in energy and heath. First, a seawater sample was enriched in a Tris-Acetate-Phosphate (TAP) media prior to growth in a TAP agar plate. Once a single colony was obtained, it was grown into a 1 L culture successively to obtain adequate dried biomass prior to screening their potential for lutein and fatty acids. Several microalgae isolates were screened for lutein and lipids using a biorefinery concept and chromatographic methods. The major objectives of this research were (1) to identify the best microalgal strain for enhancing the yield of these products, (2) to explore process enhancement strategies including other trophic (autotrophic, heterotrophic, and mixotrophic) modes with different organic sources (glycerol, molasses, standard sugars), and (3) to optimize growth conditions, such as lighting, C/N ratio, pH, temperature, etc. The outcome of the above screenings will be disseminated in detail during the conference, and will cover several potential strains from the Taiwan seacoast which were discovered to be best for harvesting particular types of products.

Keywords: Marine Microalgae, Tris-Acetate-Phosphate.

編號：MST05

A Comparative Study on the Production of Bacterial Cellulose of Komagataeibacter europeaus and Komagataeibacter xylinus

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Abstract

Bacterial cellulose is an excellent biomaterial due to its remarkable properties and which finds applications in various areas. In this study, we have optimized the bioprocessing parameters for bacterial cellulose production. The effects of the cultivation/incubation period and the inoculum ratio on bacterial cellulose production by Komagataeibacter europaeus and K. xylinus were studied and compared. The sugar utilization efficiency was affected by the inoculum ratio of the two strains. An inoculum ratio of 5% was found best for both the bacterial strains for cellulose production. K. europaeus and K. xylinus showed a 57.58% sugar utilization efficiency at a 5% inoculum ratio, and a 49.27% sugar utilization efficiency at a 12.5% inoculum ratio, respectively. This work provides optimized parameters to execute the bioprocess production of bacterial cellulose.

Keywords: Bacterial Cellulose, *Komagataeibacter,* Bioprocess.

編號：MST06

Discussion of Special Typhoon Generating Areas

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Abstract

In summer and autumn every year, typhoons always cause serious disasters to Taiwan, not only causing casualties, but also causing heavy losses to agriculture and industry. Furthermore, this occurs not only in Taiwan, but also tropical cyclones (typhoons or hurricanes, depending on the location of formation) occur in many other parts of the world. Interestingly, there are some tropical areas where cyclones rarely occur. Finding the reason why is the purpose of this work. Accounts from textbooks and literature surveys were too brief to provide us with a complete answer, and the information on the Internet was fragmented. This work attempts to provide this missing information, as relevant research sparsely comments on this question. Our curiosity and ambition invites us to unify the data found through this research and solve the confusion.

Keywords: Special Typhoon.

Theme 3：Ocean Conservation

主題三：海洋保育

編號：OC01

Exploring Fishery Management Options using System Dynamics

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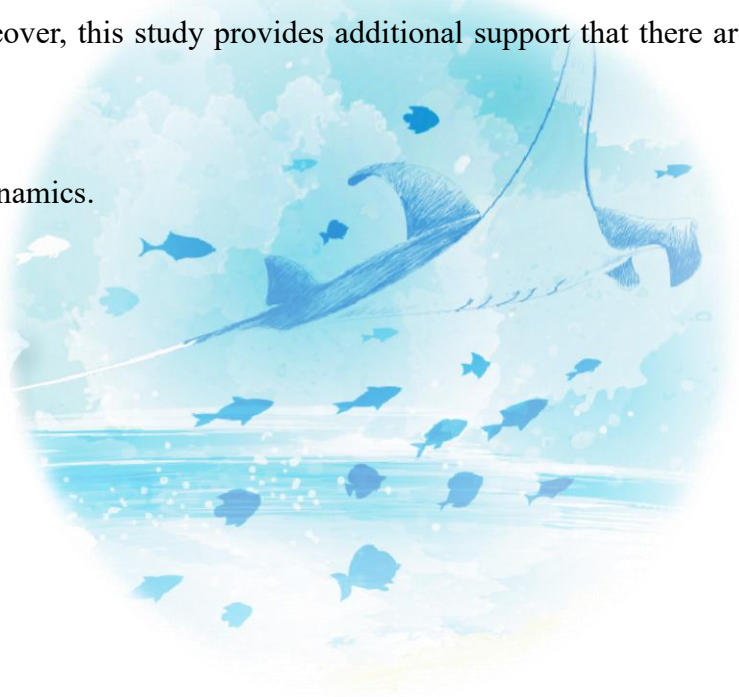
National Sun Yat-Sen University

Abstract

System Dynamics (SD) is a technique used to imitate real world phenomena through modeling. This study used SD to explore management options for sustainable fishery specifically to simulate the effects of supply and demand of fish and Marine Protected Areas (MPAs) on fish stocks. It was assumed that habitats inside and outside the MPA were similar. The model was calibrated with actual datasets taken from Pingtung, Taiwan. Three scenarios were built: (1) a varying percentage of protection, (2) policies that aim to reduce the demand for fish consumption, and (3) a composite scenario to determine how these may affect fishery production. Our results show that the calibrated model fits the reference model reasonably well. Based from our model, we also find that 15% protection will result in an optimal strategy to obtain equal benefits from both yield and stock, while 80% protection may be ineffective. It is also indicated in our results that 20% protection will result in the same yield as that of reducing 30% of the population demand and a combination of 15% reduction and approximately 12.5% protection. This study further shows the importance of SD and modeling in drawing possible conservation scenarios that may be beneficial for sustainable development. Moreover, this study provides additional support that there are multiple options to address a certain goal.

Keywords: Marine Protected Area; System Dynamics.



編號：OC02

Marine Debris Identification based on Deep Learning Neural Network and Optimization Technology

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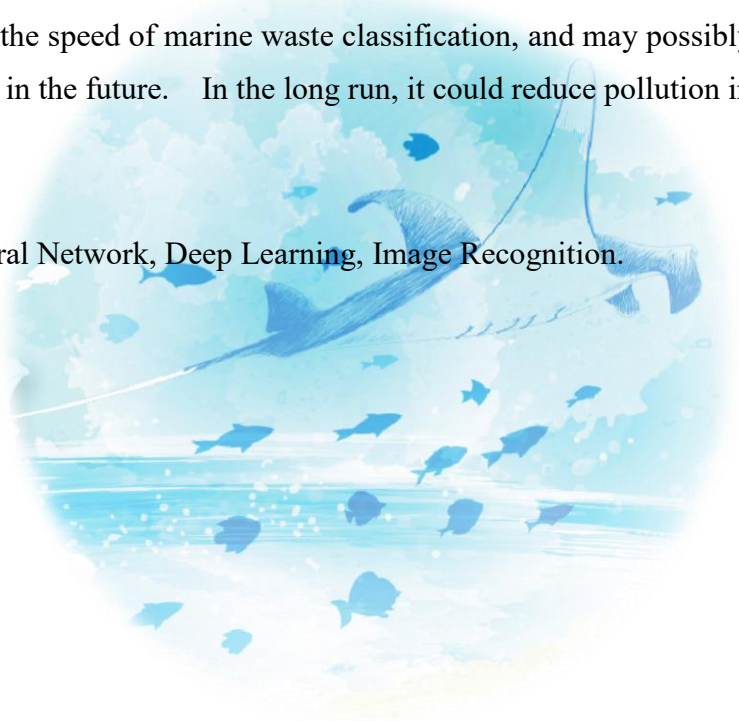
Abstract

Recently, environmental conservationists have paid more and more attention to incidents of marine organisms eating plastic waste resulting in death. After taking part in beach cleaning activities, I observed a significant amount of marine debris on the coastline that required long working hours of sea waste classification. Therefore, I would like to solve the problem of identifying the types of sea waste and thereby reduce the burden on workers in recycling industries and the staff of beach cleaning events. With advanced technology on artificial intelligence (AI) in recent years, Deep Learning's Convolutional Neural Network (CNN) is booming. As a result, I have classified the types of marine debris into plastic bottles, plastic bottle caps, straws, and floats, using Deep Learning's Convolutional Neural Network as the basis of marine debris identification models. The number of marine debris may be estimated via image recognition technology in the near future, making recycling faster. I hope to transplant the trained CNN model to the smartphone as an application program software (APP) for real-time identification of marine debris. As a consequence, the software may help accelerate the speed of marine waste classification, and may possibly be utilized in other ways to manage recyclables in the future. In the long run, it could reduce pollution in the sea that is mainly caused by humans.

Keywords: Marine Debris, Convolutional Neural Network, Deep Learning, Image Recognition.



編號：OC03

The Effects of Underwater Acoustics on Negaprion acutidens

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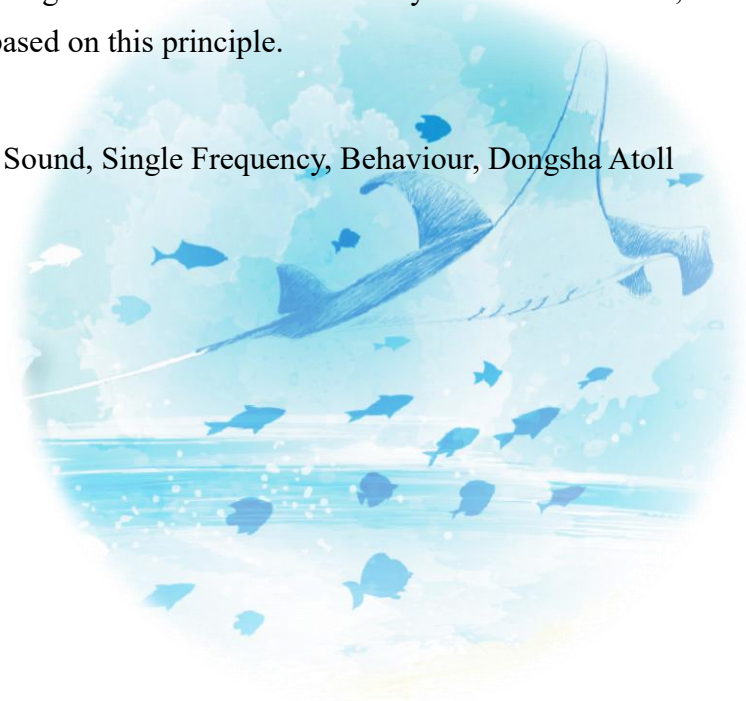
Abstract

Sound is known to affect the behavior of sharks. It is suggested that this characteristic has the potential to be employed not only to protect the sharks but also prevent people from being harmed by sharks. In this study, the response of the sicklefin lemon sharks *Negaprion acutidens* were explored using single-frequency underwater sounds. In the experiment, bait tubes were kept to attract the sicklefin lemon sharks, and an underwater speaker was used to emit the sounds. Ten frequency ranges from 25~800Hz, were selected along with silent controls, and the behavior of sharks were filmed with an underwater camera. The study conducted 20 experiments, with data being gathered for all. Observations showed that there was a correlation between the presence of sound and the behavior of sharks, indicating that sharks had a higher probability of contacting the bait tubes in the absence of the sound treatment. However, there was no significant difference in the number of sicklefin lemon sharks in the video with or without sound. Overall, this preliminary study revealed that the sicklefin lemon sharks could hear and respond to the sound information accordingly. Their feeding behaviors were modified by the artificial sound, and it is plausible to develop conservation methods based on this principle.

Keywords: *Negaprion acutidens*, Underwater Sound, Single Frequency, Behaviour, Dongsha Atoll National Park.



編號：OC04

The Ocean's Future：When Marine Preservation Meets COVID-19

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Abstract

We are living in a world of COVID-19 which has a significant impact on our lives. Yet, we probably never realized how much the pandemic has influenced marine wildlife. This paper attempts to emphasize the relations between marine conservation and COVID-19. At the same time, how each type of marine industry is affected by COVID-19 is thoroughly explained in context. Hopefully, the hidden astonishing facts revealed in this study will bring further awareness to the general public.

While world nations invest huge amounts of funds to save marine departments, it is our belief that ensuring these infusions of capital are beneficial towards rebuilding bluer and healthier oceans under sustainable and fair circumstances. By adopting evidence and data through the context, the primary objective of this study is to offer public and governmental guidelines for appropriate initiatives to resolve problems related to ocean sustainability during the crises. In conclusion, we propose that marine conservation efforts require a concentrated public effort. Consequently, we can restore “blue” and “green” marine ecosystems.

Keywords: COVID-19, Marine Conservation, Marine Industries, Blue Economy, Sustainability.

編號：OC05

Ecology and Exploitation of Mud Lobsters in the Philippines: A Social Media Analysis

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Abstract

Mud lobsters are burrowing crustaceans, somehow neglected in scientific studies in the Philippines. Increasing risks brought by this pandemic further impede field surveys as mobilization is highly regulated. Hence, the use of social media platforms was explored to study the ecology and exploitation of mud lobsters in the country. We used content analysis of YouTube videos. Key terms were searched to identify contents such as “Philippines”, “mud lobsters”, and local terms like “bulaso”, “uson”, and “urong”. A total of 30 videos were analysed. Videos were posted from 2015-2021 from at least 10 Provinces. Results reinforce already known wide distribution of mud lobsters in mangrove forests, fishpond areas and rice fields beside mangroves. Still, there were important mud lobster behaviours observed, such as surfacing during rainy season, and the timing of when a disturbed burrow is repaired. Mud lobsters were commonly caught using bamboo traps but some people developed unique fishing techniques, such as mound disturbance and the tali-tali method. Alarmingly, this study also discovered an illegal fishing activity hotspot where the use of toxic chemicals is concentrated. This study provides evidence on the potential use of social media to study aquatic organisms. Additional knowledge on mud lobster ecology and baseline information on some aspects of its fishery in the Philippines was observed.

Keywords: Behaviour, Fishing Methods, Illegal Fishing, Thalassinidae, YouTube Videos.

編號：OC06

Comparing size and density fractionation in phytoplankton trace metal assessment

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Abstract

Studies on phytoplankton and its effects on trace metal biogeochemical process have increased in the past decades. However, determining trace metal stoichiometry for phytoplankton is challenging due to the difficulty of isolating phytoplankton assemblages from other suspended solids. Assessment in marine environments currently employs two distinct methods, size and density fractionation, where results were usually treated similarly in previous studies. Here, we compared trace metal concentrations in phytoplankton using the two aforesaid techniques. Trace metals such as Cu, Zn, As, Hg, and Pb were analysed using an inductively coupled plasma mass spectrometer. It was found that trace metals in density fractionated plankton were lower compared to those in size fractionated samples. A highly significant difference of $P < 0.01$ was found in both small (1.2 to 55 μm) and large (55 to 120 μm) fractions for As concentrations. Zn and Hg were also significantly lower at $P < 0.05$ in smaller fractions and in both fractions for Cu. Using both data from size and density fractionated plankton, we estimated that trace metals of abiogenic origin contribute 72-88% of the trace metals in the 1.2 to 120 μm plankton size fractions. This study proves that density fractionation can significantly reduce trace metals in plankton samples. Also, the high estimated trace metal concentration from abiogenic sources suggest that trace metals in size fractionated plankton reported as concentrations in phytoplankton may have been overestimated. Hence, the reduction of abiogenic materials present in plankton samples is important to provide a more accurate picture of phytoplankton contributions in trace metal biogeochemistry.

Keywords: Biogeochemistry, Heavy Metals, Kaohsiung Harbor, Phytoplankton, Stoichiometry.

Theme 4：Maritime Safety & Security

主題四：海域安全

編號：MSS01

Identifying Safety Risk Control Factors in the Waters around Taiwan – A Case Study of Ship Collision

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Abstract

The waters around Taiwan are a moderate risk environment with frequent ship collisions that result in not only injuries, missing and even death of ship's crew, but also devastation of marine ecology and the environment. In 2019, the Covid-19 pandemic caused global economic panic and most businesses went into a nose dive, including the shipping business. However, that did not lead to the decrease of ship collision incidents. On the other hand, the Covid-19 vaccination campaign in the second half of 2020 seemed to gradually keep the pandemic under control, and the shipping business started to experience explosive growth worldwide, which included Asian shipping routes. Because Taiwan is situated at the center of the Asian maritime hub, the complexity of maritime transportation started to increase. In response, this study is designed to investigate the risk factors of ship collisions in the waters around Taiwan. 29 initial risk factors were identified in a literature review, and 8 of these were selected as representative factors having a significant correlation and influence as determined by an expert decision-making team, rough set theory (RST), and rough sets theory for group decision making to representative indicators (RGRI). Finally, the bow-tie analysis is introduced to identify the causes of ship collision and the consequences, so as to keep the occurrence of ship collisions and the consequences of collisions in check.

Keywords: Rough Set Theory, Bow-tie Analysis, Ship Collision.

編號：MSS02

Marine Spread of the Exotic Disease: The Need for Reinforcing Communication on African Swine Fever with the Upcoming Restorations of the Yanliao Fishing Port

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Abstract

This paper (study) reflects important communications regarding the environmental efforts needed to restore a fishing port, and how to implement risk management concerning the possible spread of African Swine Fever (ASF) due to the marine transport of people and products from around the world. Several precautions are recommended as necessary to prevent the transmission of this deadly disease for pigs.

A meeting for discussing the status quo, restoration, and management of the Yanliao fishing port was held on Oct 8, 2020 in Hualien, Taiwan. One of the purposes of this meeting was to examine Yanliao as a possible hotspot of disease transmission that would deserve a regional response, regular monitoring, and compensation. Attendants ranging from governance officials, professors, and locals did not concur about how to prevent the spread of the exotic disease, and unanimity was not achieved on all the policy questions that were posed. Upon reflection, it can be seen that media communications complimentary to the issues posed at a meeting (conference) can assist the communication of risk factors and increase the consideration of risk assessments in the planning process. As part of the restoration campaign, risk communications were not made available to people of Yanliao to raise awareness of the risk of spreading the disease, such as posters, brochures, a short animation, and a general information video. Many of these media tools are still not available to the general public.

Keywords: Risk Communication, Yanliao, ASF.

編號：MSS03

A Study on Homicides at Sea and Preventive Strategies

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Abstract

Homicides at sea have become more serious in recent years, however very few studies have been conducted in Taiwan. This study intends to fill such a void, and hopefully explore the underlying factors of such heinous violent crimes. To achieve the above goal, data was collected from Taiwanese court cases from January 1974 to June 2021. A total of 92 homicide cases were found that matched the research criterion.

After processing and analyzing the data by frequency analysis, the basic attributes of 13 variables were obtained. The "seriousness of the homicide" was categorized into two groups, the "low group (1 death each case)" and the "high group (≧ 2 deaths)". There were eight variables significantly related to these two groups, while four variables were unrelated by Chi-square test. This study employed the "Quantification Theory Type II" to determine which factors discriminate between the two groups. The order of importance of the eight relative factors is as follows: (1) seagoing duration, (2) motive of the assault, (3) the type of assault, (4) nationalities of the offender(s) and victim(s), (5) acting alone or with accomplice, (6) the geographic location of the assault, (7) drinking before the assault or not, (8) fallen (or thrown) into the sea or not. These eight variables constitute a discriminating model and a relatively high 73.91% positive identification rate was derived.

After completing the analysis, the preventive strategies are proposed as follows: (1) Appropriate seagoing duration. (2) Careful selection and appropriate training of the crew. (3) Improved local culture courses for foreign crew. (4) Improvement of management problems. (5) Strengthening of maritime law enforcement. (6) Construction of emergency systems. (7) The application of a secret satellite tracking system.

Keywords: Maritime Safety, Law Enforcement, Violence, Homicide, Quantification Theory Type II.

編號：MSS04

Border Security Management during a Pandemic – A Case Study on Coast Guard Authority

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Abstract

The COVID-19 virus was first found at the end of 2019 and soon spread across the world in 2020, and turned into a global pandemic later. As of June 2021, 174 million were tested positive for the virus around the world, including more than 3.773 million deaths. This is one of the greatest pandemics in the human history (COVID-19 Pandemic 2021).

The Central Epidemic Command Center established an emergency protocol for large-scale infection events, such as the COVID-19 infection on board the cruise ship SuperStar Aquarius, and it was a significant success. In response, the Fleet Branch, the Coast Guard Administration, and the Ocean Affairs Council developed several quarantine practices as an indication that the government is taking the pandemic very seriously.

However, a closer look suggests that the quarantine actions taken, as presented above, were developed for vessels arriving at dock. Those who work on board the vessels under the command of the Fleet Branch are in fact frontline workers who investigate smuggling and stowaways, and perform emergency rescues at sea. They are addressing situations that happen out at sea in a harsh environment, within a confined space where resources are limited, and it is therefore not easy to provide support. On the other hand, standard operation procedures are lacking, ranging from how to conduct an investigation at sea to protocols for bringing a violating vessel back to Taiwan's territory. This study is designed to establish a standard operation procedure for the safety of those who enforce maritime law on the high seas.

A literature analysis was conducted to collect and compare the available knowledge, including "Port quarantine in the case of SuperStar Aquarius" on Feb 8 2020, the "Quarantine Practice for Duties on Vessels at Sea for Severe Pneumonia with Novel Pathogens", and "Rules for Quarantine of Transgressing Chinese Mainland Vessels with Violation Records during COVID-19 Pandemic" which was established by the Fleet Branch, the Coast Guard Administration, the Ocean Affairs Council, and the Executive Yuan in 2021. Suggestions were proposed for the COVID-19 quarantine of maritime investigations by the Coast Guard Administration in Taiwan after a series of data sorting, analysis, and compilation. To prevent the pandemic from further spreading, the following are concluded and suggested: (I) intruding vessels found outside of Taiwan's territorial waters should be driven away; (II) for smuggling found in Taiwan's territorial

waters, it is suggested that: (1) a dedicated quarantine site should be established with quarantine facilities and manpower to contain possible virus intrusions, and (2) the production of maritime smuggling investigation documents should be postponed in order to reduce the workload and exposure of the personnel on duty, and thereby reduce the risks of infection among frontline workers.

Keywords: COVID-19, Coast Guard, SuperStar Aquarius.

編號：MSS05

Continuous Berth and Dynamic Quay Crane Assignments by Using a Hybrid Approach Combining an Improved Shuffled Frog-Leaping Algorithm with a Simple Heuristic

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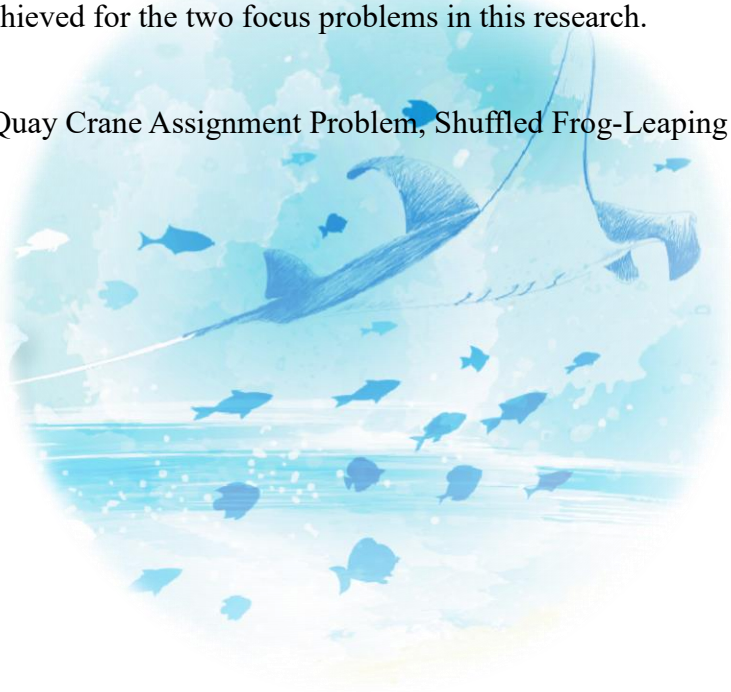
Abstract

Berth Allocation Problem (BAP) and Quay Crane Assignment Problem (QCAP) are two essential operational problems in a container terminal. They can affect the performance of a container terminal considerably. This research focuses on dealing with the Dynamic and Continuous BAP (DCBAP) and Dynamic QCAP (DQCAP) by using a hybrid approach which combines an Improved Shuffled Frog-Leaping Algorithm (ISFLA) with a simple heuristic. A two-stage procedure is employed. The first stage employs ISFLA to initiate an operational sequence; the second stage uses a heuristic to deal with the DQCAP, while resolving the problem of overlapping shipping. The purpose of the hybrid approach aims to best allocate the berth and QCs in the DCBAP for ships calling in at container terminals. Here, a quay is used as a continuous line to accommodate calling ships. In the DQCAP, the number of QCs assigned to a ship can be further adjusted to best utilize the available QCs. Experiments have been conducted and the results showed good solutions have been achieved for the two focus problems in this research.

Keywords: Berth Allocation Problem (BAP), Quay Crane Assignment Problem, Shuffled Frog-Leaping Algorithm (SFLA).



編號：MSS06

“Semper Paratus” in the Tri-Service Maritime Strategy of American Seapower: How Can the Taiwan Coast Guard Deal with China’s Grey-Zone Conflict?

Tzu-Hao Liao

National Cheng Chi University

Abstract

The maritime grey-zone conflict has become the major concern of national and global security, especially with the rise of China. The US and its allies in East Asia are focusing on hybrid strategies to balance the security threats. In this article, we examine the mechanism of inter-operational cooperation and the joint strategic concept of the US Coast Guard (USCG) among maritime services, and provide further suggestions for the Taiwan Coast Guard Administration (CGA) in the contemporary era of grey-zone conflict. The article unfolds in four parts. The first part depicts the aggrandisement of national threats towards Taiwan and the US by outlining crucial actors and behaviour types in East-Asian maritime grey-zone conflicts. The second section discusses the current development and configuration of the CGA, a fairly new naval force established in 2000. The third part analyses the integrated approach of the unified maritime strategies of the USCG which plays a pivotal role in homeland security and international partnership. In the concluding segment, directions and implications of future bilateral cooperation in the Indo-Pacific strategy, and domestic improvements for CGA are considered. Building on these insights, this article suggests 4 focal points for forwarding Taiwan-US arrangements. (1) It is essential for Taiwan to review the grand combat environment in a more innovative way. (2) Multi-service interoperability should be prioritised when forming a united maritime strategy. (3) Operational conditions in the post-pandemic era act as a contributing factor of multi-domain warfare. (4) Also, emphasising the free circulation of intelligence and information in both domestic services and international alliances will serve Taiwan’s policy goals.

Keywords: US Coast Guard, Taiwan Coast Guard, Grey-Zone Conflict, National Security, Taiwan-US Cooperation.

Theme 5：Ocean Environmental Engineering

主題五：海洋工程

編號：OE01

A P-Y Based Approach to Predict the Displacement of Monopiles Embedded in Soft Clay due to Long-Term Cyclic Loading

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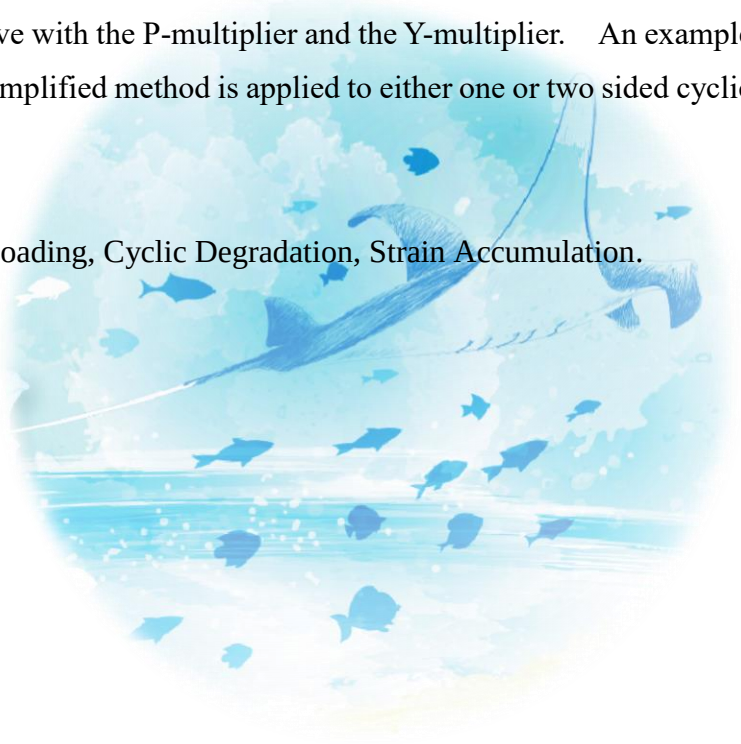
Abstract

Offshore wind turbines (OWTs) are subjected to environmental loadings such as those induced by waves or wind, typically comprising up to millions of cycles with small to moderate amplitudes (so-called high-cycle loading). To evaluate the performance of OWTs during a lifetime cycle, this study proposed a P-Y based approach to predict monopile displacement due to long-term cyclic loading. Cyclic loading may cause an accumulation of strain and a build-up of excess pore water pressure under undrained conditions, accompanied by a corresponding change of stiffness and shear strength in soft marine clay. Therefore, in the proposed procedure, a P-multiplier and a Y-multiplier are first determined based on the cyclic degradation and strain accumulation, respectively estimated by a generalized empirical model built on a given loading condition. Afterward, the responses of piles subjected to long-term cyclic loading are predicted by modifying the preselected P-Y curve with the P-multiplier and the Y-multiplier. An example is presented to demonstrate how the proposed simplified method is applied to either one or two sided cyclic loading.

Keywords: P-Y Analysis, Long Term Cyclic Loading, Cyclic Degradation, Strain Accumulation.



編號：OE02

Synthesis of $NiCo_2O_4$/MnOOH/GO Heterojunctions to Enhance Catalytic Activity for PMS Activation toward Ciprofloxacin Degradation.

Van-Re Le[1], Thanh-Binh Nguyen[1], Chiu-Wen Chen[1], Cheng-Di Dong[1]

1 Department of Marine Environmental Engineering, National Kaohsiung University of Science and Technology

Abstract

In this research, the fabrications of manganese oxyhydroxide (MnOOH), MnOOH-reduced graphene oxide (MnOOH/GO), and ternary heterojunctions of $NiCo_2O_4$/MnOOH/GO were successfully synthesized by thermal methods. The morphological structure of the catalyst was determined by scanning electron microscope (SEM) observation. These catalysts were used with a peroxymonosulfate (PMS) activator to enhance the catalytic activity for the ciprofloxacin (CIP) degradation. Results showed that $NiCo_2O4$/MnOOH/GO demonstrated the highest performance. The removal efficiency of CIP (0.02 mM) was 94% after a 30 min reaction at a dosage of 0.2 mM PMS and 0.15 g/L $NiCo_2O_4$/MnOOH/GO. The observed kinetics rate constant (kobs) of the $NiCo_2O_4$/MnOOH/GO system was 1.77 x 10^{-1} min^{-1}, which was 7.5 and 4.5 times higher than that of MnOOH and MnOOH/GO, respectively.

Keywords: $NiCo_2O_4$, MnOOH, GO, Peroxymonosulfate, Ciprofloxacin.

編號：OE03

Adsorption of Tetracycline by Polyethylene Microplastics under Different Wavelengths of UV Light Irradiation

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Abstract

One of the main factors impacting the microstructural changes of polymers is UV light. This study provides a basic comparison of the different effects that varying wavelengths of UV light have on polyethylene microplastics (PE MPs). Here, the aging mechanism of PE MPs under the influence of different wavelengths of UV light (254 nm and 360 nm) and the adsorption behavior of tetracycline (TC) after aging has been studied. The results show that under different wavelengths, the characteristics of PE MPs undergo different chemical changes. A kinetics model is offered to illustrated that the adsorption capacity of TC on the PE MPs particle surface is higher after aging compared to before. Based on the Langmuir model, the adsorption amounts of the original PE MPs, after aging by 245 nm UV light, and after aging by 360 nm UV light, is 9.77 mg g^{-1}, 14.15 mg g^{-1}, and 40.03 mg g^{-1}, respectively.

Keywords: Adsorption, Polyethylene, Tetracycline, UV Light.

編號：OE04

Modification of Zeolitic Imidazole Framework-67 (ZIF-67) by Nitrogen as a Predominant, Adsorbent, and Highly Efficient Peroxymonosulfate Activator for Ciprofloxacin Degradation

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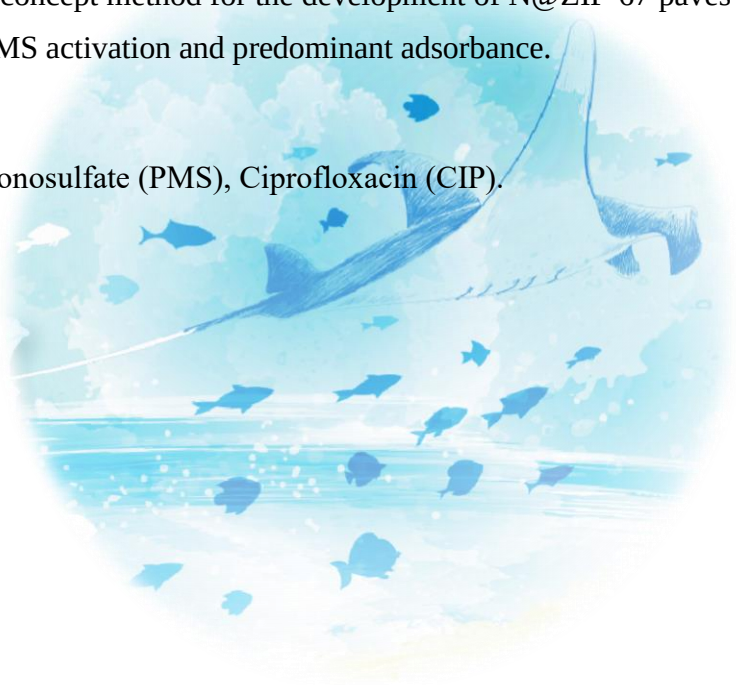
* Corresponding Author

Abstract

In this study, N doped ZIF-67 was facilely prepared via hydrothermal methods and applied in a heterogeneous catalytic activation of peroxymonosulfate (PMS) and adsorption for ciprofloxacin (CIP) degradation. The catalytic activities were systematically studied on an adsorption isotherm, catalyst dosage, and PMS dosage. The results showed that the removal of CIP (87%) was achieved using N@ZIF-67/PMS system after 30 min of reaction under optimal conditions. Based on HPLC results, the degradation pathway of CIP in N@ZIF-67/PMS system was put forward. The results showed that the synergistic effect between N and the ZIF-67 structure not only significantly boosted the removal efficiency, but also added to the long-term stability of the composite. This proof-of-concept method for the development of N@ZIF-67 paves a new way for wastewater remediation through PMS activation and predominant adsorbance.

Keywords: Nitrogen Doping ZIF-67, Peroxymonosulfate (PMS), Ciprofloxacin (CIP).



編號：OE05

Mesoporous and Adsorption Behavior of Algal Biochar Prepared via Sequential Hydrothermal Carbonization and $ZnCl_2$ Activation

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Department of Marine Environmental Engineering, National Kaohsiung University of Science and Technology

Abstract

In this study, biochar derived from brown algal Ascophyllum nodosum was synthesized through coupling hydrothermal carbonization (HTC) with $ZnCl_2$ chemical activation, and was used as a sustainable adsorbent for the removal of ciprofloxacin (CIP) from water. Fourier transform infrared (FTIR) spectroscopy was used to clarify the surface properties of the prepared biochars. Batch adsorption experiments were conducted to explore the adsorption performance of biochars under the effects of different parameters (initial pH, adsorbate concentration, temperature, etc.). The results showed that mesoporous biochar with remarkable adsorptive properties was successfully prepared by combining the HTC and $ZnCl_2$ activation methods. The application of the prepared biochar in CIP removal showed a favorable adsorption capacity (350−400 mg g^{-1}). Overall, algal biochars, as a product recycled from biowaste, demonstrate a novel and promising adsorbent for the effective and sustainable removal of pollutants from water.

Keywords: Algal Biochar, Hydrothermal Carbonization, $ZnCl_2$, Ciprofloxacin (CIP), Adsorption.

編號：OE06

Removal of Tetracycline Hydrochloride from Water via Peroxymonosulfate Activation by Oxidation Biochar Supported Nickel Cobaltite Particles

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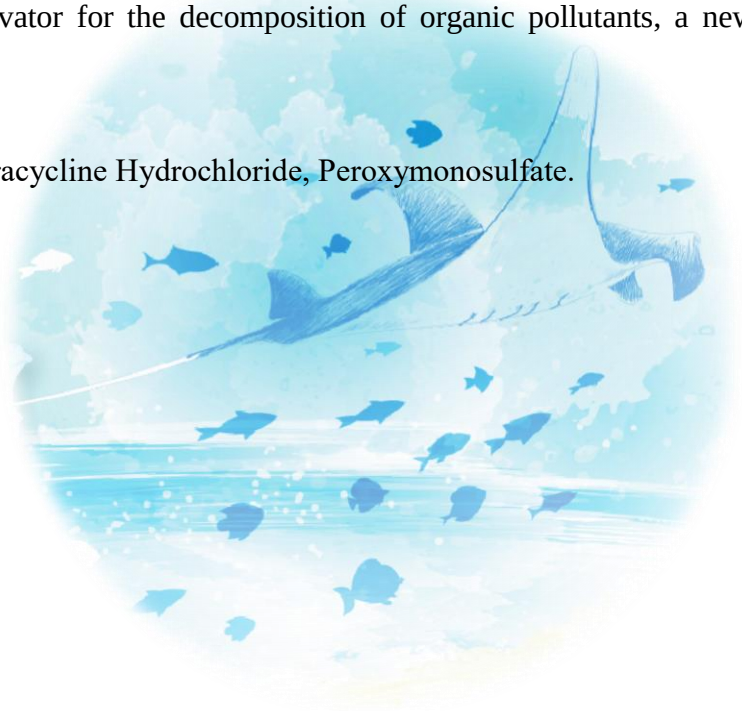
Abstract

The objective of this study was to develop the use of modified biochar as an adsorbant. Here, sunflower seed husk biochar modified by $ZnCl_2$ (ZSF), and sunflower seed husk doped with Nickel and Cobalt ($NiCo_2O_4$@ZSF), showed high catalytic activity using peroxymonosulfate (PMS) as an activator to decompose tetracycline hydrochloride (TC) in water. The materials were characterized by Raman spectra analysis, Thermogravimetric analysis (TGA), and measurements of the specific surface area (BET). The $NiCo_2O_4$ NPs dispersed over biochar resulted in the formation of $NiCo_2O_4$@ZSF having a specific surface area of 1013.06 $m^2\ g^{-1}$ and a total pore volume of 1.17 $cm^3\ g^{-1}$. The results showed that the $NiCo_2O_4$@ZSF was effectively activated by PMS, leading to a high degradation of TC in water. $NiCo_2O_4$@ZSF could be an efficient and environmentally friendly activator for the decomposition of organic pollutants, a new strategy for water treatment.

Keywords: Sunflower Seed Husks, AOPs, Tetracycline Hydrochloride, Peroxymonosulfate.



Theme 6：Marine Industry

主題六：海洋產業

編號：MI01

A Decision Support Framework for the Sustainable Performance Assessment of the Maritime Transport Industry: The Case in Vietnam

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Abstract:

Over the past decades, container shipping companies (CSCs) have grown exponentially with high capacities. Container shipping plays a vital role in the global cargo transportation market, thus measuring the efficiency of CSCs has been a concern of practitioners. This paper adopts a combinational approach using the Fuzzy Analytic Hierarchy Process (FAHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) for evaluating and selecting the top CSCs in Vietnam. In the proposed model, criteria concerning the economic, service level, environmental, social, and risk aspects were taken into the FAHP and TOPSIS models. Linguistic variables were used to minimize the unpredictable levels in the criterion weights when dealing with fuzzy knowledge in the natural decision-making process. As a result, FAHP was used to determine and quantify the relative significant weight of each criterion. After that, the TOPSIS was used to rate the options. The results of the FAHP and TOPSIS methods provide a more consistent and reliable ranking. Among the criteria, “reliability and delivery time”, “voice of customer”, “logistics cost”, “network management”, and “quality of service” were the most influential factors in the container shipping context. The developed integrated model provides comprehensive insights that assist CSCs in making strategic decisions to promote their performance. Based on these findings, extensive expertise and appropriate strategies are leading elements for CSCs to survive and operate more efficiently.

Keywords: Maritime, Container Shipping Companies, Performance, Decision-Making, Fuzzy Theory.

編號：MI02

Electricity Cost Assessment of Offshore Wind Energy Underlying Uncertainty of Capacity Factor: Case Studies

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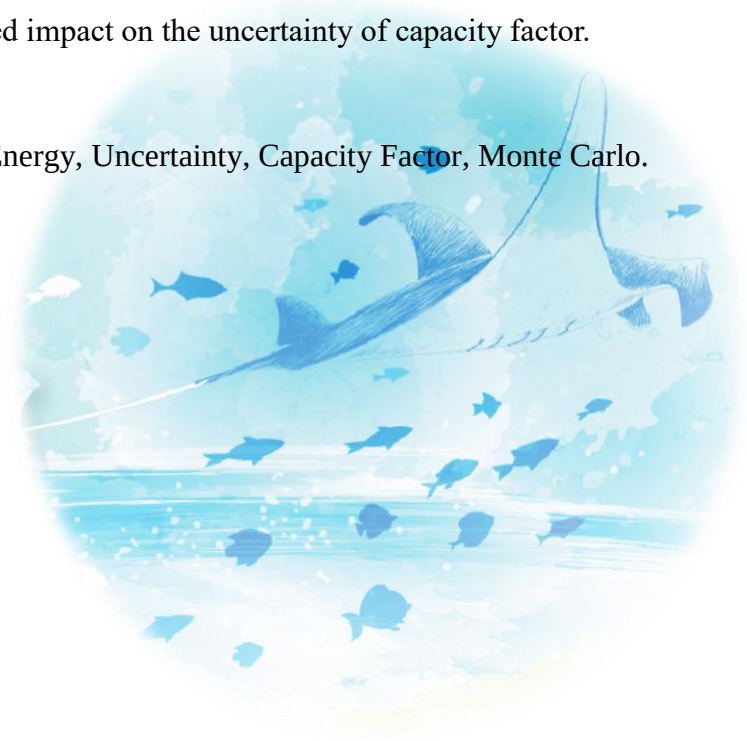
Abstract

The Levelized Cost of Electricity (LCOE) model is a widely used model to assess the electricity cost of renewable energy including offshore wind energy. To capture the uncertainty of input variables in the LCOE model, a probabilistic approach and a Monte Carlo technique are commonly used to obtain a probability distribution of the LCOE output. However, a simple assumption for the range of values of the capacity factor (CF), a main input variable in the LCOE model, might exaggerate its impact on the LCOE output distribution. This study uses the chronological approach to directly investigate the probability function of the capacity factor for a specific wind farm site. Through case studies of wind projects in Vietnam and Taiwan, the proposed model shows its superiority for analyzing a specific project′s LCOE, especially when accounting for a location-based impact on the uncertainty of capacity factor.

Keywords: Wind Energy, Levelized Cost of Energy, Uncertainty, Capacity Factor, Monte Carlo.



編號：MI03

Applying Service Quality to Evaluate Key Success Factors of Ocean Freight Forwarders in the Post-Pandemic Era

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2. Professor, Department of Aviation and Maritime Transportation Management, Chang Jung Christian University
3. Professor, Department of Aviation and Maritime Transportation Management, Chang Jung Christian University

Abstract

This study designed the basic characteristics and service quality of ocean freight forwarders and subdivided the five dimensions into 19 appropriate evaluation indicators to make an expert questionnaire based on the SERVQUAL scale questionnaire structure. The indicators of satisfaction and the importance of service quality are identified through the analytic hierarchy process (AHP) for decision-makers to explore their key abilities. According to the results, ocean freight forwarders can identify the key success factors of service quality and explore the standard service model as a reference to build competitive advantages and ensure sustainable business decisions. Furthermore, the indicators of the key success factors based on the results are as follows: (1) “Companies can grasp the market information at any time to provide customers with an emergency response and reduce risks”, (2) “Scheduled freighters are highly flexible and punctual”, (3) “Transportation and business personnel have good communication skills and are trustworthy”, (4) “Transportation and business personnel are able to deal with emergencies”, and (5) “Containers with good cargo worthiness can be provided”.

Keywords: AHP, SERVQUAL, Ocean Freight Forwarders.

編號：MI04

A Window-DEA Based Efficiency Evaluation of Harbors in Vietnam

Ngoc-Ai-Thy Nguyen[1,*], Thanh-Tuan Dang[1,2], Chia-Nan Wang[1], Hector Tibo[3]

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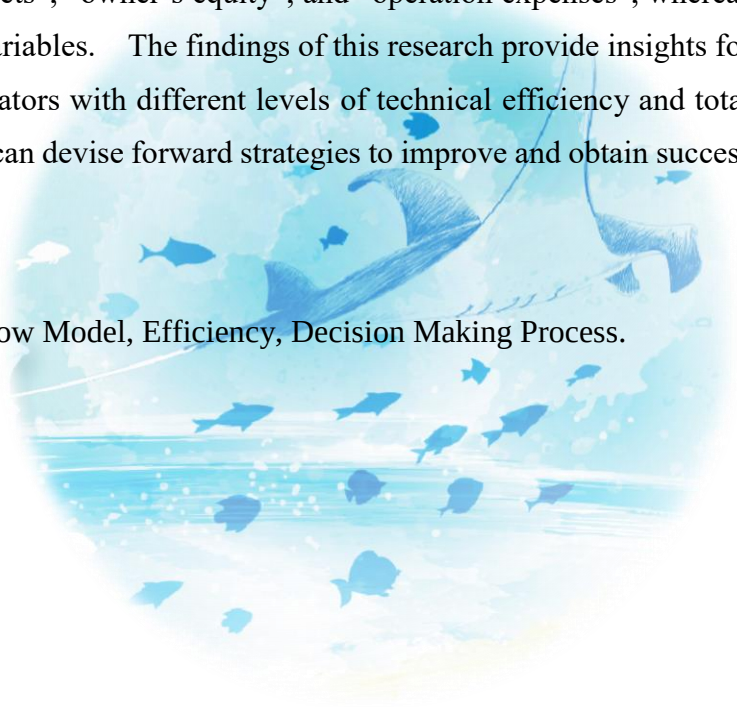
Abstract

Maritime transport remains the backbone of the ever-increasing globalized economy and international trade system, significantly supporting the ongoing and complex processes of global supply chains. Seaport terminals (i.e. harbors) form vital links in the overall trading chain, acting as an incentive to the development of the marine economy and a key contributor to a nation's international competitiveness. In this paper, a Data Envelopment Analysis (DEA) with a Window model is proposed towards addressing the issue of performance evaluation of seaport terminal operators. By using the prescribed approach, the authors considered the top 10 potential seaport companies of Vietnam with respect to their efficiency evaluations during the research period (2016-2020). Based on the importance of financial indicators, three input variables were listed, which are "total assets", "owner's equity", and "operation expenses", whereas revenue and net profit were chosen as output variables. The findings of this research provide insights for management and policymakers of seaport operators with different levels of technical efficiency and total performance advancement. In so doing, they can devise forward strategies to improve and obtain success in the industry.

Keywords: Data Envelopment Analysis, Window Model, Efficiency, Decision Making Process.



編號：MI05

Assessing Suez Canal Risks after Covid-19 and the Evergiven Crisis: Multimodal Logistics and Smart Solutions

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Abstract

This paper aims to assess the Evergiven crisis in the Suez Canal, fluctuations in trade as a result of the Covid19 epidemic, as well as to explore and assess alternative logistical solutions, such as multimodal routes and smart transportation solutions for a smoother Eurasian trade. Rather than the commonly used experimental or empirical approaches, this paper adopts a critical and analytical approach to assess and find solutions regarding the key risks threatening international trade and logistics along the Suez route between Europe and Asia. The results of this assessment find that the alternative multimodal routes between Europe and Asia are not yet reliable and therefore suggest that the further development of multimodal alternatives may be of great service.

Several alternatives are assessed based on industry management tools for analysis and risk assessment. One approach is based on designing tools for new product and service developments, such as the product service system blueprint, and a prototype concept design for a multimodal hybrid vehicle (known as *Cargo Jumper*) that can operate as a truck, vessel, and airship. Using SolidWorks Computer Aided Design (CAD) software, the prototype concept vehicle is designed to be able transport a 40-foot-long container with a maximum weight of 30 tons, and it relies on renewable energy to achieve social, economic and environmental sustainability. This vehicle is a market-shifting innovation that can be a convenient and competitive solution for end-users in need of intercontinental door-to-door logistics.

Finally, this paper is lacking the empirical and experimental simulation testing which are discussed in future research directions and the recommendations section.

Keywords: Sustainable Smart Logistics, Suez-Evergiven Crisis, Amphibious Airship, Industry Analysis\Design, SolidWorks.

編號：MI06

Determinants of Access to Formal Credit Available to Fisherman Households in the Mekong Delta, Vietnam

Phan Thi Kieu, Pham Van Ca

Abstract

The primary purpose of this study is to analyze the factors affecting the ability to access formal credit by fisherman households in the Mekong Delta, Vietnam. This research is based on a survey of 300 fisherman households, conducted between Oct 2020 and Feb 2021, and proposes six independent variables affecting the capacity to access traditional credit. A binary logistic regression analysis was applied to evaluate the impact of the independent variable on the dependent variable. The results indicate that there are five independent variables affecting credit access in the Mekong Delta region. The level of importance from high to low is as follows: (i) Job experience, (ii) Collateral, (iii) Education level, (iv) Social prestige, and (v) Interest rate. Of particular note, the interest rate has a significant negative impact on real access to formal credit (because when the interest rate increases, then fishermen must pay more on the loan cost). Collectively, these five factors explain 56.7% of the variation in formal credit accessibility in the Mekong Delta, Vietnam. (The remaining 43.3% is due to errors and other factors.)

Keywords: Formal Credit, Fisherman Households, Mekong Delta Region, Vietnam.