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Science, Engineering and Technology for Better Future

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The current need to reduce dependence on non-renewable fuels has contributed a lot to the rapid growth of renewable energy systems and electric vehicles. One of the exciting sources of energy storage is the battery. The development of lithium-based batteries is an exciting trend and is continuously being developed for long life and high-level battery quality. Batteries are considered a primary energy storage source. They are essential materials for many applications such as vehicles and electronic devices, including laptops, mobile phones, watches, etc.

With the increasing demand and use of batteries globally for many applications, much research on advanced batteries has been interested in improving their performance, significantly to extend their safety and prolong their service life. The type of batteries and some external parameters, including voltage, current, and temperature, are essential to further exploration.

Research on how to minimize the pollution from after-used batteries is also needed since electronic waste cannot be disposed into nature without prior treatment. This is important in preventing environmental destruction and supporting environmental sustainability, in addition to the economic impact of reusing certain technologies. Furthermore, with the advancement of civilization and technology, everything related to engineering and sciences can be developed according to its functions and humans' need.

To address the above issues, the 5th International Tropical Renewable Energy Conference (i-TREC) was held on October 29-30, 2020, via online conference. The i-TREC is an annual event organized by the Tropical Research Energy Center, Faculty of Engineering Universitas Indonesia (TREC FTUI). The theme of this conference is the role of renewable

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and clean energy in supporting sustainable development goals. From the papers presented there, 18 paper have been selected for publication in IJTech. These 18 papers are summarized below.

The first paper was written by Y. Muharam, and J.A. Soedarsono and reported on the hydrodeoxygenation of vegetable oil in a trickle bed reactor for renewable diesel production. $NiMo/Al_2O_3$ catalysts with the composition of 6.13% w/w Ni, 12.49% w/w Mo, and 81.33% w/w Al_2O_3 were used. The trickle bed reactor of 2.01 cm in diameter and 24 cm in bed length was able to convert triolein into renewable diesel. C_{18} hydrocarbons became dominant reacting compounds at temperatures above 310°C and a pressure of 15 bar, which reached more than 50% w/w. At a pressure of 5 bar, fatty acids, with stearic acid as the acid with the highest concentration, were the dominant reacting components, reaching more than 60% w/w at temperatures above 280°C. This showed that double bond saturation happens once the reactants mix.

The second paper was written by M. Sudibandriyo, and F.A. Putri, and presented a review of adsorbent performance on continuous adsorption processes through fixed bed columns in different variations of ethanol influent concentration. This study was carried out under a bed operation condition of atmospheric temperature and pressure (20°C and 1 atm), with 50% v/v and 10% v/v ethanol inlet concentration which had a 10 ml/min flow rate. A breakthrough curve was used to analyze the adsorption performance including the highest ethanol effluent concentration, adsorption capacity, and effective adsorption time. Zeolite 3A as an adsorbent has better adsorption performance resulting in higher ethanol purity, higher adsorption capacity, and a longer saturated time when compared with zeolite 4A.

The third paper was written by M.S. Omar, M.N.M.N.M. Sanif, N.H.S.O. Ali, M.H.S.A. Hamid, H. Taha, A.H. Mahadi, Y.W. Soon, Z. Ngaini, M.Y.H. Rosli, and A. Usman. It presented Schiff bases containing salicylaldehyde moiety, namely salicylaldehyde 2-methyl-3-thiosemicarbazone and salicylaldehyde triazole that was synthesized using the conventional refluxing method. The Schiff bases were utilized in the encapsulation of ZnS nanoparticles using the co-precipitation method. The Schiff base encapsulated ZnS particles form the cubic crystal phase of ZnS with the average crystallite sizes being approximately within 56 and 60 nm. The antibacterial activities of the Schiff base encapsulated ZnS nanoparticles were screened against *Escherichia coli, Bacillus subtilis, Pseudomonas aeruginosa* and *Staphylococcus aureus* using the agar diffusion method. However, the Schiff base encapsulated ZnS nanoparticles were inactive against those bacteria.

The fourth paper was written by N.H.S.O. Ali, S.N.S.A. Rahman, H.A. Adol, M.H.S.A. Hamid, H. Taha, M.Y.H. Rosli, N.T.R.N. Kumara, A.H. Mahadi, and A. Usman. They presented the microcrystallization of 2-thiophenecarboxaldehyde Schiff base of S-benzyldithiocarbazate, i.e. benzyl (2E)-2-[(thiophen-2-yl)methylidene]hydrazine-1-carbodithioate (TASBnDTC). This compound was fabricated using a reprecipitation method in an organic solvent-water system across different crystallization parameters, including temperature and concentration of the target compound. The TASBnDTC microcrystals were found to enhance the diameter inhibition zone range from 8.0 to 10.75 mm against Escherichia coli, Bacillus subtilis, Pseudomonas aeruginosa and Staphylococcus aureus compared with its molecular form that showed no activity.

The fifth paper was written by F.A. Pratiwi, T.S. Utami, and R. Arbianti, and examined cigarette butts as a waste for bioinsecticide production. The extraction of compounds contained in cigarette butts was performed using the ultrasonic-assisted extraction method and a variety of solvents, namely aquadest, 96% ethanol, and NADES as a green solvent. The highest extraction yield was 27.2±2.0% and the highest mortality rate fall was for

armyworm, produced with 96% ethanol extract. The 16-Hentriacontanone compound with the highest peak area of 22.67% was obtained using a GC/MS instrument. All compounds were obtained from the GC/MS then they were simulated with molecular docking to the acetylcholinesterase receptor. The highest docking score was -10.3 kcal/mol for the 2,3-Dimethyl-5,6-diphenyl-1,7-dihydrodipyrrolo pyridine and 16-Hentriacontanone had a 100% similarity to interactions with the control ligand.

The sixth paper was written by H.D.S. Budiono, D.A. Sumarsono, M. Adhitya, A.S. Baskoro, A.S. Saragih, S. Prasetya, F. Zainuri, Nazaruddin, G. Heryana, and R. Siregar. The paper presented the development of an alternative actuator for electric vehicle (EV) braking using direct fuel (electricity) and converting it into movement. By utilizing a magnetic system via solenoids for moving the lever of the cam, the tests confirm that the implementation of the alternative actuator functionally works. The objective of this study was to obtain a proper control system in order to generate a magnetic field gradually. The result shows that the intensity of braking can alternate smoothly depending on the braking signal variation using a 10 μs sampling period input PWM with a 10 ms execution time. Furthermore, it improves the time response that compensates for losses due to piping-hoses in pneumatic systems.

The seventh paper, written by M.A. Berawi, N. Suwartha, M. Elrizqi, G. Saroji, and M. Sari, presented the factors that influence consumer preferences in buying residential property in the Transit-Oriented Development (TOD) area, which serves as the basis for planning residential apartments in the next TOD area development. Both quantitative and qualitative methods were used, via desk study and benchmarking, questionnaire surveys and fuzzy logic. The order of the priority factors for consumers intending to buy property was financial, property type, and demographic factors. Consumers intending to rent property prioritize property type, financial and demographic factors.

The eightth paper was written by H. Dwiputera, N.Y. Prawira, M.A. Andira, and M.A. Budiyanto. It presented the effect of the angle of attack configuration of stern foil using a 1-meter ship model with varying angles of attack: 0 degrees, 1 degree, 2 degrees, and 5 degrees, using a computational fluid dynamic method. The results of this study indicate that the use of this stern foil configuration is effective in reducing a ship's drag by 9%-26% on Froude number 0.5-0.75.

The ninth paper was written by W. Sulistyawati, and P.J. Suranto, and presented a comparison of two numerical methods in optimizing the shape of the hull concerning the minimization of total ship resistance in calm water conditions. The optimization method uses a theoretical approach based on Michell's integral method and the Rankine source method. The discussion of the two methods emphasizes the comparison of wave resistance, total resistance, wave profiles, and wave contour. The optimized hull form comparison of total resistance between Michell's integral method and the Rankine source method decreased by 3.79% and 4.0%, respectively. The wave resistance saw decreases of 5.52% based on Michell's integral method and 13.33% using the Rankine source method. The wave profiles generated by both methods presented a fair amount of compatibility; the wave contour illustrated a reasonably straightforward agreement on the optimal hull but were dissimilar on the initial hull.

The tenth paper was written by C.S Wibowo, N.I. Setiady, M. Masuku, A. Hamzah, I. Fedori, Maymuchar, Y.S. Nugroho, and B. Sugiarto. It presented the effect of characteristics on various fuel blends and performance with above 40% ethanol. This study used a 150 cc SI engine that is standard on the market as the test engine and connected with the engine dyno test to obtain the performance data (torque, power, and specific fuel consumption) and emission data including hydrocarbon, carbon monoxide, carbon dioxide from RON 92

gasoline, with a mixture of 40% (E40), 50% (E50), and 60% (E60). The E60 mixture was considered as the most optimum mixture for increasing the torque and power.

The eleventh paper was written by W.N. Septiadi, K.W.T. Prasetia, M.R. Murti, I.G.K. Sukadana, F. Rahman, G.J.P. Putra, and K.M. Marianti. They reported a cascade straight heat pipe (CSHP) as a CPU cooling system was tested with 3 effective lengths: 20, 23 and 26 cm. The workload provided was *idle*, where the processor only ran the operating system without being given a software load, so that the processor utilization was only 1%-10%, and *full load*, where the processor was utilizing 95%-100% of its capacity. The cascade heat pipe showed better cooling performance than the stock cooler.

The twelfth paper was written by Yanuar, Gunawan, A.S.A. Utomo, M.N. Luthfi, M.A.B. Baezal, F.R.S. Majid, and Z. Chairunisa. They reported the effect of the *istiophorus platypterus* design distance between hull (clearance) variation on the total resistance of the catamaran hull model by an experimental method and a computational fluid dynamics (CFD) simulation method. The result of experiments and simulations showed that the distance between hull variations has a considerable effect on the total resistance of the catamaran hull model. The catamaran hull which has the optimal clearance configuration will cause the resulting wave interference and resistance to be small. The model was towed with Froude numbers ranging from 0.35 to 0.65. The results showed that the hull separation made a difference to the total resistance coefficient on the same experimental configurations.

The thirteenth paper was written by Y.A. Santoso, R.M.N. Tambunan, S. Soekirno, Nasruddin., and N.B. Prihantini, evaluates the effect of sound wave exposure on different photoperiodism for *Synechococcus* HS-9 cell density and lipid content in the tubular photobioreactor. The result showed that the peak of *Synechococcus* HS-9 cell density average in PBR A, B, and K respectively are 8.883×10^5 cells/mL; 7.242×10^5 cells/mL; and 6.175×10^5 cells/mL. The highest lipid percentage was achieved in PBR A at 17%, then PBR B at 16%, and PBR K at 7%. Yet, *Synechococcus* HS-9 in PBR B showed a higher growth rate compared with PBR A and PBR K. Sound waves could increase the cell activity and metabolism which led to the increase of cell density and the lipid percentage of *Synechococcus* HS-9. The difference in photoperiodism might cause a lower photosynthetic rate and cell metabolism, but the sound wave could help promote the growth of *Synechococcus* HS-9 despite the lower photosynthesis rate.

The fourteenth paper is written by M.M.Y. Harahap, R. Suryantini, K.D. Paramita, and Y.A. Yatmo. They investigated the utilisation of currently available energy and its implication on a more ecological production of architecture materials. The study focused on the sun-drying process by craftsmen in the traditional brickmaking process, arguing that such practices demonstrate ways to utilize energy that is significantly informed by local knowledge, showing interconnection with the wider ecology. A brick-drying process at two locations using traditional brickmaking in Central Java, Indonesia was observed. The drying process in the brickmaking practice utilized various exposure strategies to maximise the potential heat from the sun that can be transferred to the bricks, which in turn influences the flow of the production process.

The fifteenth paper was written by N.H.C. Damanik, D. Susanto, and E. Suganda, and investigated the effect on compressive strength of unfired clay brick by adding reinforcement, specifically SBF and bio-enzyme. The experiment produced four specimens that contained the same percentage of composition but differed in ingredients. The brick samples were produced manually with sizes of 50 mm × 50 mm × 50 mm. There were a total of 120 brick samples. They were cured for 28 days at room temperature 2±28°C before the compressive strength was tested. The results showed that adding SBF to the samples

increased their compressive strength. Moreover, by adding both SBF and bio-enzymes the highest compressive strength was found compared to the other specimens.

The sixteenth paper was written by G.A. Kristanto, A. Jansen, and W. Koven, presenting the potential of landfill mining materials from Jakarta's largest landfill, Bantar Gebang, as compost and RDF. It found that the excavated material was dominated by soil-like materials (33–35%) and plastic (26–31%). The soil-like material had 47–51% water content; 4.42–6.23 C/N ratio; and did not meet Indonesia's national standard for compost. The materials for RDF had 13–15 MJ/kg calorific value, 48–50% water and 24–27% ash contents, and the possibility of high chlorine emissions. No RDF standard is currently available in Indonesia, but the materials did not meet the European standard. It was suggested that soil-like materials be used for soil amendment instead of compost, and plastic waste and other combustible materials be separated and dried to fulfill the RDF standard.

The seventeenth paper was written by T. Nur, and M. Siregar, investigates how to reduce the cogging torque in an Inset-Permanent Magnet Generator. The electromagnetic simulations and the analysis of the permanent magnet generator were performed using numerical analysis by means of FEMM 4.2. To obtain a faster computation, the FEMM 4.2 was coupled with LUA 4.0 programming. Using the FEMM 4.2, it was found that by employing the two slottings in the magnet edge combined with a gradually inclined surface end, the cogging torque of the permanent magnet generator selected can reduce the cogging torque of the machine effectively by approximately 98.14 % when compared with the initial magnet model. This demonstrated that this particular method can reduce the cogging torque of the permanent magnet generator effectively.

The eighteenth paper was written by P. Mahadika, A. Subiantoro, and B. Kusumoputro, who developed a controller using Neural Network Predictive Control (NNPC) that integrates the capability of Artificial Neural Networks (ANN) to imitate vehicle characteristics and Model Predictive Controls (MPC) to obtain future reference trajectories. Two separate control loops were used, an outer loop based on PI controllers to give the inner loop a speed reference for maintaining a safe distance from the vehicle in front. NNPC was used in the inner loop to control the throttle and the brake pressure. The result of this study was that the controller can maintain a safe distance while having a smooth response.

We hope this special edition of *IJTech* includes findings and insights that lead to new knowledge. We invite you to join us by sending in your research for consideration.

With warmest regards from Jakarta,

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