

**LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW
KARYA ILMIAH : JURNAL ILMIAH**

Judul Jurnal Ilmiah (Artikel) : Application of leachate recirculation as an alternative treatment method in landfills

Jumlah Penulis : 4 orang (Ika Bagus Priyambada, Budi Widianarko, **Setia Budi Sasongko** and Alfian Rizky Rizaldianto)

Status Pengusul : penulis ke-3

Identitas Jurnal Ilmiah :

- a. Nama Jurnal : ARPN Journal of Engineering and Applied Sciences
- b. Nomor ISSN : 1819-6608
- c. Vol, No., Bln Thn : Vol. 16 No. 6 March 2021
- d. Penerbit : Asian Research Publishing Network (ARPN)
- e. DOI artikel (jika ada) : -
- f. Alamat web jurnal : http://www.arpnjournals.com/jeas/volume_06_2021.htm
- g. Alamat Artikel : http://www.arpnjournals.org/jeas/research_papers/rp_2021/jeas_0321_8533.pdf
- g. Terindex : Scopus, Q3

Kategori Publikasi Jurnal Ilmiah : Jurnal Ilmiah Internasional
(beri ✓ pada kategori yang tepat) Jurnal Ilmiah Nasional Terakreditasi
 Jurnal Ilmiah Nasional Tidak Terakreditasi

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b. Ruang lingkup dan kedalaman pembahasan (30%)	7,00	7,00	7,00
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Total = (100%)	27,00	25,00	26,00
Nilai Pengusul = (40% x 26,00)/3 = 3,47			

Semarang, 26 Juli 2021

Reviewer 2



Prof. Dr. Moh. Djaeni, S.T., M.Eng.
NIP. 197102071995121001
Unit : Dept. Teknik Kimia FT UNDIP

Reviewer 1



Prof. Prof.Ir. Abdullah, M.S., Ph.D.
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a. Kelengkapan unsur isi jurnal (10%)	4,00			4,00
b. Ruang lingkup dan kedalaman pembahasan (30%)	12,00			7,00
c. Kecukupan dan kemutakhiran data/informasi dan metodologi (30%)	12,00			8,00
d. Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	12,00			8,00
Total = (100%)	40,00			27,00
Nilai Pengusul = (40% x 27,00)/3 = 3,60				

Catatan Penilaian artikel oleh Reviewer :

1. Kesesuaian dan kelengkapan unsur isi jurnal:

Artikel disusun sesuai template penulisan ARPN Journal of Engineering and Applied Sciences yang terdiri dari abstract, introduction, material and methods, results and discussions, conclusions, serta references. Artikel berisi sesuai dengan bidang pengusul yaitu Teknik Kimia (Pengolahan Limbah).

2. Ruang lingkup dan kedalaman pembahasan:

Ruang lingkup artikel tentang pengolahan limbah yaitu studi mengevaluasi penerapan resirkulasipada pengolahan lindi (produk dari proses biodegradasi di TPA), menggunakan reactor seri di tempat pembuangan akhir. Artikel ditulis dengan pembahasan dilengkapi dengan 8 gambar., dan didukung sitasi 8 artikel dari 28 buah jumlah referensi .

3. Kecukupan dan kemutakhiran data/informasi dan metodologi:

Data/informasi pada artikel ini menunjukkan kemutakhiran, dengan mensitasi artikel (10 tahun terakhir) sebanyak 16 artikel dari 28 artikel yang disitasi (57,1%). Metodologi penelitian ditulis cukup lengkap, dan didukung oleh instrumen uji yang baik.

4. Kelengkapan unsur dan kualitas terbitan:

ARPN Journal of Engineering and Applied Sciences terindex di scopus dengan katagori Q3.

Semarang, 26 Juli 2021

Reviewer 1

Prof. Prof.Ir. Abdullah, M.S., Ph.D.
 NIP. 195512311983031014
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 Jurnal Ilmiah Nasional Tidak Terakreditasi

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	Internasional	Nasional Terakreditasi	Nasional Tidak Terakreditasi	
	40	<input type="checkbox"/>	<input type="checkbox"/>	
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b. Ruang lingkup dan kedalaman pembahasan (30%)	12,00			7,00
c. Kecukupan dan kemutakhiran data/informasi dan metodologi (30%)	12,00			8,00
d. Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	12,00			6,00
Total = (100%)	40,00			25,00
Nilai Pengusul = (40% x 25)/3 = 3,33				

Catatan Penilaian artikel oleh Reviewer :

1. Kesesuaian dan kelengkapan unsur isi jurnal:

Artikel ini terdiri dari: Title, Abstract, Introduction, Materials and Method, Results and Discussion, Conclusion, Acknowledgment, References dan ditulis sesuai dengan Guide for Author. Substansi artikel sesuai dengan bidang Teknik Kimia.

2. Ruang lingkup dan kedalaman pembahasan:

Artikel ini membahas penurunan BOD dan COD pada lindi yaitu limbah cair dari suatu degradasi bahan organik. Proses dilakukan secara multistage sehingga BOD bisa diturunkan sampai 90%, sementara COD bisa turun 80%. Dibandingkan dengan metode lain, proses secara multistage dengan resirkulasi ini mampu menurunkan BOD dan COD lebih. Pun demikian, justifikasi ini kurang meyakinkan, karena pada pembahasan sedikit sekali mensitasi artikel-artikel dari penelitian sebelumnya.

3. Kecukupan dan kemutakhiran data/informasi dan metodologi:

Kemutakhiran artikel ini berkategori sedang. Hal ini ditunjukkan dengan jumlah referensi 10 tahun terakhir menunjukkan 17 dari 28 artikel (60%) adalah 10 tahun terakhir. Metode sangat singkat, sehingga para peneliti/pembaca mungkin tidak dapat mencoba metode tersebut. Data-data juga disajikan sangat terbatas.

4. Kelengkapan unsur dan kualitas terbitan:

Jurnal diterbitkan oleh Asian Research Publishing Network (ARPN), termasuk dalam Jurnal Terindeks Scopus, SJR : 0,24 (2020), Similaritas artikel berdasarkan turnitin sebesar 5%. Publisher dan Jurnalnya termasuk kurang bereputasi.

Semarang, 26 Juli 2021

Reviewer 2



Prof. Dr. Møh. Djaeni, S.T., M.Eng.

NIP. 197102071995121001

Unit : Dept. Teknik Kimia FT UNDIP

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- Title:** Modeling of the accumulation of kinetic energy in elastic elements and change in the constructive parameters of a dynamic soil-processing working part
- Author (s):** Nozim Ismoilovich Jabborov, Aleksandr Vladimirovich Sergeev, Valeriy Andreevich Eviev and Nimya Grigorievich Ochirov
- Abstract:** Modeling the process of accumulation of kinetic energy in the elastic elements of a dynamic tillage working part and changing its constructive parameters is an urgent issue, since it allows to develop new efficient tillage working parts endowed with the property of dynamism. The aim of the research is to develop mathematical models of the process of accumulation of kinetic energy and changes in the constructive parameters of dynamic tillage working parts. The object of research is a dynamic arrow-shaped tillage working part with a capture width of 330 mm for surface tillage to a depth of 14 cm. The subject of research is the regularities of the process of accumulating kinetic energy in elastic elements and changes in the constructive parameters of a dynamic tillage working part. The research was carried out using methods of mathematical modeling based on the study of physical laws that occur during soil cultivation; experimental research on energy assessment of tillage working parts, analysis and generalization of experimental data. The scientific novelty of the paper is represented by mathematical models of the process of accumulating kinetic energy and changing constructive parameters of a dynamic tillage working part. Mathematical models and graphic interpretation of the dependences of the axial force on the elastic element, the traction resistance of the dynamic working part, the average value of the width of capture on the speed of movement of the dynamic working part are presented in this paper. In particular, it was found that under the specific conditions of experiments with an increase in the speed of operation from 1.94 to 3.61 m / s, the average value of the width of capture of a dynamic tillage working part decreases from 306.90 to 300.50 mm. At rest, the dynamic soil tillage implement has a working width of 330 mm. The meaning of the swath width of a dynamic tillage working body, depending on the characteristics of the soil and the speed of movement, fluctuates within certain limits set by design parameters and is a random value. The statistical standard error of the sample mean value of the traction resistance and the speed of movement of the dynamic working body, respectively, varied in the range of 0.094 - 0.0167 kN and 0.012 - 0.032 m/s.

[Full Text](#)

Title: Application of leachate recirculation as an alternative treatment method in landfills

Author (s): Ika Bagus Priyambada, Budi Widianarko, **Setia Budi Sasongko** and Alfian Rizky Rizaldianto

Abstract: Leachate is the product of biodegradation process in the landfill, which possesses various disadvantages to the environment. It needs proper treatment to avoid those negative impacts of the leachate. On-site treatment of leachate using leachate recirculation is one of the alternative technologies to reduce the hazard. This study evaluated the application of leachate recirculation as an alternative method of leachate treatment in landfills. Experiments were performed in a laboratory using a total of 60 lysimeters, with 1 L in volume for 365 days. The waste was placed on the top of a gravel to avoid any blockage and percolate the leachate to the bottom of lysimeter. The lysimeter was divided into two groups, with 10 reactors each group arranged in series and conducted in triplicate. Leachate recirculation will be given to second reactor until tenth reactor, using high concentration of leachate for the first group and low concentration of leachate for the second. The recirculation of leachate in both treatment groups significantly increased the organic content in the waste. In the reactor group with low-concentration leachate, the increase in organic content was lower than in reactors with high-concentration leachate. It was found that leachate recirculation accelerates reductions in the BOD and COD concentrations of leachate, compared to reactors without leachate recirculation. This condition applied to both treatment groups. In general, reactors with leachate recirculation had higher BOD and COD removal efficiencies than those without.

[Full Text](#)

Title: The influence of metachronal beating of cilia on the behavior of blood flowing through elastic stenosed arteries

Author (s): M. A. El Kot

Abstract: The influence of the metachronal beating of cilia, heat transfer phenomenon, oblique magnetic field, and Hall currents on blood flowing inside an isotropically stenosed elastic artery were investigated analytically. All physical parameters associated with blood flow properties were studied and discussed graphically for both ciliated-free isotropic artery and ciliated-tethered artery. The results obtained in this study showed that the velocity, the distribution of wall shear stress, and the resistance are higher for free isotropic artery model than that for tethered artery model. The distribution of wall shear stress increases with the cilia position increasing and it decreases by increasing the eccentricity of the elliptic path

whereas the resistance impedance has inverse trend. Furthermore, the streamlines patterns illustrating the features of the ciliary motion have been plotted for various imbedded flow parameters.

[Full Text](#)

Title: Impact of lean automation on adaptive control for improved real-time process control in sugar industry: Case of Kenya

Author (s): Osore E. A. E., Ogola J. M. and Madara O. M.

Abstract: The basic criterion of performance in a production system is response time and variability of process parameters, and it is reasonable if all of these are at their lowest value to demonstrate the rapid rate at which an anomaly can be detected by the system and appropriate action taken. With lean automation technique in the sugar industry, process variability and real time control can be monitored. Also, to note is the consistency of the response times where sharp variations will imply erroneous system operation. This technology is achievable through the different levels of automations that sugar industries adopt. Thus, an analysis of the different levels of automation was carried out at different stages of pre-milling process of sugarcane to determine the optimum automation level for adaptive control in a case sugar company. It was found that level 4 of automation had a slow response to anomaly with the longest mean response time of 3.33 minutes compared to levels 5 and 6 which depicted a rapid response to anomaly with the shortest response time of 0.54 min. Also, conventional automation (LoA 4) resulted to an average temperature variability of 2.75 °C. While the SCADA (LoA 5) and DCS (LoA 6) showed no temperature variability in the three process stages. Thus, adopting levels 5 or 6 the process parameters are controlled and maintained at the optimum levels and provide a steadfast real time monitoring, control and maintenance of process parameters that will enhance quality production.

[Full Text](#)

Title: A low-cost integrated NIR spectrometer for chlorophyll content index measurement

Author (s): Luong Vinh Quoc Danh, Nguyen Cao Qui, Truong Phong Tuyen and Anh V. Dinh

Abstract: Chlorophyll sustains plants as it is one of the vital components in the photosynthesis process. Chlorophyll content in the leaf indicates the health of the plants and it can be used as an indicator for fertilizer requirement, in particular for Nitrogen management, in the growing cycle of certain crops. Chlorophyll measurement is required for the growers to monitor and make decision for fertilization schedule. The measurement is also needed for plant scientists. Chlorophyll meters are used to measure the relative chlorophyll content index in the leaf either by chemical process, image processing, or spectroscopy technique. In general, chlorophyll meters are expensive. This work proposes a low-cost meter to measure the chlorophyll index by exploiting the newly-developed near-infrared spectrometer. The NIR spectrometer is an optical MEMS sensor having 6 channels spanning from 610nm to 860nm. The simple prototype was built by using the common Raspberry Pi to collect data from the spectrometer. Fifteen leaf samples from various tree types were measured and data were analyzed. The results were compared with the commercial hand-held device, the SPAD-502. An average error of 7.84% was obtained using the designed meter. Off-the-shelf components provide a fraction of the cost of the high-end meters for an acceptable chlorophyll content index reading.

[Full Text](#)

Title: Principal design of methane-oxygen combustion chamber with supercritical CO₂

Author (s): Komarov I., Kharlamova D., Vegera A. and Makhmutov B.

Abstract: The report presents the results of research at the engineering design of a turbomachine combustion chamber running on supercritical carbon dioxide at an ambient pressure of 300 bar. The research method is a numerical simulation of turbulent-kinetic processes in the Ansys Fluent software package using the reduced methane combustion mechanism. Two key features characterize the combustion of methane in CO₂ diluent. Firstly, combustion occurs with a significantly smaller excess of oxidizing agent than in the combustion chamber of traditional gas turbines. Secondly, the normal flame propagation velocity in CO₂ at ultrahigh pressure is much lower than with N₂ diluent. In order to ensure stable and complete burning of fuel, various ways to increase the real burning rate were reviewed - swirling the mixture of fuel and oxidizer, controlling the distribution of diluent over the volume of the combustion chamber, changing the main structural dimensions of the combustion chamber.

[Full Text](#)

Title: A novel NLP and machine learning based text extraction approach from online news feed

Author (s): Srinivas Kolli, Peddarapu Rama Krishna and Parvathala Balakesava Reddy

Abstract: Extracting text information from a web intelligence page is a difficult task as a great piece of the E-News substance is given assistance from the backend Content supervision method. Web content extraction is a vital innovation for empowering a variety of utilizations pointed toward accepting the network. While mechanized web harvesting has been concentrated widely, they regularly center around separating organized information that shows up multiple times on a solitary website page, similar to item indexes. In this Work, we present a customized news internet searcher that centers around constructing a storehouse of reporting stories by relating proficient mining of content data from a network information sheet from shifted e-information entrances. Our approach characterizes text blocks utilizing a combination of visual and language autonomous highlights. The framework depends on the idea of the Document Object Model (DOM) hierarchy control for separating content and changing the site page configuration to prohibit unessential substance like advertisements and client remarks. We additionally utilize WordNet, a vocabulary of the English speech dependent on psycho bilingual person reads for coordinating the separated substance equivalent to heading of website page. TF-IDF (Term Frequency Inverse Document Frequency) is utilized to recognize the sheet block conveying data pertinent to the page's designation. Notwithstanding the pulling out of data, working to accumulate associated data from various web information documents & sum up the assembled data dependent on client inclinations which have additionally incorporated. Furthermore, a pipeline is devised to naturally name data points through bunching where each group is scored dependent on its importance to the site page depiction extricated from the Meta labels, and data-points in the best group are chosen as certain preparation models.

[Full Text](#)

Title: Digital Twin: An option for the integrated design of upper limb robotic exoskeletons for rehabilitation tasks

Author (s): José Alejandro Castañeira Armero, Mauricio Torres Quezada, Leonardo Broche Vázquez, Ruthber Rodríguez Serrezuela, Jeidy Johanna Gómez Montiel, Daily Milanés Hermosilla and Roberto Sagaró Zamora

Abstract: The development of the Digital Twin of an exoskeleton for upper limb rehabilitation task for hemiplegic patients, and its Virtual Commissioning prior to its manufacture is presented in this work. In these context biomechanical and clinical design criteria are integrated into Digital Twin concept. The power actuators, the development of 4 freedoms degree's mechanisms for shoulder and elbow flexion/extension, external and internal rotation and abduction of the upper limb, and prone/supination of wrist, the control system and user interface as well as its integration with the mechanical system is carried out. The mechatronic concept design is done using NX MCD software. Automation takes place in the TIA Portal software. A PLC which can be virtually simulated with the use of PLCSIM Advanced software and a Human-Machine Interface (HMI) for the control of the exoskeleton are included in the hardware configuration. The Real Commissioning of the designed prototype has been successful and its operation has been validated in pilot tests carried out at the Santiago de Cuba Surgical Clinical Hospital in hemiplegic patients with painful shoulder syndrome.

[Full Text](#)

Title: Evaluation of wastewater treatment plants in Aqaba governorate, Jordan

Author (s): Ahmad M. Dahamsheh, Ghassan Suleiman and Dua'a O. Al-Masry

Abstract: The objective of this study to evaluate the performance efficiency of wastewater treatment plant in Aqaba governorate in Jordan. One hundred twenty samples of wastewater were collected from both influent and effluent of Aqaba Wastewater Treatment Plant (AWWTP). Samples are analyzed for biochemical oxygen demand (BOD), chemical oxygen demand (COD) and total suspended solids (TSS) to evaluate efficiency of (AWWTP). BOD was nearly decreased to extremely low level and the decrease rate is 98.9 % while COD 97.3 % and TSS is 98.7 %. These rates of decrease of BOD, COD and TSS clarified the satisfying in general effectiveness of the plant. Regression equations for BOD, COD and TSS removal percentages were proposed which can be utilized to evaluate rapid effluent assessment after the treatment processes or optimal process control to improve the performance of (WWTP). The average Biodegradability index (BI) was found to be 0.46. The percentage removal of influent BOD, influent COD and influent TSS were found with high determination coefficient (R²) 0.97, 0.97 and 0.89 respectively.

[Full Text](#)

Title: Educational computer program for the matrix analysis of plane frames

Author (s): Myriam Rocío Pallares Muñoz and Rosa Alejandra Méndez

Abstract: An educational computer program was developed for the matrix analysis of plane frames aimed at engineering students. Unlike commercial programs, the application has a plus since it is designed to assist in the step-by-step calculation of matrix analysis of plane frames subject to point loads and uniformly distributed loads perpendicular to the elements. This topic is fundamental in the teaching of the structural analysis course in engineering careers. The conceptual and mathematical model, the pseudo code of the computational model in FORTRAN, the verification of the application with SAP2000 using a classic problem from the literature are shown, concluding that the tool developed is an alternative for assisting the teaching-learning process in the classroom and for the autonomous work of engineering students in studying of the plane-frame matrix analysis method. This educational program is part of an educational-toolkit project developing to improve students' autonomous work and teacher-student communication [1].

[Full Text](#)

Title: Investigation of effect of modification by rare-earth metals on quantity and morphology of non-metallic inclusions of electric slag coke castings made of steel H11

Author (s): Tokmin A. M., Larionova N. V., Masanskii O. A., Svechnikova L. A., Kazakov V. S., Berezuk V. G., Lytkina S. I., Khudonogov S. A. and Marchenkova S. G.

Abstract: Improving the physical and mechanical properties of castings from alloyed steels and alloys is achieved in various ways, such as: increasing the purity of metal by non-metallic inclusions, creating favorable crystallization conditions that affect the formation of macro and microstructure, reducing the development of liquation processes, etc. Currently, high-energy processes, including electroslag technologies, are widely used. Application of this technology makes it possible to significantly improve quality of steels due to reduction of content of harmful impurities as a result of refining action of slag in process of electrode remelting, besides, it performs protective function in process of metal remelting and pouring into mold. After overflowing the metal from the crucible into the shape, the flux accumulates in the upper part of the casting and acts as a thermal extension, which has a favorable effect on the crystallization process. The purpose of this work is to study the physical and chemical processes that occur during the interaction of harmful impurities - sulfur, phosphorus and oxygen, with components that are part of slag and with rare earth metals, which are modifiers, as well as to study the effect of the amount, morphology and distribution of non-metallic inclusions on the mechanical properties of castings from steel H11 when using electric slag coke casting. In the course of the work, based on the calculated reactions, the influence of Ca and Al on the desulfurization, dephosphorization and deoxidation of steel, as well as the effect of rare earth metals on the formation of sulfide, oxysulfide and phosphide compounds, which are prone to the formation of large conglomerates, which contributed to their accelerated surfacing in the upper part of the casting and, as a result, to a decrease in the total number of non-metallic inclusions in steel. The number of non-metallic inclusions in the modified steel decreases by more than 4 times compared to the non-modified steel, and the toughness increases from 0,20 to 0,32-0,30 MDzh/m².

[Full Text](#)

Title: An error of transmitting a colour by video path after use of a random spectral distribution of light and end-path device

Author (s): Abdullah Qays Taher, Ali Ihsan Alanssari and Volodymyr Pyliavskyy

Abstract: This work is aimed at studying the colour rendering parameter in telecommunication paths. The authors present an analysis of the existing problem, which may occur when introducing machine vision and artificial intelligence training systems. An important feature that is discussed in this paper is the influence of the light source and the parameters of the final equipment. The authors also discuss a comparative analysis of the influence of various light sources, and those differing from the reference spectral characteristics of the camera. Conclusions are made about the possibility of eliminating colour rendering errors in telecommunication paths. Recommendations are presented to show how to reduce the impact on colour rendering quality.

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APPLICATION OF LEACHATE RECIRCULATION AS AN ALTERNATIVE TREATMENT METHOD IN LANDFILLS

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ABSTRACT

Leachate is the product of biodegradation process in the landfill, which possesses various disadvantages to the environment. It needs proper treatment to avoid those negative impacts of the leachate. On-site treatment of leachate using leachate recirculation is one of the alternative technologies to reduce the hazard. This study evaluated the application of leachate recirculation as an alternative method of leachate treatment in landfills. Experiments were performed in a laboratory using a total of 60 lysimeters, with 1 L in volume for 365 days. The waste was placed on the top of a gravel to avoid any blockage and percolate the leachate to the bottom of lysimeter. The lysimeter was divided into two groups, with 10 reactors each group arranged in series and conducted in triplicate. Leachate recirculation will be given to second reactor until tenth reactor, using high concentration of leachate for the first group and low concentration of leachate for the second. The recirculation of leachate in both treatment groups significantly increased the organic content in the waste. In the reactor group with low-concentration leachate, the increase in organic content was lower than in reactors with high-concentration leachate. It was found that leachate recirculation accelerates reductions in the BOD and COD concentrations of leachate, compared to reactors without leachate recirculation. This condition applied to both treatment groups. In general, reactors with leachate recirculation had higher BOD and COD removal efficiencies than those without.

Keywords: leachate, recirculation, landfill, BOD, COD.

1. INTRODUCTION

The problem of waste management in Indonesia remains unsolved. Based on data from the Ministry of Environment and Forestry (2015), as much as 66.39% of community-generated waste is disposed of in landfill. The rest is stockpiled, composted, thrown into rivers or burned. Landfill is the most acceptable and most-used method of waste management in Indonesia [1]. The most common waste disposal method in Indonesia is open dumping. The open dumping method can cause pollution of groundwater and surface water with leachate [2], produce greenhouse gasses such as methane (CH₄) and carbon dioxide (CO₂), produce odors, encourage disease vectors (flies, birds, rats, etc.) and cause social problems in communities near landfill locations.

Leachate is the result of water percolation in landfills [3]. The quality of the leachate produced is highly dependent on the amount of water that enters the landfill, including the initial water content of the waste [4]. Leachate contains many organic and inorganic materials, as well as other pollutants found in landfills [5]. Therefore, the leachate produced by a landfill must be processed before being discharged into the environment [1]. Leachate management methods that are often used in Indonesia include off-site management, where leachate is collected from a landfill and then processed in a leachate treatment plant either physically, chemically, biologically, or by a combination of all three [1]. However, many landfills do not have any leachate treatment plant, which is mainly because of the open dumping system and high costs in the treatment process. As a result, the leachate may contaminate the environment [6]. Leachate, being the

product of the degradation of organic waste, consists of various chemical compounds, organic compounds, and microorganisms that are pathogens [5, 7]. These materials could lead into the decrease of environmental quality, especially soil and groundwater contamination as well as public health problems [8-10]. The leachate potentially pollutes the environment for a long time, as the leachate will still be produced for decades or even centuries, if there are no adequate treatment [11].

Another alternative method of leachate management is on-site or in-situ management, where leachate is treated by re-flowing the leachate into a pile of garbage [6]. This method allows the garbage pile to function as a bioreactor [12]. Research on landfills utilized as bioreactors has been conducted for more than 20 years in laboratory-scale reactors, pilot-scale lysimeters, and full-scale landfills. It shows that bioreactors are able to control the waste decomposition process in landfills and minimize long-term risks to humans and the environment [13]. In addition, leachate recirculation into landfills can provide various benefits, such as increasing waste moisture, accelerating biodegradation, reducing the time needed for stabilization, reducing the total volume and concentration of leachate that must be processed after the landfill is closed, increasing the rate and amount of gas production, accelerating the growth of microbial populations, increasing the distribution of nutrients and enzymes, controlling pH, diluting the material that inhibits decomposition (inhibitors), recycling and distributing methanogenic bacteria, leachate storage, and increasing leachate evaporation [3, 13-16].



MODELING OF THE ACCUMULATION OF KINETIC ENERGY IN ELASTIC ELEMENTS AND CHANGE IN THE CONSTRUCTIVE PARAMETERS OF A DYNAMIC SOIL-PROCESSING WORKING PART

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ABSTRACT

Modeling the process of accumulation of kinetic energy in the elastic elements of a dynamic tillage working part and changing its constructive parameters is an urgent issue, since it allows to develop new efficient tillage working parts endowed with the property of dynamism. The aim of the research is to develop mathematical models of the process of accumulation of kinetic energy and changes in the constructive parameters of dynamic tillage working parts. The object of research is a dynamic arrow-shaped tillage working part with a capture width of 330 mm for surface tillage to a depth of 14 cm. The subject of research is the regularities of the process of accumulating kinetic energy in elastic elements and changes in the constructive parameters of a dynamic tillage working part. The research was carried out using methods of mathematical modeling based on the study of physical laws that occur during soil cultivation; experimental research on energy assessment of tillage working parts, analysis and generalization of experimental data. The scientific novelty of the paper is represented by mathematical models of the process of accumulating kinetic energy and changing constructive parameters of a dynamic tillage working part. Mathematical models and graphic interpretation of the dependences of the axial force on the elastic element, the traction resistance of the dynamic working part, the average value of the width of capture on the speed of movement of the dynamic working part are presented in this paper. In particular, it was found that under the specific conditions of experiments with an increase in the speed of operation from 1.94 to 3.61 m / s, the average value of the width of capture of a dynamic tillage working part decreases from 306.90 to 300.50 mm. At rest, the dynamic soil tillage implement has a working width of 330 mm. The meaning of the swath width of a dynamic tillage working body, depending on the characteristics of the soil and the speed of movement, fluctuates within certain limits set by design parameters and is a random value. The statistical standard error of the sample mean value of the traction resistance and the speed of movement of the dynamic working body, respectively, varied in the range of 0.094 - 0.0167 kN and 0.012 - 0.032 m/s.

Keywords: mathematical model, kinetic energy, constructive parameters, elastic element, dynamic tillage working part.

INTRODUCTION

Modeling the technological operation of soil cultivation, the process of energy accumulation in the elastic elements of the structure of dynamic tillage working parts, as well as changes in their constructive parameters, taking into account the fluctuations in the speed of their movement, is an urgent issue, since it allows to predict the efficiency of functioning in various soil conditions.

The introduction of information and digital technologies in crop production requires the development of calculation algorithms and computer programs based on mathematical models of various production processes. Mobile agricultural units (ACU), which include tillage machines and working parts, are objects of management. The developed information systems should provide high technical and economic indicators of the ACU [1, 2].

Under operational conditions, the energy, technical, economic and agrotechnical indicators of tillage machines are unstable and vary within wide limits under the influence of the internal and external environment of the ACU. Numerous researches of scientists have

developed deterministic and probabilistic mathematical models of the processes occurring in the systems of energetic (tractors) and technological modules (agricultural machines), as an example, we can cite the works [3-5]. The proposed systems of mathematical models serve as a scientific basis for calculating and optimizing the operating modes of various ACU.

It is necessary to have probabilistic mathematical models in developing new innovative soil-cultivating working parts, endowed with the property of dynamism, in order to predict the limits of change in the working width of a dynamic working part, the magnitude of the axial displacement of its elastic elements and the accumulation of kinetic energy in them

The following were chosen as constraints set by agrotechnical requirements [6] on the process of surface tillage: unevenness of working depth and field surface, ridgeiness of the field surface after processing, as well as the degree of soil loosening, which depend to a greater extent on the speed of movement of tillage implements, when modeling the technological operation of soil cultivation, the process of energy accumulation in the



IMPACT OF LEAN AUTOMATION ON ADAPTIVE CONTROL FOR IMPROVED REAL-TIME PROCESS CONTROL IN SUGAR INDUSTRY: CASE OF KENYA

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ABSTRACT

The basic criterion of performance in a production system is response time and variability of process parameters, and it is reasonable if all of these are at their lowest value to demonstrate the rapid rate at which an anomaly can be detected by the system and appropriate action taken. With lean automation technique in the sugar industry, process variability and real time control can be monitored. Also, to note is the consistency of the response times where sharp variations will imply erroneous system operation. This technology is achievable through the different levels of automations that sugar industries adopt. Thus, an analysis of the different levels of automation was carried out at different stages of pre-milling process of sugarcane to determine the optimum automation level for adaptive control in a case sugar company. It was found that level 4 of automation had a slow response to anomaly with the longest mean response time of 3.33 minutes compared to levels 5 and 6 which depicted a rapid response to anomaly with the shortest response time of 0.54 min. Also, conventional automation (LoA 4) resulted to an average temperature variability of 2.75 °C. While the SCADA (LoA 5) and DCS (LoA 6) showed no temperature variability in the three process stages. Thus, adopting levels 5 or 6 the process parameters are controlled and maintained at the optimum levels and provide a steadfast real time monitoring, control and maintenance of process parameters that will enhance quality production.

Keywords: lean automation, level of automation (LoA), real time, process variability.

1. INTRODUCTION

The impact of lean automation was analyzed based on its ability to improve on the adaptive real time control of processes. The lean automation was accomplished through the integration of three different levels of automation in a lean system of sugar production.

The Kenya's manufacturing industry, in which the sugar industries belongs, has declined in its GDP contribution. The stagnation has been at an average of 10% for more than ten years, with Sugar industry contributing 41% decrease in manufactured products. The Kenya vision 2030 stipulates that the industry should account for a GDP of 20%. Attaining this goal needs that the underlying constraints which hinder rapid growth be addressed. As reviewed by Ondiek and Kisome (2013), In spite of the availability of 11 sugar companies in Kenya as highlighted by KESREF (2010), sustainability and self-sufficiency in sugar production continues to drop as consumption demands continues to increase. Several challenges like high cost of production continues to affect the performance of sugar industries depicted by undesirable process efficiencies and productivity with average sugar productivity of 85%, which is below 92% recommended world average. In Kenya, the sugar production cost is approximately Ksh 46,000 per metric ton, and this is almost twice that of countries like Swaziland in Southern Africa register which is Ksh 24,000, KESREF (2010) confirms. It will be beneficial therefore, if sugar industries in Kenya can give consideration to the holistic application of key components of lean thinking so that they can reap maximally and more importantly enhance their process performance among them lead time. These lean techniques among them

employee involvement, visual display and control, 5S, and standardization are applied prior to adoption of advanced techniques like production smoothing and value stream mapping. This is because the advanced methods can only be implemented when there is good quality, stable machine condition and good layout. Current studies in the sugar industries show that, instead of a holistic approach, lean thinking is not embraced or employed selectively with no regard to its knowledge and principles. The optimum outcomes of a production system therefore, requires a proper determination and integration of all the related and associated advanced technology. Thus, the need to investigate the impact of integration levels of automation with a holistic implementation of lean manufacturing techniques to satisfy customer needs. With the help of process indicators such as lead and cycle times, product quality and frequency of injuries, the effectiveness of this integration can be evaluated, Ondiek and Kisome (2013). Therefore, a proper integration between lean techniques and optimum level of automation to have lean automation, its adoption and implementation can be investigated on processes to see if it can achieve this. There is a possibility that, effective process performance in sugar industry will be realized when lean approach is applied full prior to appropriate selective automation. Thus, the need to assess the potential of integrating lean techniques with appropriate level of automation in lean automation on adaptive control.

With lean automation approach, a process can be made lean and be automated simultaneously. Automation is mainly employed to increase outputs and reduce process times, but these cannot be compared to the productive lean parameters like improving maintenance, enhancing



A LOW-COST INTEGRATED NIR SPECTROMETER FOR CHLOROPHYLL CONTENT INDEX MEASUREMENT

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ABSTRACT

Chlorophyll sustains plants as it is one of the vital components in the photosynthesis process. Chlorophyll content in the leaf indicates the health of the plants and it can be used as an indicator for fertilizer requirement, in particular for Nitrogen management, in the growing cycle of certain crops. Chlorophyll measurement is required for the growers to monitor and make decision for fertilization schedule. The measurement is also needed for plant scientists. Chlorophyll meters are used to measure the relative chlorophyll content index in the leaf either by chemical process, image processing, or spectroscopy technique. In general, chlorophyll meters are expensive. This work proposes a low-cost meter to measure the chlorophyll index by exploiting the newly-developed near-infrared spectrometer. The NIR spectrometer is an optical MEMS sensor having 6 channels spanning from 610nm to 860nm. The simple prototype was built by using the common Raspberry Pi to collect data from the spectrometer. Fifteen leaf samples from various tree types were measured and data were analyzed. The results were compared with the commercial hand-held device, the SPAD-502. An average error of 7.84% was obtained using the designed meter. Off-the-shelf components provide a fraction of the cost of the high-end meters for an acceptable chlorophyll content index reading.

Keywords: chlorophyll content index meter, near-infrared spectrometer, low-cost sensor.

INTRODUCTION AND BACKGROUND

Chlorophyll (CL) is green pigments and it was isolated in 1817 by Joseph Bienaimé Caventou and Pierre Joseph Pelletier. Chlorophyll is derived from the Greek words, chloros ("green") and phyllon ("leaf") [1]. Chlorophyll is concentrated within organisms in structures called chloroplasts. The function of the majority of chlorophyll (up to several hundred molecules per photosystem) is to absorb light energy and transfer to other parts of the photosystem [1]. Chlorophyll is essential in photosynthesis which is a chemical reaction that takes place inside a plant, producing food for the plant to survive. Water (from the soil), carbon dioxide (from the air) and light (from the sun) are essential for the photosynthesis to happen with the participation of chlorophyll. There are two main types of chlorophyll: chlorophyll: a absorbs energy from wavelengths of blue-violet and orange-red light while chlorophyll b absorbs energy from wavelengths of blue and red lights as shown in Figure-1. Both chlorophylls absorb energy from the visible spectrum of light. High levels of chlorophyll usually indicate that the leaf is high in nutrients, usually nitrogen and phosphorous [2].

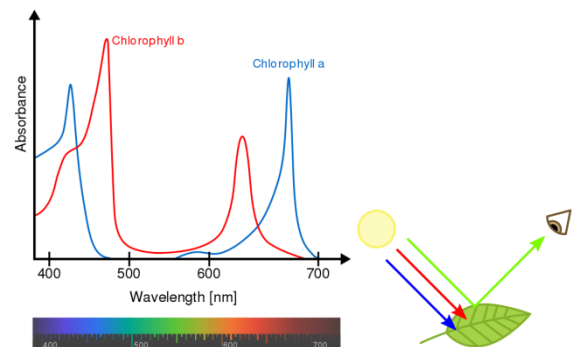


Figure-1. Chlorophyll absorption spectrum of the green leaf [3].

The accurate method to determine chlorophyll in the leaf is the use of chemical analysis called high-performance liquid chromatography (HPLC) [4]. This is a standardized method but the technique is complicated, expensive, time consuming, and can only be performed in the laboratory settings. With the advanced technology, different methods have been developed in which one is the use of image processing to estimate the chlorophyll level [5]. Spectrometer is the common technique based on the absorption and transmission characteristics of the chlorophyll to various energy wavelengths from the light [6,7]. A spectrophotometer is used to measure the amount of light absorbed or transmitted by the sample. The instrument operates by passing a beam of light through a sample and measuring the intensity of light reaching a detector. The beam of light consists of a stream of photons and they are absorbed by the chlorophyll. This absorption reduces the number of photons in the beam of light, thereby reducing the intensity of the light beam that is received and measured at the detector [8,9].