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論文 / 著書情報
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題目(和文)	タイ王国パーム油製造プロセスにおけるパーム核殻活性炭を用いた吸着による排水の処理
Title(English)	Effluent Treatment by Adsorption Using Activated Carbon Produced from Palm Kernel Shell in Palm Oil Mill Process in Thailand
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

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論 文 要 旨
THESIS SUMMARY

系・コース： Department of, Graduate major in	Transdisciplinary Science and Engineering, Global Engineering for Development, Environment and Society 系 コース	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of （ Engineering ）
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要旨（英文 800 語程度）
Thesis Summary (approx.800 English Words)

The palm oil mill industry is considered to be one of the important agro-industries contributing to Thailand's economy over the past decades. Currently, Thailand is the world's third-largest palm oil producer. With the growth in the palm oil mill industry, environmental concerns from the wastewater generated by the industry or palm oil mill effluent (POME) are also increasing in Thailand. The main objective of this thesis is to treat the effluent by adsorption using activated carbon produced from palm kernel shell in palm oil mill process in Thailand. The thesis is composed of the following six chapters.

Chapter 1, "Introduction", provides the background of this thesis. The chapter consists of general information related to palm oil, palm oil mill industry in Thailand, previous studies of adsorption and activated carbon, and objective and thesis structure of this research.

In chapter 2, "Characterization of Palm Kernel Shell", the palm kernel shell (PKS) obtained from Thailand was characterized by proximate, ultimate, and thermogravimetric analyses. The orthophosphoric acid as a chemical activating reagent was employed to treat PKS in order to investigate the potential of orthophosphoric acid toward thermal decomposition. PKS had a similar composition as that of other PKS reported in the previous studies. The high carbon and low ash contents in PKS made PKS suitable for producing activated carbon. PKS should be pyrolyzed at temperature above 500 K. The presence of orthophosphoric acid could hinder thermal decomposition in PKS at high temperature, indicating the potential to produce a high yield of palm kernel shell activated carbon (PKSAC).

In chapter 3, "Pyrolysis of Palm Kernel Shell for Activated Carbon Production", PKS which was chemically treated with orthophosphoric acid in chapter 2 was pyrolyzed to produce PKSAC and other products (off-gas and condensable liquid). The pyrolysis was performed under various operating conditions which varied in chemical treatment concentration, pyrolysis temperature, and pyrolysis time. The effects of operating conditions on yields and characterization of PKSAC and other products were discussed. The elemental balance among pyrolysis products was also performed. The presence of orthophosphoric acid in PKS could improve yield of PKSAC. The pyrolysis temperature significantly affected on yield of PKSAC whereas orthophosphoric acid concentration and pyrolysis time were insignificant. The pyrolysis temperature also showed the effect on yield of other products. Produced PKSAC had a relatively high micropore volume and specific surface area which were suitable to be used as an adsorbent. The off-gas contained flammable and non-flammable gases and one hour

of pyrolysis time was sufficient to obtain the off-gas. The condensable liquid contained chemical components such as acetic acid and methanol. The carbon content mainly remained in PKSAC while the oxygen content remained in off-gas and condensable liquid.

In chapter 4, “Equilibrium Adsorption of Unfavorable Compounds in Palm Oil Mill Effluent Using Palm Kernel Shell Activated Carbon”, PKSACs produced from various operating conditions in chapter 4 were used as the adsorbent. The adsorption of unfavorable compounds namely phenolic compounds and lignin in model POME by PKSACs was studied. PKSACs could successfully adsorb and remove unfavorable compounds from the model POME. The adsorption isotherms of unfavorable compounds by PKSACs followed the Langmuir model. PKSACs had higher adsorption performance than commercial activated carbon and could decolorize lignin in some runs. The saturated adsorbed amount of unfavorable compounds increased as orthophosphoric acid concentration increased but decreased as pyrolysis temperature and time increased. The specific surface area of PKSAC was significantly affecting unfavorable compounds adsorption performance.

In chapter 5, “Application of Effluent Treatment Using Palm Kernel Shell Activated Carbon in Palm Oil Mill Process”, the effluent treatment using PKSAC was applied to the current palm oil mill process in Thailand. Firstly, the proposed process was designed suitably and introduced into the current process to make the proposed process become reliable and practicable as possible. Following this, the material and energy balances in the proposed process were calculated based on the experimental results obtained from chapter 3 and 4. Subsequently, the feasibility of using PKSAC and other products from pyrolysis in the proposed process was investigated. The products obtained from pyrolysis could be applied into the current palm oil mill process. Based on simple material balance, PKSAC was an effective absorbent to treat unfavorable compounds in POME. The capacity of the PKSAC to adsorb the unfavorable compounds in POME was much higher than the amount of them discharged in POME. Off-gas had high heating value and could be used as an energy source for additional operations in the process. The compounds contained in condensable liquid could be raw materials for other chemical processes. Consequently, effluent treatment method using PKSAC was proposed for application in Thailand’s palm oil mill.

In chapter 6, “General Conclusions”, the summarization of this thesis is provided.

備考 ： 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。
Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).
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