EXTRACTING ETHANOL FROM ENERGY PLANT VA06- NEW ORIENTATION IN MINING ENVIRONMENTAL REHABILITATION

Đến tòa soạn 03-03-2021

Vo Tien Dung, Nguyen Tuan Binh, Truong The Manh
Nui Phao Mining Company, Dai Tu, Thai Nguyen
N. H. Ph. Lan
Institute of Environmental Science and Public Health-IESH

TÓM TẮT

CHIẾT XUẤT ETHANOL TỪ CÂY NĂNG LƯỢNG VA06- ĐỊNH HƯỚNG MỚI TRONG PHỤC HỒI MÔI TRƯỜNG SAU KHAI THÁC

Dự án khai thác mỏ Núi Pháo (NPM) đang vận hành một mỏ cắt lộ thiên và các cơ sở chế biến liên quan để thu hồi vonfram, vàng, đồng, bitmut và fluorit. Diện tích dự án khoảng 412 ha, bao gồm các hợp phần chính là 93ha lộ thiên, 175ha đuôi quặng (TSF); 81,5ha bãi thải, 35 ha nhà máy chế biến và vùng đệm. Khu vực này sẽ cần được phục hồi sau khi mỏ đóng cửa. Núi Pháo đã nghiên cứu các loại cây năng lượng như cây cao lương, cây cỏ ngọt và cây cọc rào để trồng phục hồi môi trường, trong đó việc sử dụng các cây năng lượng vào mục đích khác nhau đem lại lợi ích cho cộng đồng dân cư địa phương cũng đã được nghiên cứu.

Bài báo này trình bầy kết quả điều chế ethanol bằng phương pháp lên men và chưng cất các dịch chiết từ các cây cao lương VA06. Dịch chiết từ cây cao lượng VA06 chứa 9-14% lượng đường. Qua quá trình lên men, bằng phương pháp thủ công, các dịch chiết này đã được chiết cất bằng hệ cất chiết truyền thống dùng cất rượu từ gạo của các gia đình Việt nam. Sản phẩm thu được là rượu etanol với nồng đô 9-11độ. Với kết quả nghiên cứu này bước đầu định hướng cho mục tiêu vừa phục hồi môi trường, vừa đóng góp sản xuất ethanol làm nhiên liệu sinh học.

Keywords: *Nui Phao mining, energy plants, biofuels, sweet sorghum, ethanol, rehabilitation.*

1. INTRODUCTION

Ethanol is produced by fermentation and distillation of starchy grains can be transformed into simple sugars such as corn, barley, wheat, sugar beet, cassava and wild plants that contain cellulose. Ethanol has a high octane index (RON = 109), mixing into gasoline increases resistance to detonation, increasing the compression ratio of the engine, improving combustion efficiency, fuel economy, power and torque help the engine operate more smoothly and improve engine life.

Ethanol fuel helps reducing greenhouse gas emissions, environmental friendliness, low cost.

Nui Phao Mining has cooperated with Institute of independent environmental issue (UfU) – Germany for the project on Test Planting of Energy Crops on NPMC's Mine-site for the first period with 03 years (2016 – 2018) and the secod perIod 2 year (2020 – 2022) is focused on the trial producing Biomass and ethanol inside plant and soil improvement (focused on micronutrient). In the first period, the selected energy crops are included Acacia, Sweet Sorghum, VA06 grass, Cassava and Sugar-cane to produce the Biomass, Ethanol and Biogas. The preliminary trial results have

implied that the Acacia and VA06 grass will select to cultivate in the mine-site. These crops are quite compatible with the soil condition and good growth as well as the decisive crops for the rehabilitation objectives in the future.

To salvage the mine-land to develop into new raw-material area for the production of biomass, bioethanol to instead of traditional gasoline or the production of bio-burning pellets are used for thermal power plants.

The project of pilot energy crops will open a new direction in environmental rehabilitation and restoration works as well as the environmental and socio-economic benefits as:

• To improve the soil condition and increase the value of land after mining as well as the regional biodiversity contribution.

• To salvage the mine-land as the feeding area for local animals in the condition of increased limited cultivation areas, indirectly generate bio-energy through Bio-digester model

2. EXPERIMENTAL PROCEDURE

2.1. Race of microorganisms

• Varieties of fungi (five strains)

• Termamyl liquefied enzymes (liquerzyme; α amylase), glycemic AMG (glucoamylase) of Novo

2.2. Chemical and research equipment

2.2.1. Chemicals

+ NaOH 1.5%

+ Somogyi solution 1(Na_2CO_3, Kali tartrate, $CuSO_4.5H_2O$; $NaHCO_3$, Distilled water

+ Somogyi solution 2 ($(NH_4)_6Mo_7O_{24}4H_2O$; H_2SO_4: 96%; $Na_2HO_4.7H_2O$; Distilled water)

+Sodium acetate buffer solution 0.01 M, 0.05M, 0.1M, 0.2M, 0.5M, 1M pH 5.

+ $FeS0_4.7H_2O$; $CoCl_2.6H_2O$; $ZnSO_47.H_20$; $MnSO_{4.}H_20$; $CuSO_4.5H_20$

+ Standard glucose solutions

2.2.2. Research tools and equipment

+ Eppendorf centrifuge

+ Sigma 3K30 refrigerant centrifuge

+ Elgol flask, fermentation vessel

+ Beckman 310 pH meter

+ Heat stabilizer tank, stirrer from IKA

+ Salleron Dujadin alcohol distillation equipment

2.2.3. Materials

+ VA06 do not affect on the Food Security and should be the prospective direction. About using about 200-300kg.

+ High quality plants VA06 has a shape like sugar cane. After harvesting, the VA06 tree is cut into segments of about 50cm and is pressed for water like sugarcane juice (Fiture 1: VA06 tree and Fiture 2: VA06 plant pressed for water to ferment, distill alcohol)

Figure 1. VA 06 tree Sorghum

Ficture 2. water cane Compressor

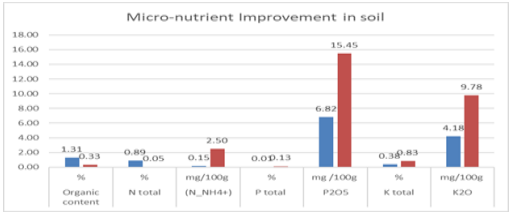
3. RESULTS AND DISCUSSION

Nui Phao Mining always emphasis on the environmental rehabilitation and restoration works during the period of mining and after mine-closure. In addition, NPMC also cooperates with the recognized international and Vietnamese organizations to research and select the effective direction in accordance to the policy of the State on environmental protection in mining.

To the date, NPMC has been rehabilitated on

totaling of 16ha with Acacia and VA06 grass on the slope of waste-dump to the aim of soil stabilization as well as soil quality improvement. Some elements of mineral and micronutrient like Organic content, N, N_NH4+, P, P2O4, K và K2O have trend an increase when compared to other without the energy crop planted.

The results of analyzing soil quality before and after exploitation, comparing with agriculture, forestry areas without mine sites, without mining activities.



Ficture 3. Micro-nutrient impeovement in soil of Nuid Phao mining area

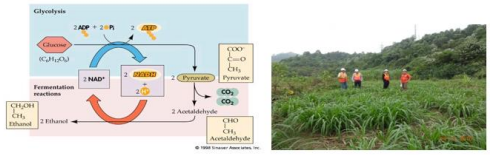
3.1. Sorghum bicolor

Ficture 4. Extraction from sorghum plants 20l/42kg of fresh tree (a), 15l/43kg of fresh tree (b) and Family modem alcohol destiler (c)

This is a kind of feeding crop, 2 – 5 m height, fast growth rate, grow best at tropical or subtropical areas, suitable crop land has pH of 5-8,5. Sorghum biolor is easy to plant, widely adaptive, good consumption for their growth in 2 harvest seasons is only ¼ of cane per harvest season. The cost of planting sorghum biolor is 3 times cheaper than planting cane. Growth time of sorghum biolor is short (from 100 to115 days), yield capacity is about 95-125 ton/ha.

It is possible to product ethanol from the trunk juice, residue and … of sorghum biolor. Each part of sorghum biolor needs to have different technology of processing and fermenting.

3.2. Steps of studying to ferment ethanol as follows:



Ficture 5. Biochemical basic for fermenting ethanol

Fermenting ethanol by yeast is the basic for producing alcohol, beer, dune, glycerin. General diagram of process of fermenting ethanol from glucose in ficture 5.

3.3. Quality of the alcohol products are prepared from plants VA06

From the pressed solution of sorghum VA06, the results were obtained as table 1. The project has pressed from 5 times, each time 50 kg of high quality plants VA 06. Has distilled 5 times, each time about 10 liters of juice from plants VA06 with sugar content from 11.9 to 14.7% sugar . The resulting volume of alcohol obtained, work concentration is recorded in Table 1.

Table 1. The quality of the alcohol product prepared from VA06

No	distilled 1	Distilled 2	Distilled 3	Distilled 4	Distilled 5
Thể tích nước ép từ VA06 (litr)	13,5	14,3	16,2	10.6	11.7
Sugar content (%)	12.5	12.7	11.9	14.7	12.6
Amount of alcohol (litr)	1.8	1.9	2.1	2.3	1.8
Alcohol level	10.3	10.6	9.4	11.2	10.5

Ficture 6. The ethanol product from sweet plant VA06

Table 1 show That recovery efficiency is about 8-15%. Concentrations range from 9.1 to 10.6 degrees. . Other information on alcohol quality is not investigated in this report

4. CONCLUTION

The research results on the plant orientation process to restore the environment of Nui Phao Company is a guide in the right direction. Bio-ethanol products from VA06 energy can completely be manufactured into recoverable plants about 10 degrees, with efficiency from 9-10%. The sugar content of the juice from plants with VA06 is about 12%.

Energy plant could cultivate on the area of earth work completion for the purpose of rehabilitation for erosion control and soil and biodiversity improvement.

Create the new oriention for using energy plant in environmental rehabilitation works in the period of mine closure as the model not only in Thai Nguyen but also in mining activity of Viet Nam.

REFERENCES

[1]Thông tin về khu khai thác KS NP

[2] Dự án khôi phục mt NP – liên kết với Đức

[3] Anastopoulos, George; Zannikou, Ypatia; Stournas, Stamoulis;Kalligeros,Stamatis(2009). "Transes terification of Vegetable Oils with Ethanol and Characterization of the Key Fuel Properties of Ethyl Esters". Energies. **2** (5 June 2009): 362–376.

[4] Power a cleaner tomorrow: Three Technologies to watch in the next phase of the energy transition. Mitsubishi Power.LTD.2018,VEA

[5] J.M.P.Q. Delgado: Book of Curent Trends in Chemical Engineering. Chaper: Biodiesel Production. 2010.

[6] Quyết định 18/2013/QĐ-TTG ngày 29/3/2013: Cải tạo, phục hồi môi trường và ký quĩ cải tạo. phục hồi Môi trường đối với hoạt động KTKS.

[7] Vera, C.R.; S.A. D'Ippolito; C.L. Pieck; J.M.Parera (2005-08-14). "Production of biodiesel by a two-step supercritical reaction process with adsorption refining" Rio de Janeiro.