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A REVIEW OF THE PRODUCTION OF BIOETHANOL FROM RICE HUSK BIOMASS

BY

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A RESEARCH REVIEW PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF CHEMISTRY IN PARTIAL FULFILLMENT FOR THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE AND EDUCATIONDEGREE OF BUSITEMA UNIVERSITY.

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DECLARATION

I **WANDULU AMBROSE** declare that this research review is my original work and has not been published or submitted before to any university or higher institution of learning for award of degree.

WANDULU AMBROSE

Sign……Date……

APPROVAL

This dissertation has been done under my supervision and guidance.

Supervisor:

DR KAMOGA OMAR

Sign……Date……

DEDICATION

This dissertation is dedicated to my dear parents, my father Mr. Walyaula George ben and my Mother Anent Nabalayo, my brother Makatu Peter, Mukabi Davide my beloved sister Esther and the entire family of Mr. Lusabe peter for their financial support. Special thanks go to my father- for their endless financial and mentor support all through my bachelor's academic journey. Above all I thank the almighty God who has guided through out the journey of my education.

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May God reward them abundantly?

ABSTRACT

Rice husk is the most abundant resources and attractive lignocellulosic materials for bioethanol production. This substrate includes cellulose and hemicellulose contents that are hydrolyzed into fermentable sugars. Rice straw substrate contains a high quantity of lignin in their composition, and needs an appropriate pretreatment approach for bioethanol production. Bioethanol is got from alcoholic fermentation of sucrose or simple sugars, which are produced from biomass using hydrolysis process. Bioethanol can be obtained using enzymatic hydrolysis and acid hydrolysis. Filtrates after hydrolysis of the various husks were subjected to 7 days fermentation with yeasts from palm wine as well as bakers' yeasts. bioethanol yields got from palm wine yeast fermented husk as well as sugar from other treated husks were obtained.

During the process of enzymatic hydrolysis of the pretreated RH, using the acid cellulase enzyme, it was found that the highest concentration of TRS in the samples was 7.788g TRS/L, obtained in a time of 24 hours of hydrolysis. After the alcoholic fermentation of the glucosed syrups obtained, at a laboratory scale, a distillate with a concentration of 3.7% v/v was achieved by simple distillation. For the pilot-scale process, 450.00g of RH pretreated with NaOH solution 2.00% w/v (430.47g dry base) were treated, with the subsequent enzymatic hydrolysis with acid cellulase, the alcoholic fermentation of the sugars reducers obtained in the hydrolysis, and fractional distillation of the must, it was possible to obtain four samples of bioethanol with concentrations of 71.3, 30.0, 10.3, and 5.3%v/v of alcohol, which when mixed produced a sample of 95mL of solution with a concentration of 27%v/v of alcohol (4.70g/100g of RH), therefore, taking as a reference the theoretical value of 30g ethanol/100g of RH, a yield of 15.67% was obtained.The production of bioethanol on a laboratory scale is preferred because it was found out that the highest bioethanol within 7 days after the alcoholic fermentation of the glucose syrup than that of the pilot scale as it will be discussed later.

Key words:- Bioethanol, Rice husks, Bio mass, Saccharification, Hydrolysis, Lignocellulosic biomass

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background.

Main sources of sugar to produce ethanol come from fuel or energy crops. Crops grown mostly for energy use include waste straw ,wheat crops, waste and sorghum plants. Bioethanol is an alcohol made by microbial fermentation, mostly from carbohydrates. Bioethanol, are interesting alternatives to surpass the global energy crisis caused by the depletion of fossil fuels and environmental problems, such as global warming (R. Chandra, 2012). Since the raw materials for bioethanol production are also used for food, this has generated economic, political, and social controversies. The production of first-generation bioethanol from sugarcane and corn is very high to be able to supply the needs of the food and bioethanol sectors (Cheng, 2002). Therefore, alternatives have been proposed, such the production of second generation biofuels from raw lignocellulosic materials. Rice straw and husk are residues of agro-industrial activities. They are composed of more than 50% cellulose and hemicelluloses, making them suitable for the production of bioethanol (P.Bibod, 2010). Rice is the most cultivated cereal in the world, especially in Asian countries. Its production generates large amounts of rice husk as lignocellulosic residue (D.Qing, 2010). According to a projection of FAO made in 2017, 24.0 million tons of rice in the years 2018/2019 were expected to be produced in South American countries, such as Brazil, Bolivia, Colombia, Ecuador and Argentina (FAO, 2017). The biomass generated as a residue (straw, husks) is generally eliminated by burning, with negative environmental impacts (M.Moniruzzaman, 1996). Cellulose, the major component of lignocellulosic biomass, is formed by large glucose chains. Hemicelluloses are formed by chains of several sugars with five and six atoms of carbon, whereas lignin is an aromatic complex (E.M.Rubin, 2008). For bioethanol production, because of the structure of lignocellulosic materials, it is necessary to pretreat the biomass before enzymatic hydrolysis and glucose fermentation (A.Cotta, 2007).

Lignocellulosic wastes minimize the potential conflict between land use for food and

energy feedstock production, The raw material is less expensive than conventional agricultural feedstock. It can also be produced with lower input of fertilizers, pesticides, and energy. Biofuels from biomass-economic, environmental friendly (low emission of green house gas) It can also provide employment in rural areas. This if successful will serve two uses; first, help reduce wastes in the environment and to create wealth from waste.

Rice is the third most important grain crop around the world. As per FAO statistics, world annual rice production in 2007 was about 650 million tons. Accordingly it was estimated that about 650-975 million tons of rice straw produced every year all around world .

The main focus for the bioethanol production is the agricultural wastes these days is due to the food and feed competition that resulted in the global scarcity of food in previous few years . The use of the agricultural residual wastes is the cost effective way for the production of ethanol. In this review the main concern is to study the bioethanol production from the residual wastes of rice crop. As in many regions burning is the main practice preferred by the farmers to decompose this waste or the other way is that they use these types of agro-waste as fodder for cattle. Therefore to use these waste products in production of bioethanol is of more economic use and is environmental favorable as the burning of these waste produces a lot of gases harmful to the environment. Waste utilization and cost reduction in industrial processing by rice husk as a valued materials. Large part of these rice residual wastes is made up of complex carbohydrates like cellulose and hemicelluloses. These cellulose and hemicelluloses can be converted into sugars and ethanol fermenting microorganisms can utilize these sugars to convert it into ethanol. Chemical composition for rice straw consists of cellulose (32-47%), hemicellulose (19-27%) and lignin (5-24% .Composition of rice husk is that it contains 75-90% of organic matter such as lignin, cellulose and hemicellulose . Rice husk generally contains approx. 29.3% hemicellulose and approx.. 34.4% cellulose which can be degraded to get reducing sugars

1.2 Problem statement

Waste material production in undeveloped areas is increasing at a high rate due to the

small industrial scale machines such as rice grinding mills. Rice husks are abundant in all tropical environments, thus making it an agro-processed waste. A great proportion of agricultural residues are derived from rice, wheat, corn and sugarcane, with rice straw being the most abundant agricultural residue worldwide. The main aim of this study is to discover the possibilities of obtaining bioethanol from rice husks after varied hydrolytic treatment.

1.3 Research objectives

This study review is aimed at discovering the possibilities of obtaining bioethanol from rice husks after varied hydrolytic treatment.

1.3.1 Specific objectives;

- To review the trend in the production of bioethanol.
- To review the different methods used in the production of bioethanol from the rice husks.
- To review the out put of the different methods used in the production of bioethanol from the rice husks.

1.4 Justification

Farmers burn the rice straw left in the field in order to clear it for the next crop. The burning of rice straw generates a lot of harmful gases like CO_2, CO, CH_4 and N_2O into the atmosphere that lead to air pollution, climate change due green house gases (Samra JS, 2003) (Gadde .B, 2009). The utilization of agricultural residues for power generation is a green initiative to provide electricity and thermal energy. The exploitation of rice straw for bioethanol generation emits fewer amounts of GHG and also lignin, unreacted carbohydrates and other organics produced during the process is used for steam and electricity generation. Therefore, use of rice straw for bioethanol generation helps in becoming more energy independent and also, provides employment and direct economic benefit to local communities. It can be concluded that conversion of rice straw for the production of bioethanol is a more sustainable process rather than the open burning of rice straw.

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