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Ethanol as a Viable Alternative for Fossil Fuels

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Abstract:
Environmental challenges from fossil fuel emission has become global issues and has contributed immensely to climate change. Ethanol has experienced unseen levels of attention due to its value as substitute to fossil fuel. Besides being a renewable and sustainable source of energy, it is also efficient, avoidable and environment friendly. Global production of ethanol continues to increase and will probably continuing to dominate the alternative fuels market in the next decade. It is important to emphasize that for ethanol to be a viable alternative, it must have ecological benefits, be economically competitive and its production must be in commercial scales without affecting the food production.

1.0 INTRODUCTION

Environmental problem from fossil fuel emission has become global issues, for instance, greenhouse effect. According to Intergovernmental Panel on Climate Change (IPCC), fossil fuel contributes to approximately 75 percent increase in carbon-dioxide (CO_2) emission (Metz et al., 2005; Olajire, 2010). Over the last decade the world has begun to realize the significance of finding clean, sustainable and renewable forms of energy. One of them is ethanol which is made from the fermentation process of crops such as corn, cassava, rice, sugar-cane and soya-beans. Licht (2006) claims that global production of ethanol has increased rapidly since 1970 when there was oil crisis, its sales rose sharply from 1975 to 2006. Goldemberg and Guardabassi (2009) explored that the present use of ethanol as a fuel is around 86.4 million litres, accounting for 0.7% of the global oil production and 2% of the fossil fuel consumption, while utilizing less than 1% of the world's cultivating land. In 2006, about 45 billion litres of ethanol were produced globally and more than half of this was generated in the Brazil and United States (Goldemberg and Guardabassi, 2009). Ethanol is a good alternative to gasoline because it does not have the impurities such as sulphur oxides that are commonly found in petroleum products.

2.0 ETHANOL AND THEIR CHALLENGES

One aspect that has received much attention is the possible link between ethanol production and food shortage such as famine. Increased ethanol production will increase the cost of crops which are the major feed-stocks, and this may result into inflation i.e. persistence rises in the price of food. According to the UN World Food Program, about 10 million people die of hunger between 2001 and 2003 out of less than a billion people that were malnourished in an average year (Tenenbaum, 2008). Bio-fuel production that uses food crops such as corn has caused rapid increased in their prices in the last few years (Keeney, 2009). Fargione. (2008) also claims that recent policy decisions to produce advanced biofuels on high standard farming land contributed to the food shortage (Slaght, 2012). However, the problem of food shortage can be solved through improved farming techniques such as efficient use of fertilizers and pesticides that will boost crop yields. Another problem that is affecting the ethanol production is technological issues for example, conversion technology and biotechnology. Ethanol production from cellulosic materials is having challenges on technology (Goldemberg and Guardabassi, 2009). Bothast. (2005) says that about ten percent of corn crop generated 3.4 billion gallons of ethanol fuel in 2004 and its demand is expected to be more than double in the next ten years. So, to meet this demand, new technologies must be moved from the research to profit-oriented (Damirbas and Balat, 2005). Therefore, global scale production of ethanol requires high-technology (advanced technological development) such as modelling, simulation and optimization. This should perhaps be applied to some processes such as fermentation, distillation, cogeneration, residue treatment, recycling, instrumentation and automatic control systems. And consequently, will contribute to the vast growth of ethanol production. Sugar production through technological advancement contributed to significant increase in the production (Costa et al., 2010). Nguyen et al. (1999) suggest the usage of both ultrafiltration and microfiltration for the collection of the cellulose from the enzymatic hydrolysis reactor during the production of ethanol from metropolis refuse (Cardona and Sanchez, 2007). Cardona and Sanchez. (2004, 2006) use Aspen Plus (software) to simulate several technological configurations that will improve the yield of ethanol from biomass and certain processes and integration possibilities are to be taken into consideration (Cardona and Sanchez, 2007). Nguyen et al. (1996) claims that a trial plant was constructed for the conversion of lignocelluloses biomass into ethanol, operated for the purpose of research and development among associate industries that deal with biomass ethanol technology (Cardona and Sanchea, 2007). Bai et al. (2008); Zhao and Bai. (2009) say that constructions of pilot and large factories have been built in China for the continuous ethanol production using flocculent yeast strain i.e. ethanol accumulation and recycling for many batches (Mussatto et al, 2010). Consequently, the continuous improvement in technology will increase the production of ethanol for global scale.

Furthermore, there are policy issues i.e. uncertain governmental policies such as un-supportive policies, and uncertainty in policies. Government policies that support demand and encourage the investment and research needed to develop an alternative fuel is paramount for environmental improvement and energy security. Government can enhance the production of ethanol by introducing certain programs such as subsidies, research and development programs. The advancement of any nation is as a result of high level of research and development for example Sao Paulo in Brazil has made huge investments in genetic research and sugarcane improvement breeding (Hira and Oliveira, 2009). Wang. (2006) says that the policy tools in China for bio-fuel promotions are tax, subsidies, cost limit, quotations, and establish changes by law (Balat and Balat, 2009). Gnansounou. (2005) also claims that two major bio-ethanol fuel programs have been accomplished in China from 2001 with the aim to enhance renewable energy sources, enhance public energy security and improve national territory (Balat and Balat, 2009). Therefore, it is possible for ethanol production to provide a viable alternative for fossil fuels on global scale i.e. private companies and public sectors are presently making progress on developing cellulose ethanol industry (Keeney, 2009). Indian's Government gives 40 per cent subsidized loans for sugar factories who are interested in ethanol manufacturing (Coyle, 2007). However, Thailand which is agricultural based nation is encouraging ethanol production that is currently obtained from cane molasses and cassava (Mussatto et al., 2010). Ethanol production increased worldwide from 17.25 billion litres in 2000 to over 46 billion litres in 2007 and its demand will exceed 125 billion litres by 2020 with the new governmental programs of America, Europe and Asia (Balat and Balat, 2009). Governments justify support in order to achieve societal goals for example, to diversify energy sources, to enhance energy security and to meet environmental and rural development objectives.Finally, Ethanol as a viable alternative for fossil fuel requires a vital role from agriculture, technology, and government intervention such as research and development, subsidies, and tax reduction. Advanced technology development such as biotechnology and process engineering could provide the means to develop economically friendly technologies for the production of fuel ethanol. Improvement in agriculture is also paramount because it is the source of the ethanol fuel i.e. raw materials or feed-stocks are from crops. Government policy is also important because it encourages people on the production of ethanol. Although all of them are the key tools for the development and production of a viable alternative and sustainable renewable energy such as ethanol, the most important and promising aspect is technology because of its wide applications, such as biotechnology, waste reduction and crop breeding technology. In addition, the technology of recombinant deoxyribonucleic acid (DNA) will have high positive advancement in fuel ethanol industries and development of genetically modified microorganisms that will increase its production.

3.0 CONCLUSION

Ethanol has experienced unseen levels of attention due to its value as substitute to fossil fuel and also mitigation option for climate changes; besides being a renewable and sustainable source of energy, it is also efficient, avoidable and environment friendly. Researches are presently focus on the development of concepts such as renewable resources and sustainable development. Hence, global production of ethanol is increasing, and it will probably continue to dominate the alternative fuels market in the next decade. It is important to emphasize that for ethanol to be a viable alternative, it must have ecological benefits, be economically competitive and its production must be in commercial scales without affecting the food production.

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