



UTILIZATION OF COFFEE INDUSTRY WASTE AND SPENT COFFEE GROUND FOR GENERATION OF POWER ALCOHOL

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Abstract:

As a consequence of this big market, the reuse of the main coffee industry residues is of significance importance from environmental and economic viewpoint. Research employs advance process to extract oil, which involves soaking the coffee ground in organic solvents that separates the oil. The separated oil later undergoes a series of chemical reaction to produce biodiesel. Inexpensive process to extract oil from the coffee waste that was then converted into biodiesel, which could be used to fuel motor vehicles, will be use. Biodiesel from coffee oil will be more economical though in the current scenario of coffee biodiesel would not be able to replace conventional fuel. Researchers estimate that 10 kg of waste coffee grounds are produced by a small coffee shop, which can produce nearly 12 liters of bio-fuels.

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Keywords: Spent coffee ground, biodiesel, Bio-ethanol, fermentation, zero waste

INTRODUCTION

Agro – industrial wastes are generated in large quantities throughout the world. Their non – utilization results in loss of valuable nutrients and environmental pollution. The wastewater generated from such industries discharge directly into surrounding water bodies, which affect human health and aquatic life. As per research, people residing in the vicinity of this industries utilizing polluted water for domestic purposes and suffer from severe health problems. Also, projected fuels demands indicate that, new, alternative and low priced feedstock are needed. This problem will be tackle by adopting this technology as it will help in reduction of disposal of waste in surrounding. Also solve the problem of the crisis of energy fuel. Alemayehu Haddis 2008 carried out health problems reported by the population living nearby industries.

Health Problems	% of Population Affected
Spinning sensation (feeling drunk)	89
Eye irritation (burning inside)	32
Skin irritation	85
Stomach problem	42
Breathing problem	75

Table 1: Percentage of Population Affected

Presently economy of the world is manly dependent on fossil energy source like oil, coal, natural gas, etc., which are being used for generation of fuel, electricity and other goods. Large consumption of fossil fuels has resulted in high level of pollution. Global energy consumption has increased gradually with the expansion of human

population and increase industrial prosperity. Use of transport fuel is affected by limited reserves of fossil fuel in the world. Alternative energy sources must be technically feasible, economically competitive, environmentally acceptable and readily available. Several alternative fuels have been proposed, such as bio-ethanol, biodiesel, methanol, hydrogen, boron, natural gas and liquefied petroleum gas. Bio-ethanol is by far the most widely used bio-fuel for transportation worldwide.

This study propose to utilize wet coffee processing waste and spent coffee ground to produce bio-ethanol which will provides the alternative energy source from waste and solves the environmental waste disposal as well as human health problems. Recycling of industrial and household waste is very imperative for keeping the environment clean. Coffee is one of the most important agricultural commodities in the world. India is the third largest producer and exporter in Asia, seventh largest producer and fifth largest exporter of coffee in the world. The country accounts for 3.66 percent of global coffee production. The coffee production in FY 2017-18 is estimated at 316,000 million tons, as against 312,000 million tons in FY 2016-17. Over April 2017- March 2018, coffee exports from India stood at 267,510 tons, registering a year-on-year growth of 12.70 percent. Italy, Russia, Germany, Belgium, Turkey, USA, Poland, Libya, Spain and Indonesia are the leading importers of Indian coffee. Out of the total coffee produced in India, around 70 percent is exported while the remaining 30 percent is consumed domestically.

EASE OF USE

Objectives:

- Coffee waste is emerging as a new feed for producing green fuel.
- To restrict non – utilization of coffee waste, which will restrict loss of valuable nutrients and environmental pollution.
- To curb the problems of coffee effluent through innovative and ecofriendly techniques.
- To produce a final effluent quality that is compatible with standards set by the Environmental Control Authority.
- To assume social, economic and industrial importance.
- To get the world think differently about ‘waste’.

Demand of technology and proof of concept

We find ourselves in an era where there is a growing public recognition of the importance of conserve fuel. If this technology will adopt in our Country, we could soon become one of the top biodiesel generating Nation in the future. So it may be not be far when we would start refueling our vehicles using biodiesel produced from waste coffee ground and effluent generated from coffee industry.

Methodology

Processing of coffee in India is accomplished using two methods, dry processing and wet processing. Given the high concentration of nutrients, carbohydrate in coffee industry effluent and coffee ground, it can be viewed as a potential raw material for bioethanol production. Furthermore, the produced ethanol could be employed for biodiesel production based on coffee waste obtained from various industries, thus further contributing for the implementation of sustainable development in the coffee and biodiesel production chains. However the production of ethanol from coffee waste will be adopted on a practical scale. Wastewater generated from coffee processing plant contains organic matter like proteins, pectin and sugars. Its disposal in nature, without any treatment causes severe environmental pollution due to putrefaction of organic matter. The better utilization by biotechnological means assumes social, economic and industrial importance.

Sample collection:

Waste water from coffee industries will be collected from wet coffee processing industries which are in the South region of the country mainly Karnataka, Kerala and Tamil Nadu. The sample will be kept in ice box and transported to the Prof. Ram Meghe Institute of Technology and Research, Badnera in the state of Maharashtra and kept in the Environmental Engineering and Bio-innovative laboratory.

Chemicals Required:

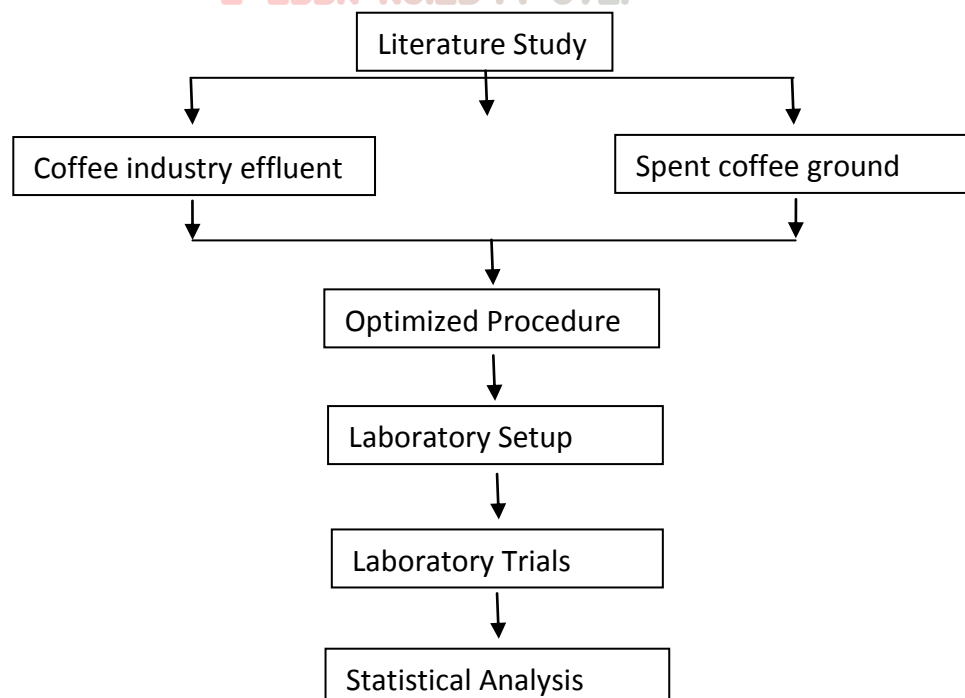
Ethyl Alcohol (Ethanol) C_2H_5OH , Sulfuric acid H_2SO_4 , Sodium Hydroxide $NaOH$, Hydrochloric acid HCl , Methylene Blue $C_{16}H_{18}ClN_3S$, Fehling Solution (A and B), Whatman No. 1 filter paper, Yeast extract, agar agar, etc.

Apparatus and Equipment Required:

The procedure used for studying the optimization of all the parameters (including sterilization, hydrolysis time, temperature, acid concentration, fermentation time and temperature, distillation and ethanol generation) is briefly described below. The effect of a particular parameter would be studying by keeping all the parameters constant except the one under study. A series of experiments will perform for production of ethanol. Coffee waste will sterilize at $120^\circ C$ for 15 minutes then cool at room temperature. Keep in a refrigerator at $4^\circ C$ before use. Yeast strain maintains on agar slants use to inoculate pre-fermenting media which contain 2% sugar and 3 g/l yeast extract and incubated for 12 hour before use. 100 ml of coffee waste transfer into 250 ml conical flask and pH will be adjusting using HCl and $NaOH$. Flask sterilized at $120^\circ C$ for 15 minutes then cool at room temperature. 5 ml of pre-fermentative yeast incubate to sterilize media and then incubate (without shaking) at an ambient temperature for 2 days. Coffee waste is then hydrolyzing. Ethanol produce will recover and purified through distillation. Ethanol concentration in distillation will determine Gas Chromatography. Presence of Nitrogen and trace elements in fermentation media will determine according to procedure. Minerals of coffee waste will obtain by dry ashing method. For generation bioethanol from spent coffee ground, soaked this waste in potassium hydroxide and heated to $700-900^\circ C$. The time taken to produce ethanol from spent coffee ground is about one day, which is less than what it takes by other such materials, hence adding to its value. Using this process and this material has several other advantages, too. It could help in reducing climate change in two ways – one is by adsorption of ethanol which is itself an anthropogenic gas and second is by making clean power fuel.

Workplan

Generation of biodiesel will be carried out by using coffee effluent generated from industries and spent coffee ground. So the work plan for both the waste will be as follows:
Data regarding the study was collected. Various methods were studied for optimization of procedure. This study is aim to optimize the parameters for the production of bio-ethanol from coffee effluent generated from industries and spent coffee ground and to characterize the sludge left after bio-ethanol production.
Data processing gives an idea about adoption of both the methods of generation of power alcohol, importance of the research and the influence of existing affecting parameters on generation of biodiesel. This part also highlights the present scenario of the project and its applicability in society.



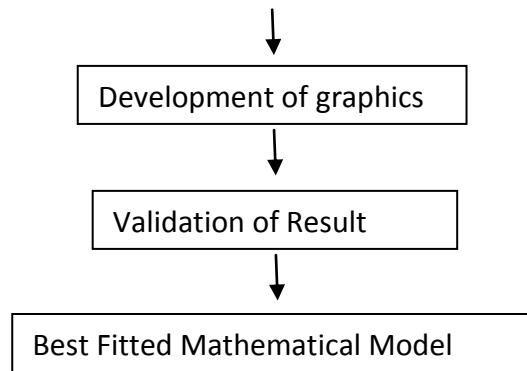


Fig. 1: Flowchart of Work plan

This study will ensure that an effluent quality that complies with the Indian Standards for the effluent discharge, different combination of treatments like bio-methanation, aeration and constructed wetland technology were adopted as an integrated system for the treatment of coffee processing waste water. So, this study will be the eye opening for the society. From this study, it is thus possible to state that there is a potential for bio-ethanol (power alcohol) production from coffee effluent generated from industries and spent coffee ground. A theoretical model for the joint treatment would also be formulated on a more sophisticated which will be beyond the scope of this study. This study will clearly give idea about the possibilities of producing ethanol from coffee waste. The utilization of coffee effluent generated from industries and spent coffee ground as an alternative energy production reduces the environmental pollution and dependence on oil and petroleum in India.

Study design, Cost-benefit analysis, Number of beneficiaries

Early studies have indicated that Coffee waste contained only 2.5-3.0% ethanol, which would implicate in high energy costs during the distillation stage. However, the recent study demonstrated that a product containing 10-14% ethanol and this was only a preliminary feasibility study, employing baker's yeast as a fermentation agent.

Researchers estimate that 10 kg of waste coffee grounds are produced by a small coffee shop, which can produce nearly 12 liters of biofuels.

The wastewater generated from such industries discharge directly into surrounding water bodies, which affect human health and aquatic life. As per research, people residing in the vicinity of these industries utilizing polluted water for domestic purposes and suffer from severe health problems. Also, projected fuels demands indicate that, new, alternative and low priced feedstock are needed.

Outcomes

This study will clearly give idea about the possibilities of producing ethanol from coffee waste. Study will promote the use of waste generated from coffee industry. This will also encourage the others to reconsidering the 'waste' as raw material for new product.

This study will develop the process of generation of biodiesel from effluent from coffee industries and from spent coffee ground. Generation of biofuel from both the waste i.e. effluent from coffee industries and spent coffee ground are studied separately, but in this study process will develop by adopting both types of waste in combination. Required modifications may be carried out to increase efficiency.

Use of waste which is generating from coffee industries will solve the problem of disposal of untreated waste directly in water bodies or land. It will also solve the problem of human health of communities which lives near the disposal site. Adoption of this technology will generate the new employment for the local community of the project area. This will help in overall development of the society. The crisis of fossil energy source like oil, coal, etc. will solve.

This would be scale up from a technical demonstration and have the opportunity to take this forward on a larger scale. Data or result generating from this research will use for mathematical modeling. There is a large scope of further research. The study can be extended to study the improvement in performance by adopting some different technologies.

Nowadays, there is great political and social pressure to reduce the pollution arising from industrial activities. Almost all developed and developing countries are trying to adopt this reality by modifying their processes so that their residues can be recycled. Consequently, most major companies no longer consider residues as waste, but as a raw material for other processes. Besides to add value to these unused materials, finding alternative forms to use them would be useful to decrease their impact to the environment. In coffee producing countries, coffee waste constitutes a source of severe contamination and serious environmental problems. For this reason, efforts have been made to develop methods for coffee waste treatment and management since the middle of 19th century. Hence there is a need to study these issues in innovative and eco-friendly technique.

With this study, by promoting valuable uses of coffee effluent generated from industries and spent coffee ground, hope to encourage others to reconsider what could be achieved with substances we currently considered as 'waste'. It has been a long process, but an exciting time scaling-up the technology and expanding the business. The challenge is to scale up from a technical demonstration and have the opportunity to take this forward on a larger scale.

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