CHAPTER I

INTRODUCTION

1. Rational for the Study

Concern over the depletion of fossil fuels in the near future and an increasing awareness of energy conservation has drawn worldwide attention. Present energy resources, such as coal, oil and gas, are being used at an accelerating rate with fear; there is also an increasing awareness about envirokn nmental pollution and ways of minimizing the same. The renewable source is used as a synonym for a source of biological origin while non-renewable source is used as synonym for a source of geological origin. There are nine general sources of energy on Earth. They are: solar, biomass, wind, wave, hydro, tidal, geothermal, nuclear and fossil. Except for the last three the remaining six are generally called renewable sources of energy, as they are not depleted with time. One of the most promising renewable sources of energy is the energy from biomass. It is, however appropriate at this junction to emphasize conservation of energy. Energy conserved is energy available for uses. Energy is not utilized properly in the world. It is, therefore, imperative to educate people to be more energy conscious and to treat conservation of energy as important as finding an alternative form fuel sources is most welcome and appreciated. Biomass materials constitute the greatest proportion of waste materials.

Most of the biomass materials are found in the developing countries in Asia and Africa whose main sources of revenue are agriculture, timber logging, animal rearing etc., where biomass is the main byproduct. The first impression is that biomass energy would be the most viable form of energy in the developing countries. However, in recent years, the developed countries in Europe in particular have promoted the importance of biomass energy [1]. Hence, biomass energy is not only essential in the developing countries but has also aroused great interest in Europe. Sweden has continued to invest in the biomass energy program as a renewable energy [2]. The difficulties faced during

the Second World War have always been a constant reminder to the Swedes and should be for most countries in the world whose prime dependence is on imported fossil fuel.

On the one side, massive technological transformations and manipulation of global ecosystem by developing countries, principally through excessive combustion of fuel, has increased the release of Carbondioxide into the atmosphere to levels, which cannot be absorbed by national ecological Carbon sinks. This problem has been exacerbated by the activities of developing countries, who through desperation and the sheer need to feed their ever growing populations, are destroying their biomass resource at much faster rate than can be regenerated. Thus, the reduction in the biomass resources of developing countries, apart from its immediate and visible forms of creeping deserts and depleting forests, is also destroying one of the earth's largest repository's for Carbondioxide. Biomass can be considered relatively clean fuel as it decreases or even eliminates net Carbondioxide emission and has low Sulphur and NO_x content and particulate emissions are lower than fossil fuel. There are actually only two principal classes of conversion process, thermal and biological.

Utilization of biomass is a very important source of energy in many parts of the world, especially for remote areas from a supply of high quality fossil fuels, such as natural gas, liquefied petroleum gas (LPG) etc. For small installations producing less than 1.5 MW thermal, coal is not a popular fuel owing to its high Sulphur content (typically 0.5-2%) and the resulting necessity for expensive removal of SO_2 from the stack. Gasification is a process converting solid/ liquid fuel into a gaseous fuel without leaving any solid carbonaceous residue. It is one of the important conversions that can be effectively utilized for decentralized power generation and thermal applications. Biomass gasification treats the solid feed material in a reactor such that virtually all of it is converted into fuel gas with calorific values typically 3-5 MJ/m^3 with most of the energy being available from H_2 and CO [3]. After cleaning, this gas can be used to direct combustion and indirect combustion.

2. Statement of Problem

Oyster mushroom in nature grows mainly in the temperate zone of the world on rotting trees. The cultivation technique for oyster mushroom is simple and cheap due to simplicity of cultural steps and availability of growing substrate such as sawdust, straw, cornstalks, hardwood chips and other plant fibers, which have high cellulose contents. There are various growing methods for oyster mushrooms. In the household and small industry scale the mushroom farmers prefers to use sawdust culture. In Thailand the oyster mushroom substrate wastes are produced from oyster mushroom processes, every 3-4 months oyster mushroom substrate are managed to be wastes, which environmental impact that shows in Figure 1.

Figure 1 Oyster mushroom substrate waste environmental impact

LPG or electrical equipment such as autoclave is used for agar media sterilization. LPG, wood or some of agricultural residue are used for oyster mushroom substrate pasteurization. Biomass gasification is one of the upcoming biomass technologies developed to produce a combustible gas mixture or heat using a variety of biomass. Gasifier is one type of thermal processing equipment, it converts carbonaceous feedstock into gaseous products at high temperature and elevated pressure in the presence of Oxygen and steam. Partial oxidation of the feedstock provides the heat. At operating conditions, chemical reactions occur that produce synthesis gas or "syngas," a mixture of predominantly CO and H_2.

Oyster mushroom substrate waste could be used as biomass for gasifier and it could be replaced conventional fuel that leads to saving energy and environmental friendly. Figure 2 shows the oyster mushroom products processes with gasification. In the oyster mushroom product processes required energy for sterilizes the oyster mushroom agar media and pasteurizes the oyster mushroom substrate. A lot of oyster mushroom substrate wastes are produced from oyster mushroom product processes. Oyster mushroom substrate are consisted of Wood sawdust 91.30 %, Rice husk 7.35 %, Calciumoxide 0.45 %, Calciumcloride 0.45 %, Gypsum 0.45%, m/m respectively. Oyster mushroom substrate wastes are almost consisted of wood sawdust. It could be used as biomass for gasification that uses for oyster mushroom products processes which saving energy and environmental friendly.

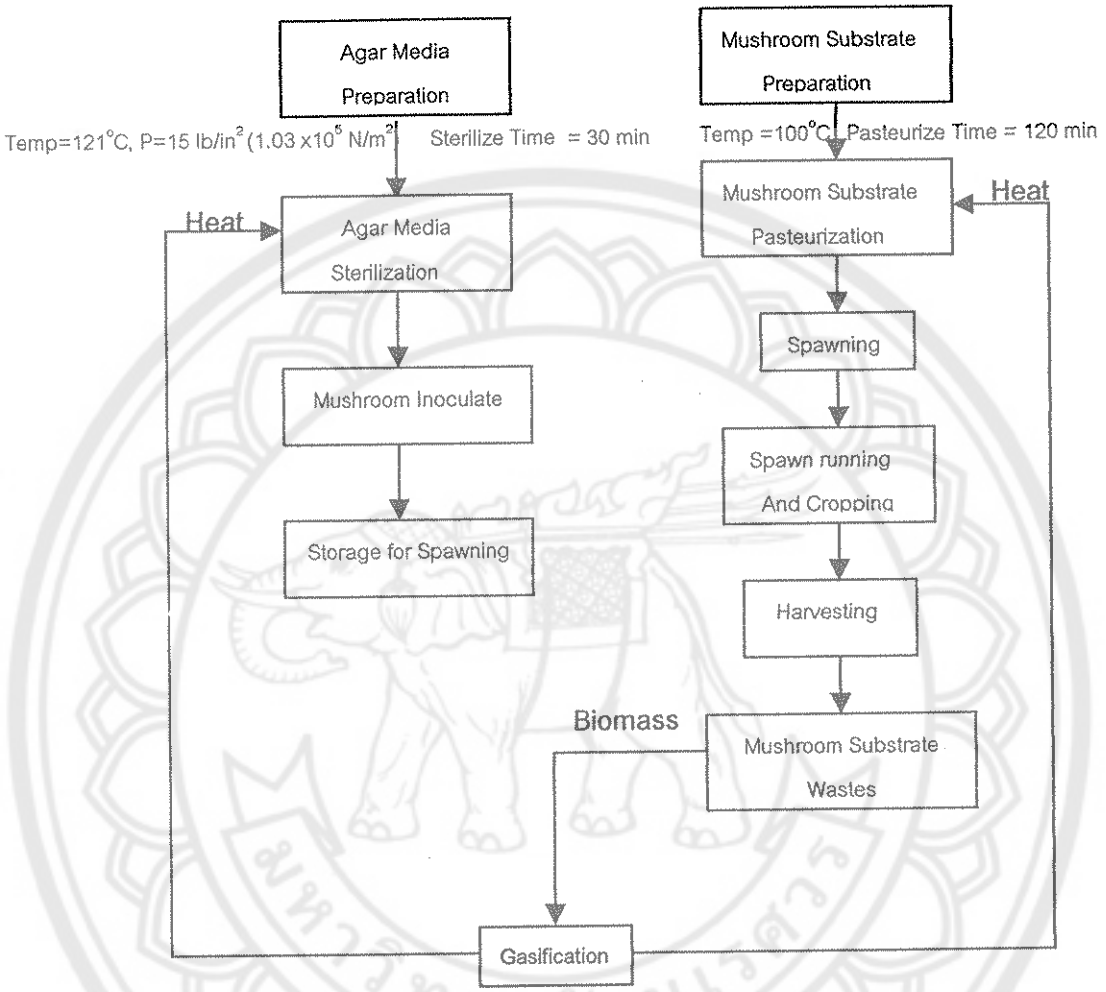

Figure 2 Oyster Mushroom Products Processes with Gasification

3. Objectives of the Study

Feasibility study of a producer gas from downdraft gasifier to run oyster mushroom product processes by using oyster mushroom substrate wastes as feedstock.

4. Scopes of the Study

4.1. A producer gas is used for oyster mushroom agar media sterilization and oyster mushroom substrate pasteurization.

4.2. The oyster mushroom substrate wastes are used as biomass in downdraft gasifier for oyster mushroom product processes.

5. Methodology

5.1. Review of related literatures and research

5.2. Setup oyster mushroom substrate waste gasification system and experiments

5.3. Data collection

5.4. Analysis of data

5.5. Conclusion

6. Expected Benefits

6.1. To have mushroom substrate waste gasification system that use for oyster mushroom products processes, which saving energy and environmental friendly

6.2. Replacing conventional fuel that used in oyster mushroom products processes, which using oyster mushroom substrate waste from its processes

6.3. To apply heat from producer gas to the other heat utilization