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LETTER TO THE EDITOR

Reuse of Waste *Lobed Kudzuvine* Root Bark

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With the increasingly severe energy situation, environmental pollution is becoming more and more serious. In order to make full use of resources, reduce environmental pollution, improve the comprehensive utilization rate of wood, and study the utilization potential of *Lobed Kudzuvine Root* Bark in high-value bio-energy and other high value-added industries. In the *Lobed Kudzuvine Root* Bark biomass oil, and the residue after the proposed active ingredients can be used as part of the biomass liquid fuel for future use. And some alcohols, acids, ketones, aldehydes, etc. can also be used as an excellent solvent commonly used in industry, aliphatic aldehydes, acids, phenols and their derivatives are chemical raw materials. Most of all, it reveals the economic value of *Lobed Kudzuvine Root* Bark and provides a scientific basis for the comprehensive utilization of high quality resources of *Lobed Kudzuvine Root* Bark.

1 Introduction

Energy is the material basis for human survival and the driving force for the development of human society. The stability of energy supply is an important guarantee for national security (Li 2012, Ge et al. 2018, Cook et al. 2010, Cardona et al. 2011). Biomass energy is a renewable energy source with great potential and value (Zhu et al. 2010, Peng et al. 2017a, Xia et al. 2012, Guo et al. 2013). The energy in biomass is mainly derived from the conversion of plants to solar energy through photosynthesis. Unlike traditional fossil fuels, biomass energy has obvious environmental advantages (Peng et al. 2017b). Biomass is the only renewable energy that can be converted into gas, liquid and solid fuels at the same time. It is one of the most promising alternatives to fossil energy (Bulushev et al. 2011, Zhang et al. 2011, Berner 2003, Navarro et al. 2007, Mondal et al. 2012). And biomass value-added uses or chemicals have received widespread attention (Navarro et al. 2007). Fast pyrolysis utilizes biomass to produce a product that is used both as an energy source and a feedstock for chemical production (Jiang et al. 2017, Saidur et al. 2011, Stelt et al. 2011, Oasmaa et al. 2015). The article studies the use of fast pyrolysis to fully exploit the potential utilization value of the *Lobed Kudzuvine Root* Bark.

Lobed Kudzuvine Root Bark has light brown skin, vertical wrinkles, and is rough, with yellowish-white color on the cut surface, good quality, and strong fiber, odorless, and slightly sweet (Zhou et al. 2011, Kayanoaab et al. 2012). This study provides a scientific basis for the comprehensive development and utilization of forest resources. The high-grade resource of *Lobed Kudzuvine Root* Bark the most promising technology of market development and industrialization in industrial utilization (Junior et al. 2019, Shen et al. 2017, Wani et al. 2018).

This study uses TGA-DTG, and Py-GC-MS, technology to study the potential of high-grade recycling of *Lobed Kudzuvine Root* Bark.

2 Material and methods

2.1 Experimental Methods

Experimental technical routes are shown in Figure 1.

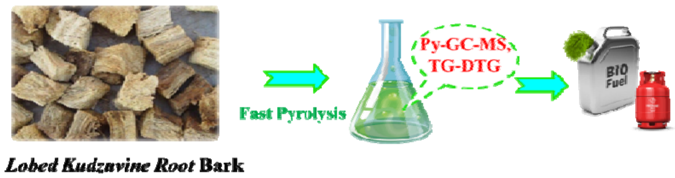


Figure 1. Experimental flow chart.

2.2 TG-DTG Analysis.

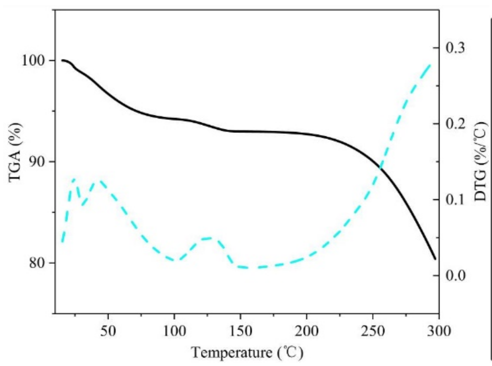
The samples of *Lobed Kudzuvine Root* Bark was analyzed by thermogravimetric analyzer (TGA Q50 V20.8 Build 34). The nitrogen release rate was 60ml/min. The temperature program of TG starts at 30℃ and rises to 300℃ at a rate of 5℃/min (Jiang et al. 2018, Zhang et al. 2016; Lamet al, 2019).

2.3 Py-GC-MS Analysis.

The powder of *Lobed Kudzuvine Root* Bark was analyzed by thermal cracking-gas chromatography-mass spectrometry (CDS 5000-Agilent 7890B-5977 A). The carrier gas used for high purity helium, the pyrolysis temperature was 500℃, the heating rate was 20 °C/ms, and the pyrolysis time was 15 s. The pyrolysis product transfer line and the injection valve temperature are set to 300°C; Column TR-5MS; Capillary column (30 m × 0.25 mm × 0.25 μm); Shunt mode, split ratio of 1:60, shunt rate of 50 mL/min. The temperature of the GC program starts at 40°C for 2 min, rises to 120°C at a rate of 5 °C/min, and then rises to 200°C at a rate of 10°C /min for 15 min. Ion source (EI) temperature of 280°C, scanning range of 28 amu-500 amu (Jiang et al. 2018).

3 Results and discussion

3.1 Analysis of TGA and DTG



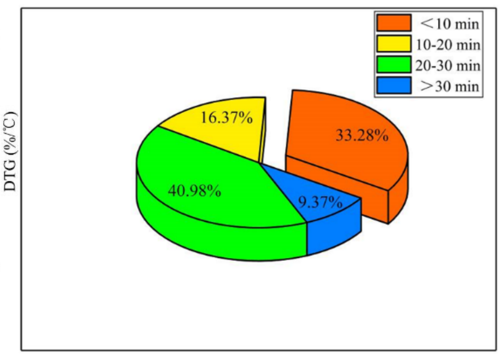


Figure 2. TGA and DTG thermal curves **Figure 3.** Distribution characteristic by Py-GC-MS

TGA is an essential laboratory tool for material characterization and is used to characterize materials in various environments by measuring mass changes in a controlled atmosphere with temperature variations. In controlled hot N_2, The *Lobed Kudzuvine Root* Bark lose mass by oxidation, dehydration, hydration, reduction, and decomposition (Jiang et al. 2018). The TGA temperature program started at 20°C and was increased to 300°C at heating rates of 5°C/min. The TGA and DTG curves are presented in Figure 2. The process can compare the changes in mass and changes in weight loss rate change of the *Lobed Kudzuvine Root* Bark. The *Lobed Kudzuvine Root* Bark was investigated by TGA between 30°C and 300°C. The TGA and DTG curves are shown in Figure 2. At mass loss rates of 1%, 5%, and 10%, the decomposition temperatures were 27.6℃, 71.4°C, and 250.5°C, for *Lobed Kudzuvine Root* Bark. At 100°C, the mass loss rates were 5.78%, at a maximum temperature, the mass loss rates were 19.59%. The TGA is divided into three stages: the first stage is the evaporation of water in the sample at 20-100°C. The second stage is the pyrolysis weight loss of cellulose, hemicellulose, and some lignin in the sample at 100-150°C; The third stage is the pyrolysis weight loss of some lignin in the sample at 150-300°C. Between 20-300°C, *Lobed Kudzuvine Root* Bark thermo-gravimetric only around 19.59%, thermal weightlessness is less. And the TGA and DTG test showed that at 300°C below, *Lobed Kudzuvine Root* Bark only a small amount of hemicellulose, cellulose and lignin pyrolysis (Lu et al. 2018, Jiang et al. 2018, Peng et al. 2017c).

3.2 Analysis of Py-GC-MS

The results of Py-GC-MS analysis show that, 225 chemical constituents were identified in 243 peaks of *Lobed Kudzuvine Root* Bark pyrolysis products. And the *Lobed Kudzuvine Root* Bark pyrolysis products peak area accounted for 31.13% of the total peak area, of which the content was higher: .beta.-D-Glucopyranose, 1,6-anhydro- (2.64%), Acetic acid (8.33%), 2-Methoxy-4-vinylphenol (2.43%), Coniferyl aldehyde (2.10%), Creosol (2.31%), D-Allose (2.04%), Dimethylamine (2.52%), Ethyne, fluoro- (6.31%).

In addition, the distribution characteristic of the *Lobed Kudzuvine Root* Bark sample studied by Py-GC-MS are shown in Figure 3. For the *Lobed Kudzuvine Root* Bark pyrolysis products, 33.28%, 16.37%, 40.98% and 9.37% of the sample had a retention time of less than 10, 20, 30 and greater than 30 min, respectively. And according to the results of Py-GC-MS analysis, the fast pyrolysis components of *Lobed Kudzuvine Root* Bark mainly include alkanes, phenols, alcohols, terpenes (alkenes), acids, ketones, pyrimidines and so on. And Dimethylamine can be used as a raw material for organic vulcanization accelerators, leather depilatory agents, pharmaceuticals (antibiotics), pesticides, textile industry solvents, dyes, explosives, propellants, dimethylhydrazine, ect (Cai et al. 2016). Methyl glyoxal can be used as cimetidine, lactic acid, pyruvic acid, analgesics, anti-cancer, antihypertensive drugs, desensitizing agents, cosmetics and other raw materials (Morris 2010). Formic acid can be used in chemical products, rubber coagulants and textiles, printing and dyeing, electroplating, etc (Boddien et al. 2011, Johnson et al. 2010, Hou et al. 2016, Álvarez et al. 2017). Geranyl geraniol itself has a wide range of physiological activities, such as anti-virus, anti-virus, anti-tumor, etc. have a therapeutic effect on a variety of diseases (Faustman et al. 2010; Jiang et al. 2018)

4 Conclusion

The *Lobed Kudzuvine Root* Bark weight loss process is mainly divided into three stages: at 20-100°C (the evaporation of water), at 100-150°C (cellulose, hemicellulose, and some lignin), and at 150-300°C (some lignin). And at high temperature pyrolysis, the *Lobed Kudzuvine Root* Bark produces more bio-active molecules, which can be used as raw materials for biomedicine, pesticides, dyes, cosmetics, chemicals. Above all, *Lobed Kudzuvine Root* Bark has high economic value and provides guidance for the development and utilization of high value-added products of *Lobed Kudzuvine Root* Bark, which promotes economic development.

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