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Discussion Tourism Industry on Energy of Green Tourism and Green Hotel

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Abstract. Tourism industry is closely linked with the natural environment but with a highly indivisibility of symbiotic relationship. Green tourism and green tourism hotel are not only the spindle stage of development industry. The environmental protection is also an environmental conservation and sustainable development of substantive liability demonstration. The study is also belong to the substance RDF itself, so we can call "clean energy". The raw materials came from agricultural waste through proper blending ratio and control technology, after PP14 adhesive extruded through the fluidized bed pyrolysis cracking process to burn stability. The recovery can also be used as fuel volatile process of drying and gasification. However, in the actual economic cost of the test running the hotel industry can reduce the cost per MJ USD $ 0.0082, more economical than coal expenses 23.17% of the fuel. Therefore, green hotel through biomass fuels RDF as clean fuels can further reduce carbon emissions to reach the green hotel of expectations.

1. Introduction

Tourism and hospitality industry has always been the important economic policy and development project of national development of each country in recent years. Moreover, in China, Taiwan and Hong Kong, such industry has risen in response to China's domestic needs of tourism industry and overall economic development. It is in an urgent demand for development of tourism and hospitality industry. However, in tourism industry, hotel industry plays a very important role. With a huge investment, hotel industry is featured by long payback period and amazing energy consumption, and the derivatives have a great impact on environment and ecology. With the rise of ideas on environmental protection and ecosystem conservation in various countries in the world, the energy consumption and environmental impact in the operation process are increasingly valued. Therefore, in tourism and hospitality industry, hotel industry is regarded as the main energy consumer. In the hotel industry, most hotels use boilers to meet the demands of hot water system in the operation

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process, and the fuel is dominated by fuel oil and anthracite. Moreover, small hotels lack think little of ecosystem conservation and environmental liability, causing a quite serious impact on the environment. However, in the past several decades, with the rapid development of hotel industry, the energy consumption has been greatly increased, and meanwhile, the pollutant emission and carbon emission indirectly generated in the operation of hotel industry are increasingly serious. Therefore, it is the important issue that the hotel industry should, through knowledge and education experience, effectively influence the operators to be willing to carry out environmental protection and green hotel practice in the tourism and hospitality industry in recent years [1, 2, 6, 7].

The tourism industry and the natural environment are of highly symbiotic relationship. However, with the overuse of non-renewable energy resources and the highly waste emissions in the hotel industry, a trend of green hotels has been emerged in recent years. In 2009, Starwood Hotels and Resorts launched the "green plan" through consumer feedback mechanism. Such green plan, in the form of discount, effectively guides the consumers to reduce the use of electricity, water, natural gas, and related cleaning chemicals. After the implementation of such plan, it has been acknowledged by a large number of consumers unexpectedly, resulting in the effective reduction of use of water, electricity, and natural gas and the significant reduction in consumption of cleaning chemicals. Therefore, green hotel is the new trend of future consciousness development and ecotourism. To implement the green hotel not only is the representation of ecosystem conservation and environmental responsibility, but also can keep a high competitiveness of hotel industry in fierce competition of tourism industry [3, 4, and 5].

Most hot water supply systems in the hotel industry take boilers as main sources of hot water supply. The fuel oil is used as the hot water boiler fuel is only applicable to small or urban hotels, but the fuel oil has a quite high fuel cost, and contains a high sulfur content, so it is likely to pollute the air. The anthracite used as hot water boiler fuel is more suitable to large hotels and the hotels in the suburbs. Although the anthracite has a lower overall economic cost of combustion, the subsequent ash handling and carbon emission are the quite important factors to be considered. In recent years, with the booming development of renewable energy, reducing carbon emissions is the development trend of the world, there is a considerable breakthrough in application of biomass fuel. The application of biomass energy as fuel suits the clean energy use, and moreover, the biomass energy is the composition of plant wastes, and it is different from non-renewable fossil fuel, so biomass energy belongs to renewable energy carbon cycle fuel in energy application, which can comprehensively reduce the carbon emissions. With the present anthracite for example, its heat value is about 5000-6500Kcal/Kg, however, the heat value of RDF (Refuse Derived Fuel) of biomass energy can reach 5900Kcal/Kg, so such fuel can completely take the place of anthracite, and meanwhile, the RDF of biomass energy is stable, odorless and tasteless in burning process, and it is free of sulfur molecule, therefore, it has a significant effect on reduction of air pollutant emissions, and can make contributions to environmental protection and ecosystem conservation [8, 9].

In the Pearl River Delta Region of Guangdong Province, China (including Guangzhou, Shenzhen, Dongguan, Foshan, Zhuhai, Zhongshan, Jiangmen…etc.), the boilers below 10t have been comprehensively restricted from 2010, and RDF of biomass energy has been taken as the unique fuel to take place of the coal-related fuels, and the control range includes factory, industrial park, as well as hospital, school, hotel, sauna, Spa, and other related fields. Therefore, in green hotels, hot water system changes to use biomass RDF as fuel, which can effectively reduce the air pollutant emissions and has positive environmental protection responsibility for effective reduction of carbon emissions, environmental protection, and

ecosystem conservation, and moreover, a mutual-benefit and sustainable development with the nature can be achieved [10].

2. Research Methods

Raw Material Source of Biomass RDF. The raw materials of biomass RDF are sourced from agricultural wastes which include straw, rice husk, bagasse, wheat-straw, sawdust, bark, coconut shell, and etc. Different agricultural wastes have different heat values, water contents and densities, the agricultural wastes shall be subject to preliminary breaking treatment and crushing treatment, so that they can be actually grinded and crushed, becoming the particles (length: less than 30mm, and width: less than 5mm). Therefore, the biomass RDF herein is not prepared with single raw material, and instead, the agricultural wastes including various raw materials are adopted, and through crushing, stirring, mixing of pretreatment as well as precise calculation and accurate control technique. The heat value, colloid, burning time, and ash of biomass RDF product are fully mastered, so as to guarantee the stability in combustion characteristic of each batch of products. So, the biomass RDF can directly replace the coal product series.

Adhesive Selection. Although the agricultural wastes have colloid in themselves, and also through high temperature and high pressure technologies as well as effective heating and extruding methods, the agricultural wastes can take shape without the adhesive, higher power and energy consumption are needed relatively. Therefore, this experiment seeks for effective reduction of equipment investment and energy consumption under the most economical state, so as to actually reduce the production cost. In this paper, chemically modified starch series and natural starch series are taken as adhesives, and the characteristics of three kinds of adhesives are as shown in the table below:

Table 1 Adhesive Characteristic Analysis Table

Species	PP14	TS18	QG15
Category	Chemically modified starch Series	Natural starch Series	Chemically modified starch Series
Hardening and drying time	15-20Mins /130℃	120-130Mins /130 ℃	30-40Mins /130℃
Appearance	Alcohol + Water	Water	Water
Adhesion	9000-12000cps /VT-04	12000-15000cps /VT-04	9000-12000cps /VT-04
Color	Brown	White	Milky
Diluent	Gel	Powder	Liquid
Characteristics	Strong cohesion Fast drying Milkey after drying No pollution Initially and good operation	Ordinary cohesion Colorless and transparent after drying Very Poor weather resistance	Strong cohesion Colorless and transparent after drying Collision-protection
Products	The laboratory's own	The laboratory's own	ZKHN LTD.

3. Biomass RDF Processing and Making

After becoming particles through pretreatment, the agricultural wastes will be added with a proper amount of adhesive to be fully mixed, and then through extrusion forming technology under low temperature and high pressure, they will be extruded into semi-finished products (diameter 60mm, length 100-150mm), then the semi-finished

products are placed in baking tunnel, and it is required to adjust the drying time based on the adhesive characteristics, so that the semi-finished products will be fully dried and formed. The addition of adhesive can effectively enhance the structure stability of biomass RDF semi-finished product, and also can effectively resist the possible damages and losses in handling or subsequent processing. After biomass RDF semi-finished products are fully dries, they will be provided with quite considerable structural stability and shock resistance. However, the biomass RDF raw materials mentioned herein are sourced from agricultural wastes, and the agricultural wastes are likely to generate volatile matters in the heating combustion process, which will result in the generation of instability phenomenon in the overall combustion process. Therefore, in this study, the biomass RDF semi-finished product is placed in low-temperature fluidized bed to be subject to preliminary gasification and thermal cracking reaction, and under the low-temperature (320-370℃) and mionectic conditions, the volatile matters inside the biomass RDF semi-finished product are mostly eliminated, which can effectively make the biomass RDF be burned stably in the boiler, to reduce flash burn and sudden explosion, and moreover, the volatile matters collected through gasification and thermal cracking technologies can be used as heat source for drying of pre-processing, to effectively reduce the overall production cost.

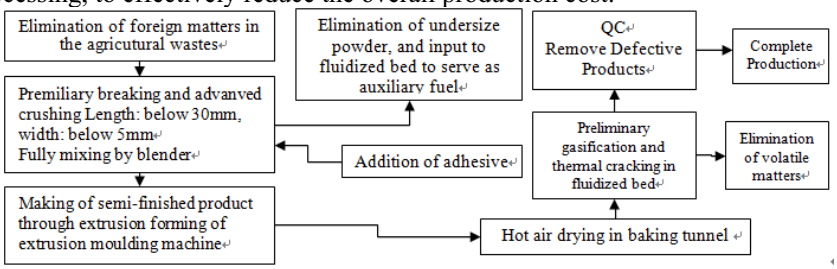

Figure 1. Biomass RDF processing and making process

Figure 1. Biomass RDF processing and making process

Analysis of Basic Physical properties of Biomass RDF. Biomass RDF is featured by cleanliness and high heat value in itself, and moreover, the biomass RDF mentioned herein has been subject to gasification and thermal cracking treatment in fluidized bed, therefore, the combustible matters of such biomass RDF can be effectively improved, and moreover, the volatile matters are effectively reduced, so that the biomass RDF may keep a stable burning, and flash burn and sudden explosion can be reduced simultaneously. Therefore, the raw materials of biomass RDF mentioned herein are made of agricultural wastes, and through proper blending and processing technologies, the biomass RDF is close to coal products in basic physical properties, so it can be directly used for coal-fired boiler to directly replace the original fuel, so as to meet the specifications of related clean energy of green energy sources. In this study, three different adhesives are adopted for making of biomass RDF, and the basic physical properties of biomass RDF are shown as below:

TABLE 2 ANALYSIS OF BIOMASS RDF PROPERTIES

Basic Properties	Model -1	Model -2	Model-3
	Adhesive:PP14	Adhesive:TS18	Adhesive:QG15
Density (g/cm^3)	1.09	1.23	1.15
Compressive Strength (Kgf/cm^2)	10.7	6.9	8.8
Ash Content (%)	3.8	4.2	4.1
Combustible Content (%)	91	85	89
Volatile content (%)	3	7	4
Total sulfur content (%)	<0.05	<0.05	<0.05
Heat Value(Kcal/Kg)	5960	7140	6980

4. Results and Discussion

Emissions of Boiler Combustion. In this study, the hot water supply system of Hotel A is taken as the burning boiler for use. The hot water boiler of such hotel is used to supply hot water for bathing, and also used for the heater unit of the hotel. The boiler is of ordinary pressure and low temperature smelting-bar-type feeding system. The fuel drops to smelting bar row through the adjustment of scuttle, and burns through combustion furnace, and generates hot water through heat exchange system. Such boiler is of semi-automation control, the boiler water feed can be automatically adjusted, and the boiler is provided with related pollution prevention device. The boiler specifications are shown as below:

Table 3 Hot Water Boiler Specifications

Boiler system	Boiler-1	Boiler-2
	For warming and water heating	For water heating
Rated power (MJ)	2500	720
Heating area (m^2)	5500	----
Standard temperature of feed water(℃)	25	20
Standard temperature of effluent(℃)	95	45
Rated working pressure (Kg/cm^2)	0	0
Fuel consumption (Kg/h)	125	32
Rated combustion efficiency(%)	63	58
Year to build (Year)	2006	2002

In this paper, the raw material of original boiler, anthracite, is replaced with biomass RDF produced in this study for combustion test, and the combustion pollutant emissions are shown as below:

Table 4 Pollutant Emissions Of Hot Water Boiler

Boiler system	Regulation/standard	Boiler-1	Boiler-1	Boiler-2	Boiler-2
	GB 13271-2014	Fuel: anthracite	Fuel: RDF	Fuel: anthracite	Fuel: RDF
Particulate pollutant (mg/m^3)	30	25	14	32	18
Sulfur dioxide (mg/m^3)	200	183	6	207	17
Nitric oxide (mg/m^3)	200	124	159	193	202
Mercury and other chemical compounds (mg/m^3)	0.05	0.03	<0.01	0.03	<0.01
Blackness of exhaustion (ringelman emittance, level)	<1	<1	<1	<2	<1
Actual fuel consumption (Kg/h)	----	138	129	39	34
Actual combustion efficiency (%)	----	53	59	44	51

According to the data of combustion emissions, we can clearly know that, the biomass RDF in this study has a significant improvement in particulate pollutant and sulfur dioxide. However, as the biomass RDF herein is higher than the original anthracite in combustion temperature, it has a slight increase in emission concentration of nitric oxide. Boiler-1 is provided with air pollution prevention device, so its emission concentration of nitric oxide is in line with the standards given in the related regulations. However, Boiler-2 is not provided with related air pollution prevention device, so its emission concentration of nitric oxide is slightly higher than the standards given in the related regulations, but such problem may be solved through installation of air pollution prevention device or use of catalyst, to reduce the nitric oxide pollution.

Analysis on Economic Efficiency of Biomass RDF Combustion. Hotel A is provided three hot water boilers which are, Boiler-1 and Boiler-2 are of normal operation and adopt anthracite as fuel, while Boiler-3 is of abnormal operation and uses diesel as fuel. Therefore, this study conducts analysis and comparison in the mode of power, and the related data are shown as below:

Table 5 Comparison Of Economic Efficiency Of Hot Water Boilers

Boiler system	Boiler-1	Boiler-1	Boiler-2	Boiler-2	Boiler-3
	Fuel: anthracite	Fuel: RDF	Fuel: anthracite	Fuel: RDF	Fuel: Diesel
Actual fuel consumption (Kg/h)	138	129	39	34	26
Actual combustion efficiency(%)	53	59	44	51	81
Actual output power (MJ)	1990	1960	467	450	630
Fuel cost (Kg/USD)	0.146	0.125	0.146	0.125	0.70
Cost/MJ(USD)	0.0101	0.0082	0.0122	0.0095	0.0289

* Boiler-3 is a standby one, and its air pollutant emission is fully in accordance with the standard of clean energy equipment with low pollutant emissions in the air pollutant emission standards given in the relevant regulations, and it is used for check by the government unit.

It can be known from the economic effectiveness analysis above that, with the adoption of biomass RDS as fuel of hot water supply system in the hotel, the pollutant emissions can be reduced effectively, and the hotel will bear the social responsibility and environmental responsibility, and moreover, the biomass RDF is clean in texture, and it is a kind of natural clean fuel rather than fossil fuel, and after gasification and thermal cracking treatment of fluidized bed, the combustion of biomass RDF can completely improve the boiler combustion efficiency, so as to reduce the overall combustion cost.

Feasibility of Adoption of Biomass RDF in Hot Water Boiler of Hotel. According to the judgment of above data on the biomass RDF is applied in the hot water supply system of hotel industry, it can effectively reduce the air pollutant emissions, to achieve the expectation of energy conservation and carbon emission reduction in green hotel, and through the combustion of clean fuel, the generated ash can be effectively reduced, and moreover, the environmental responsibility can be borne further. However, in the combustion process of biomass RDF, its burning temperature is slightly higher than that of traditional coal, therefore, the higher the burning temperature is, the more serious the generated nitric oxide pollutant emissions. It is not difficult to eliminate the nitric oxide in the present boiler pollutant prevention technology, and this problem can be solved only through the installation of pollutant prevention equipment, so that the boiler pollutant emissions can meet the standards given in the related regulations. However, the pollutant prevention equipment is restricted by the field environment and the space, and not all hotels are suitable to adopt such method, therefore, the nitric oxide emissions can be effectively reduced through the addition of catalyst in the combustion process. The addition of catalyst is about 0.1% of the fuel, and the catalyst is about USD$0.3/Kg. In this case, the cost of rated power (MJ) is only increased in USD0.00002/MJ, and it is still far lower than the cost of the boiler with coal as fuel. In addition, the ash after burning of biomass RDF can be taken as the soil conditioner, and without special treatment, it can be taken as general wastes to be cleaned and transported, to effectively reduce the ash waste cleaning and transporting cost in the hotel industry. Therefore, it is a feasible way to adopt biomass fuel in the hot water supply in hotel industry, and moreover, the hotel can be promoted to green hotel to bear the social responsibility and environmental responsibility.

5. Conclusions

Tourism and hospitality industry is one of major industries of China, Taiwan and Hong Kong, and the hotel industry is playing a very important role in the economic development and policy promotion of each country in the world. However, tourism and hospitality industry is closely related with natural environment, and they are of indivisible highly symbiotic relationship, therefore, green tourism and green hotel are not only the main axles of tourism industry in the present stage, but also the sustainable manifestation of sustainable development responsibility of environmental protection and ecosystem conservation.

With raw materials sourced from agricultural wastes, the biomass RDF has a positive effect on ecological maintenance, to reduce the use of fossil fuel, and moreover, biomass RDF is clean energy in itself, therefore, in the combustion process, the pollutant emissions can be greatly reduced, and moreover, there is a positive effect on carbon emission reduction. Therefore, in this study, through precision calculation and accurate regulation technique of agricultural wastes, the heat value, colloid, combustion time, and ash of biomass RDF are fully mastered, to make each batch of products have a stable representation in combustion characteristic, and chemically modified starch series of PP14 are taken as adhesive, to effectively reduce the RDF production cost and equipment investment, so that the biomass RDF is competitive. In this study, the biomass RDF semi-finished product of extrusion forming is subject to preliminary gasification and thermal cracking reaction through low temperature fluidized bed, and under the low-temperature and mionectic conditions, the volatile matters inside the biomass RDF semi-finished product are mostly eliminated, to improve the stability of RDF combustion process, and meanwhile, the volatile matters collected can be used by drying equipment and pyrolysis cracking equipment, to further reduce the production cost of biomass RDF.

When the biomass RDF herein is applied in actual boiler combustion test in hotel industry, and RDF is taken as fuel, there is a significant improvement in particulate pollutant and sulfur dioxide pollution emissions, and moreover, in terms of economic effectiveness of operation cost. The cost of rated power (MJ) is decreased to USD0.0082/MJ, so 23.17% expenditure is saved compared with the coal as fuel.

In conclusion, when biomass RDF is used for hot water and heating systems in the hotel industry, the air pollutant emissions and operation costs can be reduced, and through the use of biomass RDF clean fuel, the expectation of green hotel with carbon reduction can be achieved, and moreover, the environmental protection responsibility and ecosystem conservation responsibility will be further shouldered. It is hoped that the related data in this study can provide the important reference basis for change of traditional hotels to green hotels, to make contributions to sustainable development of global ecology and tourism and hospitality industry.

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