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Using agricultural by-product for useful work in Vietnam: Potential and Applicability

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Abstract
Vietnam is an agricultural country; annually producing agro-forestry produces a large volume of by-products with about 30 million tons of straw, 10-15 million tons of rice bran and rice husk, millions of tons of sawdust, many Bodies, branches, 110-120 million tons of animal waste. These waste, by-products, if not treated, will be rubbish, especially waste from livestock is a leading and common factor polluting the agricultural and rural environment today. But more than 70% of that could become a source of production and life if recycled.

Keywords: agro-forestry produces, agricultural by-products, agricultural environment, biomass.

Introduction

In the past, agricultural by-products such as rice straw, corn stalk ... were often used by farmers for feed, as fertilizer for crops or for fuel. In recent years, due to the better economic life, agricultural wastes have been re-used which farmers have thrown or burned in the fields, villages and alleys.

The world is also interested in the ability to apply biotechnology to treat the environment and recycle waste from agriculture into clean, effective and safe products. Some countries, such as Thailand, Japan, Korea, and China, have developed very strong technologies and industries that use technology to process waste and agricultural by-products. For example, rice bran products have a higher value from 100 to 300% when processed into animal feed, soap, cosmetic or pharmaceutical products, straw is processed member for animal feed, as raw material. Can be used in breeding or exporting. In these countries, straw is also processed with ethanol or bio-diesel (bio-diesel), bio-plastics processing to produce environmentally-friendly bio-packaging and glass containers. Make soap, oil, cosmetics.

In the United States, straw is recycled into a special material called straw bales. According to the California Building Society, dried straw can last for thousands of years. The straw has good thermal insulation properties such as plaster and plaster. Bale bales usually weigh between 23 and 41 kilograms, with each house of approximately 200 square meters requiring about 300 bales of straw to be built. The straw walls can withstand winds of over 193 km / h, water flows of more than 4 tons and the working temperature is from -20 to 50 degrees Celsius, traditional.

At the University of Industry in Ho Chi Minh City, scientists have successfully researched gasification technology from agricultural byproducts (the focus from waste husks) to use as heat energy, electric power. The current selling price of the system is 1 billion 50 million, the localization rate is 85-90%, nearly half cheaper than the imported product with nearly equivalent performance. The product has been applied at the mill No.1 food processing, Tien Giang Food Company. According to calculations, the system using rice husk electricity will save the system of national electricity 331,864 VND per day if the amount of rice husk is 300 kg / day (price 330 VND / kg) and rice husk humidity is 15.5%.

In Hanoi, for the reuse of agricultural by-products, the Hanoi Agricultural Extension Center has developed a model for the application of biological products for the treatment of rice straw in service of some crops in the Red River Delta and the Mekong River Delta. Coordinated by the Institute of Soils and Fertilizers in My Duc district. The application of bioproducts for the treatment of straw on the structure of rice and soybean production with the size of 60 households involved, the deployment period from August to December 2014, mainly support seeds Materials and funding for the households involved, funding to support

more than 148 million. The results showed that the yield was higher than that of untreated peanut from 17-20 kg / sao. The root is decomposed rapidly after 50 days, reaching 70%; Reducing the number of fertilizers and pesticides from 1-2 times per crop. The growth model is well-developed to limit pests and diseases, minimize environmental pollution and improve soil fertility.

In Lao Cai, in order to adapt to climate change, protect the environment and reduce greenhouse gas emissions, the sector has actively applied science and technology to agricultural production. The province has invested in the topics, Research, pilot and disseminate technologies for treating and reusing by-products and agricultural by-products to create animal feed, mushroom cultivation, industrial raw materials, biogas, biochar, fertilizers. Organic. Through this, the formation and development of the agricultural by-product industry will be improved and the production value and pollution emissions reduced. Typically, the "Low Carbon Agriculture" Project has installed 487 biogas tanks; "Biogas program for animal husbandry in Lao Cai province" has helped to effectively build and put into operation 214 biogas plants in 8/9 districts and cities. Biogas tanks are highly appreciated by the people, helping rural farmers to deal with organic waste, create clean energy sources, and prevent environmental pollution. The application of low-carbon agricultural production models improves livelihoods and enhances the quality of life of people.

Re-use of waste products and agricultural by-products has brought about high economic efficiency, reduction of greenhouse gas emissions and environmental protection, thus contributing to a green and sustainable economy.

Fig. 1: Agricultural by-product source

Potential of agricultural by-product in Vietnam

Rice is one of the five major food crops of the world. The rice grain after husking the outer shell obtains the by-products of rice bran and rice husk. In 2011, according to MARD statistics, Vietnamese rice production was 42 million tons. Among them, the production of rice husk is about 4-5 million tons, the rest is not collected waste into the environment. In the Mekong Delta, rice mills pour husks into rivers and canals; the husk of rice husk drifted away, sinking to the bottom, polluting the water and affecting the lives of people. With natural properties such as hard, fibrous, easily scratched making products made from rice husk low degree of corrosion, high ash. Due to its low economic value as well as its value, hulls are considered as agricultural waste and one of the polluting factors. Therefore, the recycling and utilization of waste not only bring about economic and social benefits but also important in protecting the environment. Research on the treatment of heavy metals and organic matter by using low cost, environmentally friendly adsorbents made from agricultural waste is an issue that many authors in the country and in the world are interested in. research. Agricultural waste is the residue after harvesting. They can be collected with conventional harvesting equipment at the same time or after harvesting. Depending on the origin, agricultural residues are classified into two categories:

- Direct by-product residues: These are organic substances directly arising in the field such as roots, stems, leaves of old or post-harvest crops. These discarded materials are often used in the field to return some organic matter to the

soil, including stem and leaf, straw, etc. However, soil cannot absorb all nutrients from the soil. scum. These residues are not fully utilized and rotting is wasted energy.

- By-product residues: These by-products include rice husk, bagasse, corn cobs, coffee husks, cassava chips, sawdust ... This type of by-product is mainly used as a by-product. Burning, a small part is used for purposes such as building materials, materials for environmental treatment ... However, the current economic development, which involves the use of these by-products as fuel. Much less than before. Therefore, to eliminate these unwanted waste, producers have thrown out or burned out, causing serious environmental pollution.

Rice husk is separated during rice milling. According to Nguyen Ba Tuan (2012), in rice husks, about 75% of volatile organic compounds are burned during combustion and the remaining 25% is converted to ash. Organic substances contain mainly cellulose, ligin and hemi-cellulose. In addition, there are other ingredients such as nitrogen and inorganic compounds. Ligin is about 25-30% and cellulose is about 35-40%.

Purpose of using agricultural by-product

Biomass tablets

This is the idea from the topic "Research on the production of Biomass tablets from waste and agricultural by-products as fuel" by young engineer Nguyen Quang Vinh (Institute of Water, Irrigation and Environment under the Ministry of Agriculture and Development. countryside). The topic has just won the prize at the contest of energy saving in 2011 by Center for Science and Technology Development Youth (City Union).

Nguyen Quang Vinh said: "Vietnam is one of the world's leading agricultural exporters. Therefore, the amount of waste and by-products from agriculture such as husk, straw, bagasse ... every year tens of millions of tons are thrown away wasted wasted. These things, if leverage, will become a very useful fuel source. "

Vinh also has the opportunity to go to the rural areas of some provinces such as Thai Binh, Hung Yen, Ha Nam, Nam Dinh ..., witnessing the burning of straw in the fields after the harvest season. I feel so sorry. Moreover, this pollutes the environment, seriously affecting their own health. "Therefore, we want to use these waste to produce Biomass tablets as fuel instead of using traditional fuels such as coal, oil, gas ... are in danger of lacking. Shortage and depletion in the future, "Vinh wishes. The process of producing Biomass fuel pellets is very simple, from the raw material, after putting in the machine to extract some impurities, crushed and then pushed through the pressing into energy tablets with a diameter of 6-8 mm . Products used by manufacturers to replace input fuels are coal, FO, gas or other fuels.

The cost of using Biomass pellets is much cheaper than the current gas price, but still ensure thermal treatment for users. When manufacturers use this tablet in production, the efficiency of the business will be much better because the output is cheap, the market competitiveness is very high.

Moreover, due to its pure origin, it is also a clean, environmentally friendly fuel that contributes to CO2 balance in the atmosphere. With modern tablet press technology, according to the strict process, the fuel with high calorific value (from 3,800 - 4,500 kCal / kg) can replace coal but at 40-50% cheaper price.

"If the producers use coal to burn at an average price of 4,000 VND / kg, the heat of 1kg of coal will be equivalent to about 1.2kg of Biomass tablets (about 2,500 VND), when using Biomass tablets instead. They will save about 40% of the cost, "Vinh said. Not only that, as we make use of agricultural waste to produce fuel pellets, it will reduce greenhouse gas emissions caused by agricultural waste.

Biofuels

From 1 ton of straw, 250 kg of liquid fuel can be produced ... Scientists from the Institute of Chemistry (Vietnam Academy of Science and Technology) have successfully produced bio-oil from straw Pyrolysis technology. The study has opened up the possibility of finding alternative fuels for fossil fuels that are in danger of becoming scarcer. BARLEY = OIL OIL "If one kilogram of straw is burned, the farmer receives only a small amount of ash to fertilize the field while also polluting the environment. Meanwhile, 1 ton of straw can produce about 250kg of crude fuel oil to produce biofuel ... "Assoc. Prof. Dr. Dang Tuyet Phuong, Department of Chemistry - Surface, Institute of Chemistry Vietnam. Straw is one of the few agricultural wastes that are of little use: some are used as feeds for cattle, some are processed for use as microbial fertilizers, and most are burnt in the field. Waste and environmental pollution. The results show that each ton of paddy yields will be 1.35 tons of straw in the field respectively. Since 2002, Vietnam has produced 34 million tons of rice a year. This also means that more than 40 million tons of straw are produced annually. "If it is converted to bio-oil with a 25% efficiency, we can get 10 million tons of bio-oil each year," added Dr Dang Tuyet Phuong. NEW DIRECTIONS FOR CREATING BIOCHEMICAL FUEL By 2015, the vision to 2025 has been approved by the Prime Minister. By 2010, our country produces 100,000 tons of biofuel E -5 and 50,000 tons per year biodiesel fuel B-5, ensuring 0.4% of fuel demand in the country. By 2015, bio-ethanol and bio-diesel production is expected to increase to 250,000 tons per year with the goal of producing 5 million tons of E-5 and B-5, meeting 1% of gasoline demand. Of the country. Many countries have made biofuels from agricultural products, such as corn (US), sugarcane (Brazil), sugar beets (European countries), etc., to replace fossil fuels. But the source of this material is quite expensive and unstable, not to mention the possible food crisis that leads to food insecurity. Meanwhile, available and cheap available straw accounts for about 66% of the total amount of farm waste that has not been used effectively. If the use of this straw source to produce biofuels will have great significance in many aspects. According to Assoc. Prof. Dr. Dang Tuyet Phuong, using non-catalytic straw-based pyrolysis (at 550 degrees Celsius), liquid fuel yields reach 25-30%. If catalyst is used, the pyrolysis temperature can be reduced to 100 degrees Celsius with an equivalent oil-generating efficiency compared to no catalyst. Accordingly, the straw is collected and cleaned, dried and then put into the pyrolysis furnace. After pyrolysis, the product is obtained in all three forms of gas, liquid and solid. Liquid products are mostly bio-oil, which can be used in many areas such as chemical, pharmaceutical, industrial, food or fuel industries. Particularly in the field of energy, bio-oil can be used directly as fuel in power plants (boiler boilers, ovens ...) or diesel oil substitutes to run the engine. Solid products (coal) can be used as activated carbon, or as fertilizer back to improve the soil when added with some trace elements.

Sorbent materials

In the study of Nguyen Van Hoi (2005), the author created the rice husk to absorb material by the following way: Rice husks washed several times with distilled water, dried at 110^{o}C for 3 hours. Determining the amount of the husked husk was cleaned in 0.1 M NaOH, stirred for 1 hour at room temperature. Then, remove the husk into the distilled water, stirring for 45 minutes at room temperature, the process repeated several times until the alkali. The husk was treated above for 0.6M citric acid to react for 12 hours at 70°C. Continue filtering for hulls to be dried at 110^{o}C, rinse on distillation tank for residual acid and dry at 80^{o}C for 3 hours, obtain absorb material. Pb (II) solution for 30 min, pH was 4 and room temperature was found to be capable of separating and recovering Pb (II) in The solution, the maximum adsorption capacity qmax is 30.8 mg / g absorb material.

With the main ingredient is cellulose and hemixenlulozoa, bagasse can be denatured to become good viral load. There are some scientists in the world who work on bagasse to make environmentally friendly absorb material. By Avinash Gupta et al. (2014) in India has studied the use of bagasse for the manufacture of absorb material to remove As (III) and As (V) from the water. The maximum absorption capacity for As (III) was 28.57 mg/g absorb material, with As (V) 34.48 mg/g absorb material. Sumanjit, Walia TPS and Ravneet Kaur (2007) conducted the study and compared the ability of acid dyes in aqueous solutions of viral species such as: bagasse, peanut charcoal, tea charcoal The results showed that the viral vectors have the ability to absorb acid dyes with high efficiency. In Vietnam, there are many researches on the production of bagasse from bagasse has been published as: Research by Le Huu Thieng and Hua Thi Thuy (2010) University of Pedagogy, Thai Nguyen University. The authors used the denaturation method as follows: Cane bagasse after washing was chopped, put in distilled water, boiled for 30 minutes to remove dissolved sugar, then dried at 80^{o}C for 24 hours. Dry bagasse is ground into fine flour (raw material). This material is then mixed with 98% concentrated hydrochloric acid to make cane bagasse in 1: 1 ratio (bagasse): acid sulfate (ml) and then heated at 150^{o}C for 24 hours. Raw material after drying was washed with distilled water 2 times and then soaked in NaHCO3 1% for 24h to remove residual acid and filter and dried at 150^{o}C to dry sieve on a sieve size ≤0.02 mm. Absorb material results have the ability to absorb heavy metals Cu^{2+}, Ni^{2+}; The maximum adsorption capacity for Cu^{2+} is 54,054 mg/g absorb material, with Ni^{2+} of 44.834 mg/g absorb material. The author Nguyen Thi Thanh Tu (2010) also uses the method of making materials from bagasse like the method of author Le Huu Thieng, Hua Thi Thuy (2010) but using the substance adsorbed solution Methyl red. The result at pH 7 was the best adsorption, the adsorption equilibrium time was 90 minutes. The viral load from 0.2 to 1.0 grams, when increasing viral load, the red methyl bromide adsorption efficiency increased from 56.9% to 94.2%. Investigate the size of the viral load from 0.02 mm ÷ 0.1 mm, the adsorption efficiency decreases gradually from 91.75% to 81.78%. Maximum adsorption capacity is 63.00 mg/g. Another study by Le Huu Thieng et al. (2011) used formaldehyde chemical treatment: bagasse after harvesting for core extraction, rinsing with tap water several times and then rinsing with distilled water. Cereal residue is pre-treated by boiling in distilled water for 30 - 40 minutes to remove the soluble sugar, chopped, dried at 80^{o}C and then ground by grinding. Calculate the amount of ingredients to be mixed with 1% formaldehyde solution 1:5 (bagasse (gram): formaldehyde (ml)) and then dried at 50°C for 4 hours. Filter the material, rinse with distilled water twice to remove residual formaldehyde and dry at 80^{o}C to dry, grind, sieve to obtain viral load smaller than 0.02 mm. The IR spectra showed that the surface characteristics of the viral load varied from placebo to viral load. When examined with blue methylen obtained results: optimum pH 7.0; Equilibrium time is 60 minutes; In the mass range of 0.2 - 1 g absorb material /100 ml the highest adsorption efficiency was 94.4%. As such, just like rice husks, bagasse can be used as a raw material for the production of absorb materials, opening new avenues for the use of natural materials to treat environmental pollution.

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