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STEM STEVIA (*STEVIA REBAUDIANA BERTONI*) OF DRY USE OF IN PELLET PRODUCTION

On the basis of the procedure of calculation of the potential energy of raw material second and bioenergetic cultures is determined the energy potential of the stem of stevia. Of stevia in processing are used leaves for obtaining the intensive of sweeteners and stems as a rule are utilized. The indices of technological specifically the influence on the process of obtaining pellet and their quality. Of stevia in the production to recommend use stems of stevia in the production of those aromatized pellet for the fireplaces of houses particular.

Keywords: *stevia, pellet, the energy potential, equipment, quality.*

Introduction. Ukraine has significant agricultural potential for the production of fuels bioenergy. Resources that are not invented in the processing segment for a long time were used as waste. However, tendencies of development of the energy market in the world and the latest scientific achievements allow to use agricultural waste as new sources for the production of energy. This is primarily the production of pellets from sunflower husk, straw cereal crops and wood waste. The development of this directly contributed to the environmental factor: when the combustion of sawdust emission of carbon dioxide in the atmosphere is reduced to 50 one tims [6]. The analysts global projected in the world production of pellets to reach in 2020 year 46 million tons annually will grow 11% [p. 7, 5]. Ukraine develops the direction using the pellet sunflower husks, straw of cereals, cereals and bast crops [c. 64, 5; 6], bioenergetic culture [p. 9, 1].

Prices for pellets depend on their quality (density, size, degree of pollution preform the dust content of chlorides and ash), which in Ukraine are on the straw pellets-60-125 euro/t, wood pellets-80-160 euros/t, sunflower husk pellets – 60-100 euro/t [p. 8, 4.] quality control until recently carried out in Europe, according to German (DIN 51731) and Austrian (OENORM M 7135) standards. However, the increase of low grade pellets on the market of Germany contributed to the introduction of the certificate DIN plus. Considering the environment the most demanding is the Swedish standard SS 187121 [p. 64, 2].

In this direction is promising production pellets using stems of dry stevia (*Stevia rebaudiana Bertoni*), is known as, a natural sugar substitute intensive. For substances glycosides diterpadieness of leaves of dry stevia (*Stevia rebaudiana Bertoni*) the growing demand contributes to increasing the acreage under its plantations. In the world used for eating or leaves of dry stevia (*Stevia rebaudiana Bertoni*) processing and stems are not yet coming application and recycled.

Purpose of the work was establishing the possibility of using stalks of dry stevia (*Stevia rebaudiana Bertoni*) in producing of pellets.

The results of research. Agroclimatic conditions of Ukraine allow us to receive 2 harvests of stevia (*Stevia rebaudiana Bertoni*) per year and sometimes 3 yields, which gives the opportunity to argue about the prospects of this plant in our country [7]. In Ukraine under the plantations of stevia is 18 hectares. the stem of out is approximately 1,6 t/ha in that year will be 57,6 tons. The proportion of stems of stevia is 35-40% of the total terrestrial biomass. The coefficient of waste [p. 8, 3] is 0,4. Aware that the production process consists of the following stages: cleaning and grinding to the size of the raw material is not more than 1 mm; the formation of conglomerates of the raw size of about 85% of the minimum thickness of raw wood dries skin, if necessary raw clamped; move the conglomerates of raw materials to the pellet mill; cooling pellet air up to 25 °C, which provides a record of the lignin and curing of the product; check the pellets and their separation from the grids; storage in bulk or in bags. With all stages of production, the most significant for the quality indexes of pellets is the impact of this technological equipment as press. Known two

types of presses: with matrices of flat and circular types. Presses with matrices of flat type have a round perforated disk with two or more rotating rollers that transmit material through the holes. Presses with matrices annular type differ by rotating perforated ring on which commercial to press down material to the inner perimeter. Of pellet presses capacity not restricted by the density of the raw materials, as in the case of the piston or screw presses formation of preforms. The efficiency of the equipment depends on the properties and quality of raw materials. Of moisture mass fraction in raw materials has to be lower than 12-14%. Raw material for processing the pellets cannot contain the rotten parts of plants or roots. Impurities content of more than 0,5% lead to deterioration and reduction of power equipment. If all the technological conditions of the total density of the pellets with a diameter of 10 mm and 6 mm is 450-550 kg/m³ [pp. 20-21, 6].

Taking into account the requirements of manufacturers of equipment for raw material, stems, stevia is promising raw material. As a result of efficient post-harvest processing of stems does not contain impurities and moisture content particle mass is less than 10%. Post processing of stevia to cuts away, wash running water and drying of the contents of the mass fraction of moisture not more than 10%. After that is done to separate the leaves from the stems. Leaves are sent to storage or processing and the stems usually utilize. To produce 1 ton of pellets, which is fully composed to 1 ton the stems of stevia, which previously ground to a size of no more than 1 mm.

In producing of pellets important is determining the energy potential of the used raw materials. Energy potential of dry stevia stems (table 1) during which the ability of conditional fuel 29,31 MJ/kg and the heat of combustion of 18 Mj/kg will amount to 0,98 tons of tons of ha and energy output – 28.7 Mj/ kg. For comparison, the enthalpy of combustion of 1 cube. gas natural meter is 32-34 Mj (7600-8100 kcal). Thus, one can argue about the relatively high energy potential stems of stevia.

The main issue remains that the prospects of pellet. Stem stevia has a specific, peculiar smell. Production of pellets from 100% content of the stems of stevia is not possible due to the intense smell of their combustion. Having high purity and relatively high energy potential stem stevia can be seen in the perspective as a

component-based supplement in the amount of 10-20% for the production of pellets from other bioenergetic cultures. This will provide the opportunity not only to fully use the potential of the plant but also get pellets that can be used for fireplaces private sector. Add the stems of herbs such as Mint and lemon balm or other plants combined with stem stevia can provide a pleasant aroma of pellet.

Table 1

The energy potential of the dry stem stevia (*Stevia rebaudiana Bertoni*)

Indicator	Description
Biomass yield t/ha	1.6
Output of biofuels from 1 ha, t/ha (thousand m ³ /ha)	1.6
Output of equivalent fuel, t. w. p./HA	0.98
Energy output, MJ/ha	28.7

In addition, the stems of the stevia leaf and stem of medicinal plants may not be able to fully ensure the production capacity of the enterprise. According to analytical researches concerning the breakeven point enterprises of Ukraine for the production of pellets have a minimum production capacity is 1,3 tons of raw material per 1 hour provided for current fares and prices. With one hand pellet plants low power close to the breakeven point and at any time can become unprofitable. However, on the other hand, such plants are flexible and can use any agricultural raw material with its high quality.

The calculations above Ukraine gets about 57,6 tons per year, which will ensure production at 100% processing of enterprise capacity 1,3 tons of processing of raw materials for 1 hour at 44,3 hours or 2,4 production day. Application of the dry stems stevia as a component of supplements in amounts of 10-20% will get products specialized direction: aromatic pellets for fireplaces private houses.

Conclusion Use the stems stevia in producing of pellets has the following advantages: integrated use of plant resources of dry stevia (*Stevia rebaudiana Bertoni*); raw materials for the production of pellets is of high quality and provides an

opportunity to get advanced 0,98 ton conditional fuel from ha. Considering the small volumes of production in Ukraine of stems stevia more effective is the use of stems with medicinal raw material as a supplement to other bioenergy crops in order to produce aromatic wood for fireplaces private houses.

References

1. Біоенергетика в Україні: стан та перспективи розвитку [текст] / М.В. Роїк, В.Л. Курило, М.Я. Гументик, О.М. Ганженко // Біоенергетика. – 2013. – №1. – С. 5-10.
2. Клевцов К.М., Соблев О.А. Технологія одержання біопалива з відходів виробництва луб'яних культур відповідно до європейських стандартів [текст] / К.М. Клевцов, О.А. Соблев // Товарознавчий вісник. – 2012., В.5. – С. 63-69.
3. Ключ С.В., Забарный Г.Н. Оценка и прогноз потенциала твердого биотоплива Украины / С.В. Ключ, Г.Н. Забарный // Компрессорное и энергетическое машиностроение. – 2011. – №2(24). – С. 8-13.
4. Кузнєцова А. Виробництво пелет в Україні: прибутковий варіант сталого розвитку? [текст] / А.Кузнєцова // Німецько-український діалог APD/PP/02/2012 серія консультативних робіт. 2012. – 23 с.
5. Кузнєцова А. Використання соломи в Україні – можливості та перспективи [текст] / А. Кузнєцова // Німецько-український діалог APD/PP/02/2012 серія консультативних робіт. 2010. – 24 с.
6. Ринок пелетів – перспективи відкриття свого бізнесу [електронний ресурс] www.bio.ukrbio.com (03.12.12 р.)
7. STEVIA FROM PARAGUAY [текст], 2009. - 45 р.

Анотація

Кузнєцова І.В.

Використання стебла стевії (*Stevia rebaudiana Bertoni*) сушеної у виробництві пелет

На основі методики розрахунку енергетичного потенціалу вторинної сировини та біоенергетичних культур визначено енергетичний потенціал стебла стевії, яка утилізується виробниками інстинсивного підсолоджувача на основі стевії. Визначено вплив технологічних чинників на процес отримання пелет та на їх якість. Надано рекомендації щодо можливого використання стебла стевії у виробництві в процесі отримання ароматичних пелет для камінів приватних будинків.

Ключеві слова: стевія, пелети, енергетичний потенціал, обладнання, якість.

Аннотация

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Использование стебля стевии (*Stevia rebaudiana Bertoni*) сушеной в производстве пелет

На основе методики расчёта энергетического потенциала вторичного сырья и биоэнергетических культур определено энергетический потенциал стебля стевии. В переработке стевии используются листья для получения интенсивных подсластителей, а стебли как правило утилизируются. Определено влияние технологических показателей на процесс получения пелет и их качество. Рекомендовано использовать стебли стевии в производстве ароматизированных пелет для каминов частных домов.

Ключевые слова: стевия, пелеты, энергетический потенциал, оборудование, качество