«Advances in Science and Technology»
XI Международная научно-практическая конференция

30 ноября 2017
Научно-издательский центр «Актуальность.РФ»

СБОРНИК СТАТЕЙ

Collected Papers
XI International Scientific-Practical conference
"Advances in Science and Technology"

Research and Publishing Center
"Actualnots.RF", Moscow, Russia
November, 30, 2017

Moscow
2017

УДК: 630.576.8

POTENTIAL OF BIOMASS OF SOME HALOPHYTE PLANTS OF UZBEKISTAN AS SOURCES OF THERMAL ENERGY

Alikulov B. S., Jiyankulova Sh. K., Rakhmatova D. X.
Samarkand State University, Samarkand, Uzbekistan

This article presents information on the biomass potential of widespread halophytic plants, such as H.strobilaceum, H. belangeriana, T. hispida, H. aphyllum and others (K. caspia, C. lanata, S. microphylla) growing on the territory of Uzbekistan, as sources of thermal energy. This information is of theoretical and practical importance, since it can serve the development of new alternative energy sources.

Keywords: energy, alternative energy sources, reproducible energy sources, halophyte, biomass, heat capacity

In the present conditions of reducing the world's hydrocarbon reserves in economically developed and developing countries, an important attention is paid to studying the possibility of using alternative energy sources as the most important factor of sustainable development and economic competitiveness. In this connection, in the whole world, particularly in Uzbekistan, much attention is paid to research work aimed at developing non-traditional methods and technologies for energy production and alternative energy historians for them, as well as for their introduction into production [2, 3, 6]. In the Strategy of Action for the Development of the Republic of Uzbekistan in 2017-2021 as one of the important strategic objectives, «... the expansion of the use of renewable energy sources» [1].Today, using biomass of plants as a universal alternative source of energy, it is possible to get environmentally friendly gas, fuel and electricity. The interest in using biomass as an energy source is, first of all, biomass, which is renewed every year; accumulated energy can be stored and used for a long time, and in various states; the possibility of transferring this energy to other types of energy; in some regions this source of heat is cheaper than natural heat sources; as an environmentally friendly source of heat; its use does not cause the appearance of toxic sulfur oxides in the environment; the balance of carbon dioxide in the atmosphere and a number of other organically related factors [7-9]. Most of the territory of Uzbekistan falls on a desert zone. The steppe territories of Uzbekistan, in particular the vast territories of Karnabchul and Central KyzylKum, are not actually used in agriculture, but some halophyte plants that form a large biomass here can be explored as reserves of alternative energy sources, which is an actual problem. Potential of plant biomass as a source of thermal energy (based on direct combustion) has been studied by a number of specialists. In particular, the energy potential of V. K.Verma and others (India, 2006) on a number of algae, Xuiji Li and others (China, 2003) rice, and A. Osmak, A. Seregin (Ukraine, 2014) stems of buckwheat and wheat straw, and the results obtained were compared with traditional sources of energy.

Based on the above analysis, we have set ourselves the goal of studying the biomass potential of some species of halophyte plants as a source of warm energy. In our studies, halophyte plants *Halocnemumstrobilaceum (Pall) Bieb, Halostachysbelangeriana (Moq) Botsch, Tamarixhispida Willd, Haloxylonaphyllum (Minkw) Iljin* and others (*Kareliniacaspia, Climacopteralanata (Pall) Botsch, Suedamicrophylla Pall*).To study the potential of plant biomass as a source of thermal energy, we studied their heat capacity. The experiments were carried out using the methods of B. S.Beloselskii, V. Vdovchenko (1987), V. I. Nikolayeva (2011) [4, 5]. The research was carried out in the laboratory of Department Physiology, genetics and biochemistry of Samarkand State University. The results of the studies are given in Tables 1, 2 and 3.

Table 1. The annual yield of dry biomass of some halophytic plants, in thousands of tons (n = 5; P≤0.05)

Typesofplants	Total area, thousand hectares ***	Annual yield of dry biomass, centner / ha	Total annual amount of dry biomass, thousand tons **
H. strobilaceum	400	9,0±0,8	360,0
H. belangeriana	180	6,8±0,8	122,4
T. hispida	220	8,3±1,3	182,6
H.aphyllum	250	6,8±1,3	170,0
Mixture of other halophyte plants *	500	6,4±1,1	320,0
Total			1154,8

*Types: *K. caspia, S. microphylla* and *C. lanata*, ** theoretically calculated, *** the area of halophytic plants, is shown in the literature.

Table 2. Heat capacity of dry biomass of halophyte plants

Types	Thermal energy, kCall / g					kcal / kg
	1	2	3	4	average**	
H.strobilaceum	3,6	3,4	3,5	3,6	3,53 ± 0,04	3530
H.belangeriana	3,6	3,4	3,7	3,8	3,63 ± 0,07	3630
T. hispida	3,3	3,5	3,4	3,4	3,40 ± 0,03	3400
H. aphyllum	3,7	4,0	3,9	3,8	3,85 ± 0,05	3850
Mixture of other halophyte plants *	3	2,8	2,7	3,1	2,90 ± 0,07	2900

*Types: *K.caspia, S.microphyllaand C. Lanata,* **n=4; P≤0,05.

The results of the study (see Table 2) show that the heat capacity of the biomass of halophyte plants is close to almost all species. If the heat capacity of a biomass of the *H. strobilaceum* species is on the average 3530 kcal / kg, then in other perennials such as H.belangeriana, T. Hispida and H. aphyllum, respectively, 3630 kcal / kg, 3400 kcal / kg and 3850 kcal / kg. The heat capacity of the mixed biomass of the remaining halophyte plants (*K. caspia, S. Microphyllaand C. lanata*) was 2900 kcal / kg. The results show that the heat capacity of *H. aphyllum* biomass is 15-20 % higher than in other halophytes. Comparing the heat capacity of the biomass of halophyte plants with the same index of natural gas considered to be traditional fuel, it was obtained that 1 kg of *H. strobilaceum* biomass is equivalent to 0.44 m3 of heat capacity of natural gas. The same indicator for species *H. belangeriana, T. hispida and H. aphyllum*, are equivalent, respectively, to 0.45 m^3, 0.42 m^3 and 0.44 m3 of heat capacity of natural gas. 1 kg of biomass from a mixture of other halophyte species (*K. caspia, S. microphylla and C. lanata*) equivalent to 0.37 m^3 of natural gas.

Types of plants	Annual amount of dry biomass, thousands, tons **	Heat capacity, MJ / kg	The heat transfer potential, * 106 MJ	Equivalent		
				Natural gas, thousand, m3	Fuel oil, thousand liters	Diesel fuel, thousand liters
H.strobilaceum	360,0	14,8	5328	158,4	129,6	122,4
H.belangeriana	122,4	15,1	1848	55,1	44,9	42,5
T. hispida	182,6	14,2	2592	76,7	63,1	59,5
H. aphyllum	170,0	16,1	2737	83,3	66,6	62,9
Mixture of other halophyte plants *	320,0	12,2	3904	118,4	95,0	89,7
Total			16400	491,4	399,2	377,0

*Types: *K. caspia, S. microphyllaand C. lanata*, **theoretically calculated.

Comparing the heat capacity of biomass halophyte plants in the same indicator of fuel oil, which is one of the sources of thermal energy,it was found that 1 kg of biomass *H. strobilaceum* is equivalent to 0.36 liters of heat capacity of fuel oil. In the same amount, the biomass of species *H. belangeriana, T. hispida* and *H. aphyllum*, respectively, is equivalent to 0.37 liters, 0.35 liters and 0.4 liters of heat capacity of fuel oil. 1 kg of mixed biomass halophytes (*K. caspia, S. microphylla and C.lanata*) may be equivalent to 0.3 liters of fuel oil.

Comparing the heat capacity of biomass halophyte plants in the same indicator of diesel fuel as one of the sources of thermal energy,it was found that 1 kg of biomass of *H. strobilaceum* type is equivalent to 0.34 liters of heat capacity of fuel oil. The same amount of biomass species *H. belangeriana, T. hispida and H. aphyllum*, is equivalent, respectively, to 0.35 liters, 0.33 liters and 0.38 liters of heat capacity of diesel fuel. Biomass from other halophytes (*K. caspia, S. microphylla and C. lanata*) can be equivalent to 0.3 liters of heat capacity of diesel fuel per 1 kg of mixed biomass. The area of halophyte plants and their annual yields are based on theoretical calculations (Table 1), which show that $5328x10^6$ MJ of thermal energy is generated in direct burning of the annual dry biomass of the *H. strobilaceum* plant (Table 3). With the direct burning of plants *H. belangeriana, T. hispida, H. aphyllum* and in the mixed biomass of other halophytes (*K. caspia, S. microphylla* and *C.lanata*), this figure is respectively $1848x10^6$, $2592x10^6$, $2737x10^6$ and $3904x10^6$ MJ, respectively.

Thus, the heat energy obtained from the general dry biomass, widely widespread in the territory of Uzbekistan, halophyte plants *Halocnemumstrobilaceum (Pall) Bieb, Halostachysbelangeriana (Moq) Botsch, TamarixhispidaWilld, Haloxylonaphyllum (Minkw) Iljin* and others (*Kareliniacaspia, Climacopteralanata (Pall) Botsch, Suedamicrophylla Pall*) is $164x10^8$ MJ, this number corresponds to 491.4 thousand m^3 of natural gas, 399.2 thousand liters of fuel oil or 377.0 thousand liters of diesel fuel.

References:

1. O'zbekiston Respublikasi Prezidentining 2017 yil 7 fevraldagi 4947-sonli «O'zbekiston Respublikasini rivojlantirish bo'yicha Harakatlar strategiyasi to'g'risida»gi farmoni.
2. Аликулов Б.С. О связи виды и качество сырё на выделение биогазов из остатков биомассы растений.

Материалы XII Международной научно-практической интернет конференции «Проблемы и перспективы развития науки в начале третьего тысячелетия в странах СНГ». Украина, Переяслав-Хмельницкий. -2013. С. 7-8.
3. Альтернативные источники энергии: возможности, использование в Узбекистане. //Аналитический доклад (Доклад подготовлен Центром экономических исследований при содействии ПРООН). 2011. № 3. С.7.
4. Белосельский Б.С., Вдовченко В.С. Контроль твердого топлива на электростанциях /Белосельский Б.С., Вдовченко В.С. – М.: Энерго-атомиздат, 1987. – 121 с.
5. Определение теплоты сгорания твердого топлива. / Сост. В.И. Николаева; Томский политехнический университет. – Томск: Изд-во Томского политехнического университета, 2011. – 24 с.
6. Перспективы развития возобновляемой энергетики в Узбекистане. // Аналитический доклад (Доклад подготовлен Центром экономических исследований при содействии ПРООН). 2007. С.17.
7. Avgerinous O.S. Hydrolysis of xilan and fermentation of xylose to ethanol // Adv. Biotechnol. Proc. Int. Ferment.-London.1980.-Vol 2.-P.119-124.
8. Balat M. Production of bioethanol from lignocellulosic materials via the biochemical pathway: A review. EnergConversandManage. 2011, Vol 52. pp. 858–875.
9. Frigon, J.-C., Guiot, S.R. Biomethane production from starch and lignocellulosic crops: a comparative review. Biofuels Bioprod. Biorefin. 2010, vol 4, pp.447–458.

ПОТЕНЦИАЛ БИОМАССЫ НЕКОТОРЫХ ГАЛОФИТОВ УЗБЕКИСТАНА КАК ИСТОЧНИКА ТЕПЛОВОЙ ЭНЕРГИИ

Аликулов Б. С., Жиянкулова Ш. К., Рахматова Д. Х.
Самаркандский государственный университет, Самарканд, Узбекистан

В данной статье приведены сведения о потенциале биомассы широко распространенных галофитных растений, таких как H. strobilaceum, H. belangeriana, T. hispida, H. aphyllum и другие (K.caspia, C.lanata, S.microphylla), произрастающих на территории Узбекистана, как источников тепловой энергии. Эти сведения имеют теоретическое и практическое значение, так как могут послужить развитию новых альтернативных источников энергии.

Ключевые слова: энергетика, альтернативные энергетические источники, воспроизводимые энергетические источники, галофит, биомасса, теплоёмкость