METHOD OF THERMAL RECYCLING OF BIOMASS USING A HELIOPYROLISIS DEVICE

Almardanov Hamidilla Abdiganievich
senior lecturer
Karshi Engineering Economics Institute

Abstract. *The article analyzes the thermal performance of insolation passive solar heating systems and the results of scientific research. The developed systems, advantages and disadvantages of thermal engineering methods of their calculations are presented. The goals of the computational and theoretical studies of the type of solar heating systems under consideration are aimed at an approximate assessment, without taking into account their thermal efficiency, the degree of optimization of individual elements of the system, as well as thermal parameters.*

Key words: *solar radiation, light opening, radiation reflector, short-term heat accumulator, solar heating, insolation passive systems, thermal efficiency, heated room.*

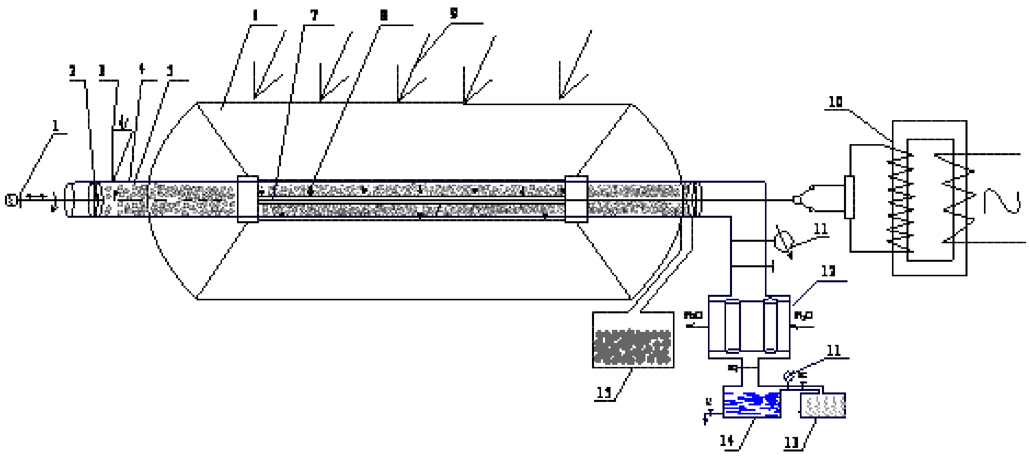
Introduction

The depletion of underground fuel reserves is increasing the possibilities of using renewable energy sources. Continuous heat and electricity production from renewable energy sources, such as biomass and solar energy, can help solve the ever-depleting natural fuels and various environmental problems. In our country, the possibilities of using solar energy are high, and radiation energy can be effectively used for various purposes in about 270-300 sunny days (2700-3000 hours) of the year [1]. The technical potential of solar energy in our republic is three times more than the amount of energy obtained for current consumption from all energy sources. In world practice, it is established to use solar energy for lighting, heating, air cooling, ventilation, heat and electricity production of buildings. The use of solar concentrators is important for the use of solar energy in technological processes that require high temperature [2,3,4].

Energy of density low from biomass in use main problem is considered. The sun from energy use through biomass heliopyrolysis to fuel rotate can. Such in progress concentrated the sun radiation biomass heliopyrolysis for high temperature heat energy source is [2]. This combination as a result from biomass three kind of fuels ie liquid, gaseous and hard alternative fuel is taken. One of the main challenges of today's rapidly developing solar energy industry is to improve the technical and economic performance of solar devices containing reflective elements and the efficient use of solar concentrators that gather solar energy into a single point. Usually, in the development of solar concentrators, their paraboloid types are widely used. Preparation of paraboloid concentrators of this type is somewhat difficult . This requires the development of simple structures for the design of window systems that collect solar radiation at one point.

In the process of designing heliopyrolysis devices, it is important to calculate the heat balance of the bioreactor to determine the consumption of thermal energy for biomass processing. Thermal processing of biomass requires a certain consumption of thermal energy in the reactor. Given heat energy biomass again at work his temperature mode save stands. Biomass again of work energy efficiency evaluation for of the reactor heat balance learning need of the reactor heat balance mathematician modeling through energy savings and heliopyrolysis reactor of optimization important problems solution will be done . To the bioreactor common heat to be included in it used useful heat and heat their losses between proportions of the reactor thermal balance with is expressed.

Pyrolysis reaction stainless of steel made inside the reactor done is increased. The sun pyrolysis system main structural parts - reactor, parabolic cylindrical the sun mining s entator and is a condenser. The principle scheme of the proposed heliopyrolysis device is presented in Fig.2. The reactor is heated externally by means of parabolic cylindrical solar concentrators along with a continuous heating system. In this case p is cylindrical the sun from concentrators the reactor heating for heat source as is used. As a result, with this combined device, it is possible to obtain heat at a temperature of 180 ◦C.



1-rotating mechanism; 2nd piston; For the 3rd hopper loading from rya; 4th reactor; 5 years; 6-solar and parabolic cylindrical concentrator; 7-thermoelectric heater; 8-thermocouple y; 9-sun's rays; 10-transforming buckle; 11th flow meter; 12-condenser-refrigerator; 13-gas holder; 14-tank for storing oil-like substances; 15-tank for wood look

Necessary the temperature create for biomass to the reactor when placed temperature and him pyrolysis to the temperature until heating up for necessary has been heat amount is determined. Loaded biomass pyrolysis process up to temperature heating up for necessary has been heat amount is determined as follows, kJ,

$$Q_{pod} = M_b c_s (t_b - t_z) \quad (1)$$

M_b — mass biomass, kg; c_s - average specific heat biomass , kDj/(kg·°C); t_b — temperature biomass,°C; t_z — same, downloadable, °C.

In a bioreactor heat losses again processed of biomass temperature and reactor of surfaces external temperature of biomass heat exchange surfaces area and external air, reactor of the wall heat conductivity coefficient with is determined. Reactor the wall through to the environment heat transmission as a result biomass lost heat quantity, kJ,

$$Q = KF(t_c - t_b) \quad (2)$$

Coefficient heat exchanger K define formula:

$$K = \frac{1}{\frac{1}{\alpha_1 d_1} + \frac{1}{2\lambda_{sm}} Ln\frac{d_1}{d_2} + \frac{1}{2\lambda_{iz}} Ln\frac{d_{iz}}{d_2} + \frac{1}{\alpha_2 d_2}} \quad (3)$$

Table 2. Heat balance to the reactor

№	m, kg	t_{d1}, °C	t_{d2}, °C	Q_{pod}, kDj	K, W /m²×K	F, m²	Q_{pod}, kDj	dQ, kDj
1	100	20	450	77400	0.3	2,512	4665.6	72734.4
2	50	20	450	38700	0.3	2,512	4665.6	34034.4
3	25	20	450	19350	0.3	2,512	4665.6	14684.4

Of biomass the sun and electricity pyrolysis during heat spending as follows is determined. Straight away in the experiment of fuel consumption is 300-600 kg/t (9-18 GJ/t). Organize that's enough except the sun in heliopyrolysis products liquid to fuel rotate for energy was 8-16 GJ/t process steam is consumed [5-29].

Solar radiation W=800÷950 W/m², wind speed ϑ=4÷5 m/s when dying, of biomass temperature time pass with 180 ° C rise a di. Initially b iomass to the reactor loading at the time the temperature is considered to be 18 °C. Of the device heat efficiency determination by the concentrator acceptance done common energy spending as follows defined as:

$$Q_v = W_g \cdot S_o \cdot R_o \cdot R_p \cdot \sigma$$

where S_o- general surfaceness reflects the surface of the device; R_0=0.78– reflection coefficient; R_p=0.81– absorption coefficient, radiation absorbance; σ=0.85 –

fastor; 3rd and s h th construction system, system tearing solar systems and properties reflect the surface.

The total direct stream of solar radiation for the year is 2000 kW·s/m^2. Teach you how, thermal energy, what can happen is achieved concentrator size 1.2x1.5 m [30,31]:

$$Q_v = W_g \cdot S_o \cdot R_o \cdot R_p \cdot \sigma = 2000 \cdot 1000 \cdot 60 \cdot 60 \cdot 1{,}8 \cdot 0{,}78 \cdot 0{,}81 \cdot 0{,}85 = 7 \cdot 10^9 Djoul$$

This that's it means heliopyrolysis devices installation through every 1 m^2 from $7 \cdot 10^9$ per year from the surface up to Joule energy get enable will give. Device by work issued heat 1 kg of energy conditional fuel combustion heat is 29.3 MJ or 7000 kcal (1 kg coal when it burns separate coming out heat) can be compared with 1 m^2 of the device which is derived from the surface yearly energy simple to fuel when we turn it$7 \cdot 10^9 / 29.3 \cdot 10^6 = 238$ kg equivalent conditional fuel savings allows.

REFERENCES

1. Khujakulov, S. M. Sposob pererabotki biomass s ispolzovaniem solnechnoy energii / S. M. Khujakulov , G. N. Uzakov , Sh. K. Yakhabaev , R. T. Rabbimov . — Text: neposredstvennyy // Molodoy uchenyy. — 2010. — No. 8 (19). — T. 1. — S. 140-145. — URL: https://moluch.ru/archive/19/1986/

2. Uzakov , GN Technical and economic calculation of combined heating and cooling systems vegetable store-solar greenhouse. Applied Solar Energy (English translation of Heliotekhnika), 2012, 48(1), RR . 60–61.

3. Khuzhakulov , SM, Uzakov, GN, Vardiyashvili , AB Effectiveness of solar heating systems for the regeneration of adsorbents in recessed fruit and vegetable storages. Applied Solar Energy (English translation of Heliotekhnika), 2013, 49(4), str . 257–260

4. Rakhimov E.Yu., Sadullaeva Sh.E., Shermatova M.B. Analysis of solar potential Republic of Uzbekistan // Sbornik materialov Mejdunarodnoy conference. Fundamental and practical questions of physics. (Tashkent, June 14-15, 2017). - Tashkent, 2017. S. 73-76.

5. Abdurakhmanov A., Kuchkarov AA, Holov Sh. R., Abdumuminov A. Calculation of optical-geometrical characteristics of parabolic-cylindrical mirror concentrating systems // European scientific review. 2017. Vol. 2. P. 201-204.

6. Abdurakhmanov AA, Kuchkarov AA, Mamatkosimov MA, Akhadov ZZ The optimization of the optical geometric characteristics of mirror concentrating systems //Applied Solar Energy. 2014. Vol. 50. No. 4. P. 244-251.

7. Uzakov G.N., Novik A.V., Davlonov X.A., Almardanov X.A., Chuliev S.E. Heat and Material Balance of Heliopyrolysis Device. ENERGETIKA. Proceedings of CIS higher education institutions and power engineering associations. 2023; 66(1):57-65. https://doi.org/10.21122/1029-7448-2023-66-1-57-65

8 Uzakov, G.N., Almardanov, X.A., Kodirov, I.N., Aliyarova, L.A. Studying the temperature regime of the heliopyrolysis device reactor. E3S Web of Conferences, 2023, 411, 01040 DOI: 10.1051/e3sconf/202341101040

9. X. Davlonov, Study on heat and material balance of heliopyrolysis device, AIP Conference Proceedings, 2686, 020023 (2022)

10. Almardanov, X. A., et al. "Application of solar concentrators to obtain alternative fuel through a heliopyrolysis device."Universum: Technical Sciences 3 (2021): 8-12.

11. Almardanov, H. and Chuliyev, S. 2022. Biomassadan geliopiroliz usulida yoqilg‘i olish tajriba qurilmasining parametrlarini asoslash. Innovatsion texnologiyalar. 1, 4 (Nov. 2022), 92–96.

12. Davlonov, X. A., X. A. Almardanov, and I. A. Khatamov. "A program for modeling and calculating the exergic balance of a heliopyrolysis device to obtain alternative fuels from biomass." No DGU 10337 (2021).

13. Almardanov, H. A. (2023). Calculation of the energy efficiency of the solar concentrator heliopyrolysis device. Educational Research in Universal Sciences, 2(12), 147–150.

14. Sh.B. Imomov, X.A. Alimardonov. Heat mode solar heating systems based on flat reflectors, sets on the north side of the building. Молодой ученый, 2015, 335-336 ст.

15. Davlonov X.A., Almardanov H.A., Toshboyev A.R., Umirov F.B. Method of Thermal Processing of Biomass With Heliopyrolysis Device. 2021, International Journal of Human Computing Studies, 3(2), 149-151.

16. Алмарданов Х.А., Хатамов И.А. Тураев З.Б., Юсупов Р.Э., Эшонкулов М.Н., Жовлиев С.М., Применение солнечных концентраторов для приема альтернативного топлива через устройство гелиопиролиза // Universum: технические науки. – 2021, Март. –№. 3(84). С. 8-11. https://7universum.com/ru/tech/archive/item/11381

17. Давлонов Х.А., Алмарданов Х.А., Гадоев С.А., Шаймарданов И.З. Исследование теплового режима процесса гелиопиролиза биомасса // Универсум: технические науки: электрон. научн. журн. 2021. 4(85) 5-8 ст. https://7universum.com/ru/tech/archive/item/11550

18. Узаков Г.Н., Новик А.В., Давлонов Х.А., Алмарданов Х.А., Чулиев С.Э. Тепловой и материальный баланс гелиопиролизного устройства. Энергетика.

Известия высших учебных заведений и энергетических объединений СНГ. 2023;66(1):57-65. https://doi.org/10.21122/1029-7448-2023-66-1-57-65

19. Т.Я. Хамраев, Х.А. Алмарданов. Режим работы установок для получения биогаза из селскохозяйственных отходов. Молодой ученый. — 2020. — № 25 (315). — С. 49-52.

20. К.К. Рахимова, Х.А. Алмарданов, С.И. Хамраев, С.М. Шамуратова, А.Р. Тошбоев, Э.Э. Турдиев. Теплоснабжение и энергосбережение сельскохозяйственных сооружений с пассивной системой солнечного отопления. ГГТУ им. ПО Сухого, 2020, 242-245 ст.

21. Almardanov , X. (2023). Research of heat exchange processes in the reactor of the solar concentrator heliopyrolisis device. Muqobil Energetika, 2(01), 41–47.

22. Almardanov H.A., Uzakov G.N. 2023. Technical-Economic Justification Of The Efficiency Of Using The Heliopyrolisis Device In Heliothermic Processing Of Biomass. Eurasian Journal of Engineering and Technology. 23, (Oct. 2023), 6–11.

23. Allamuratovich, Davlonov X., et al. "Method of Thermal Processing of Biomass with Heliopyrolysis Device."International Journal of Human Computing Studies, vol. 3, no. 2, 2021, pp. 149-151, doi:10.31149/ijhcs.v3i2.1574.

24. Саматова Ш. Й. и др. Экономичные и энергосберегающие электрические приборы //Современные проблемы и перспективы развития агропромышленного комплекса. – 2021. – С. 117-120.

25. Almardanov , H. A. (2023). Calculation of the energy efficiency of the solar concentrator heliopyrolysis device. Educational Research in Universal Sciences, 2(12), 147–150.

26. Ғ.Н. Узаков, Ҳ.А. Алмарданов. Параболик қуёш концентраторли гелиопиролиз қурилмасининг иссиқлик-технологик режимини тадқиқ қилиш. International Conference “Fundamental and Applied Problems of Modern Physics”, October 19-21, 2023, 123-128 b.

27. G.N. Uzakov, X.A. Almardanov, I.N. Kodirov, L.A. Aliyarova. Modeling the heat balance of a solar concentrator heliopyrolysis device reactor. BIO Web Conf., 71 (2023) 01098. DOI: https://doi.org/10.1051/bioconf/20237101098

28. Almardanov, X. (2023). Study of the temperature regime of the heliopyrolisis device with a parabolic concentrator. Innovatsion Texnologiyalar, 51(03), 33–39.

29. Uzakov, G., Almardanov, H. (2023). Parabolik quyosh konsentratorli geliopiroliz qurilmasining texnik-iqtisodiy parametrlarini asoslash. Muqobil Energetika, 1(10), 50–56.

30. Almardanov H.A., Uzakov G.N. Technical-Economic Justification Of The Efficiency Of Using The Heliopyrolisis Device In Heliothermic Processing Of Biomass. Genius Repository. 23, (Oct. 2023), 6–11.

31. Almardanov , X. (2023). Research of heat exchange processes in the reactor of the solar concentrator heliopyrolisis device. Muqobil Energetika, 2(01), 41–47.