CALCULATION OF THE ENERGY EFFICIENCY OF THE SOLAR CONCENTRATOR HELIOPYROLYSIS DEVICE

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ABSTRACT

This article presents as a result of the use of a parabolic solar concentrator in a heliopyrolysis device, it is possible to create a temperature regime of 400÷450 ^oC. The conducted experiments show that in the conditions of the city of Karshi, the efficiency of the parabolic solar concentrator was 60% when the solar radiation energy was 900 W. Thus, creating a heliopyrolysis device with a solar concentrator, conducting research, developing scientific and technical solutions for biomass heliopyrolysis, and putting it into practice is a promising direction in alternative energy.

Keywords: solar energy, parabolic concentrator, biomass pyrolysis, alternative fuel, solar pyrolysis plant.

The energy potential of solar and biomass energy from renewable energy sources is large, and their practical use is energetically, ecologically and economically effective (2700-3000 hours) radiation energy can be effectively used for various purposes [1].

Currently, it is important to use solar concentrators to use solar energy in technological processes that require high temperatures. In recent years, scientific studies on the use of solar energy in various technological processes have been conducted in Uzbekistan and practical results have been achieved [2-8].

In most cases, higher temperatures are required to realize the possibilities of using solar energy. In order to create high temperatures, it is necessary to concentrate (accumulate) solar radiation energy. The method of concentrating solar radiation is carried out using optical concentrator systems.

A concentrator is an optical system with a mirror that collects solar radiation and directs it to a heat receiver. The advantage of concentrating systems is the ability to generate high temperatures. Their disadvantage is complicated monitoring systems and high price.

The possibility of using concentrators in practice and their effectiveness determined by technical and economic aspects:

a) creating a heat carrier with a temperature of more than 200 ^oC and using it in various technological processes;

b) the need to use solar orientation systems;

c) high cost of skin.

Due to the high precision manufacturing of concentrators and monitoring systems, a high concentration of X >10 is ensured, thereby achieving a large temperature of the heat sink. At the focus of the concentrator, the temperature of the receiver can reach up to 3000 °C. Usually, circular concentrators, depending on the size, allow to increase the heating temperature in the focus to 1000÷2500 °C [9-15]. Thermal treatment of various materials based on them; production of difficult-to-melt pure alloys, metal-ceramic, powder and semiconductor compounds; is widely used to study high-temperature processes and heat capacities in phase transitions [16-18].

This in the article the sun of the concentrator basis as standard diameter d=1,9 m artificial companion antenna used. His reflection bringer surface metal from foil made (Fig. 1).

Fig. 1. Parabolic the sun concentrator .

The concentration coefficient of the solar concentrator is as follows (1) is determined by the formula:

$$K = \frac{q_{fok}}{q_{rad}} \quad (1)$$

where K is the concentration coefficient; q_{fok} - radiation density at the focus, W/m ^{2}; q $_{rad}$ - solar radiation, W/m ^{2}. q_{fok} and q_{rad} were determined by measurements and are 14.3 · 10 ^{3} and 940 W/m ^{2}, respectively.

Energy of the solar concentrator concentration coefficient **to the following equal to :**

$$K = \frac{14{,}3 \cdot 10^3}{940} = 15{,}2$$

Q **used to heat the biomass in the radiation receiver received as a result of radiation from the concentrator is determined using the following expression (2):**

$$Q = c_b \cdot m_b \cdot (T_2 - T_1) \quad (2)$$

here, Q - amount of heat, MJ ; C_b – heat capacity of biomass, K⁄kg · K**; m_b - mass of biomass, kg; $(T_2 - T_1)$ – temperature difference.**

$$Q = 2400 \cdot 2 \cdot (400 - 30) = 1{,}77 \text{ MJ}$$

the biomass $\tau_2 - \tau_1$ up to temperature is determined using the following formula (3):

$$P = \frac{Q}{\tau_2 - \tau_1} \quad (3)$$

this on the ground *P* is thermal power, W.

$$P = \frac{1{,}77 \cdot 10^6}{180 \cdot 60} = 163{,}8 \text{ Vt}$$

FIK of solar concentrator heliopyrolysis device is the following expression (4). using is :

$$\eta = \frac{P}{q_{rad} \cdot K \cdot F_r} \quad (4)$$

this on the ground P is heat power , W ; q_{rad} is the sun radiation , W /m ^{2}; K is concentration coefficient; F_r – heliopyrolysis of the reactor surface area, m^2.

$$\eta = \frac{163{,}8}{900 \cdot 15{,}2 \cdot 0{,}02} = 60\ \%$$

As a result of using a solar concentrator in a heliopyrolysis device, it is possible to create a temperature regime of 400÷450 ^{o}C. The conducted experiments show that the parabolic solar concentrator with an aperture of 2.54 m ^{2} in the conditions of the city of Karshi, when the energy of the sun's radiation was 900 W, the FIK of the device was 60%. Thus, creating a heliopyrolysis device with a solar concentrator, conducting research, developing scientific and technical solutions for biomass heliopyrolysis, and putting it into practice is a promising direction in alternative energy.

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