RESEARCH OF EFFICIENCY USING OF GEOTHERMAL WATER FOR GLASS CONTAINERS WASHER

Iancu Carmen*, Popovici Mariana*, Crăciun Dan**

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048, Oradea, Romania, e-mail: ciancu@uoradea.ro

Abstract

The main objective of the present work is to increase the effectiveness of the washing machines container using geothermal water as heat in the context of sustainable development, the energies of the unconventional pose a challenge to research in the field. In terms of energy usage technologies geothermal waters, there is the tendency to develop that uses less polluting uses to ensure with a minimum of power consumption, maximum efficiency and high economic efficiency in achieve the often complex processes as such, geothermal water use in technological process of washing glass containers which shall be carried out using various constructions, machines whose operating principle is based on washing containers with hot solutions and special detergents, leads to efficiency in terms of energy use.

The use of technical-economic conditions favorable to this method involves at the same time conducting extensive studies and theoretical and experimental research on all the parts of the system in order to establish the optimal Variant.

Key words: efficiency, bottle washing machine, geothermal water

INTRODUCTION

Social and economic progress of the current society is characterized by accelerated growth of energy consumption. Energy has become a factor of development, because it has major influences on the growth of labor productivity, quality and organization of economic and social activity. Economic and social life of every country, is dependent upon, the existence of sources of energy (Muscă, 1984; Răşenescu, 1972).

Thus, renewable energies come with solutions for achieving this aim. Imposition of geothermal energy as a viable alternative to fossil fuels has been supported by technical and economic advantages it presents, that is available all year round regardless of season and weather conditions, that 80 of countries have significant geothermal resources, and the fact that nuclear power poses problems related to radioactive and its acceptance in public and the hydraulic power, although it is used for a long time and contributes substantially to the production worldwide, energy cannot be increased arbitrarily.

The advantages of geothermal energy have led to the creation of new specialties in technical sciences, human and economic resources being significant both in terms of exploitation of geothermal resources, and what concerns of this form of energy uses; geothermal energy uses can be divided into two large groups: direct uses (heat transfer to a user), uses indirect (conversion into electricity). Direct use of geothermal energy may include a wide variety of areas such as: heating of premises, industrial process heating, greenhouses, and fisheries. Direct use of geothermal energy in the world-has demonstrated its technological, economic accessibility and environmental protection.

Direct use can use both geothermal resources, high temperature and low temperature.

MATERIAL AND METHOD

Washing machine for jars C-60 m is mainly used for cleaning the glass jars with capacity of 0.5 ... 1.0 l. Basis is the body, made of laminated sheet and profiled metal (Fig. 1).

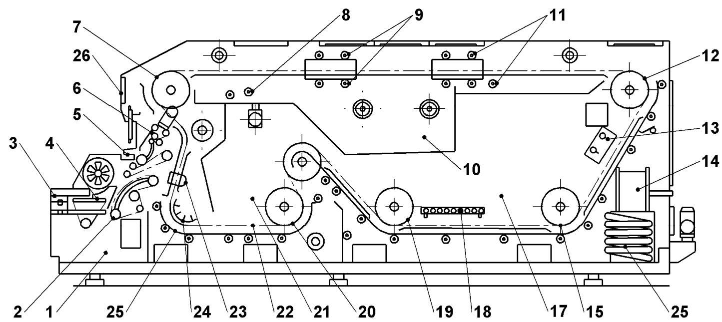

Fig. 1. Washing machine for glass containers

The jars are placed in the machine by using the transporter, then drive on battery composed of cylinders, which are taken at regular intervals with the loading mechanism and loading boxes, drop the way speakers articulated on parallel chains of the main conveyer (Amarfi et al., 1948; Ioancea, Petculescu, 1995).

The last has a intermittent motion (motion and stagnation-a cinematic cycle). During a cycle, the conveyor belt is moving parts on the brink of the chain and thus moving, introduces the jars of water preheating temperature jars with 40 ... 45 ° C. From the bathroom in the bathroom by targeting jars filled with alkaline solution at a temperature of 70 ... 90 ° C. Upon leaving the bathroom, the jars are şpriţuiesc with alkaline solution at a temperature of 70 ... 90 ° C of the nozzles, to peel the labels on the jars (Muscă, 1984; Răşenescu, 1972).

On the upper portion of the main conveyer with horizontal surfaces inner and outer jars sprinkle with water from nozzles used in temperature 90

° C, then sprinkle them with nozzles clean water warm at a temperature of 60 ° C (the final rinse).

After the preliminary and final rinsing, water builds up in the bathroom, from which she, passing through the filter is sent to the preliminary rinsing the jars. The water level in this bath is maintained constant, excess water is devarsă into the sewage. Jars, being rinsed with warm, clean water is then treated with steam from vents. The jars clean targeting towards the download mechanism, which puts them on the conveyor to be discharged (Muscă, 1984; Răşenescu, 1972).

The main carrier is put into operation at the chain wheels which, in turn, put into motion the mechanism with the laying on of the main conveyer chains cliche is carried out with the help of the chain wheel serving for changing direction motion of the conveyer. When heated, change the direction of motion of the conveyer was carried out with the help of guides. Alkaline solution in the bathroom is heated using heat exchangers. The lower portion of the main horizontal spiral conveyor is equipped with guides, which avoids the jars fall from cassettes. (Răşenescu, 1972, 1987; Stănciulescu, 1975; Banu et al., 1998, Banu et al 1999; Gheorghiţă, 1997).

For the determination of steam consumption in washing receptacles used the method of "closed volume". It is that the washing machine, the body shall be considered a closed volume, the resulting heat exchange process. Thermal calculation reduces to determining the fluxes of heat introduced to and discharged from the washing machine (closed).Based on the main parameters of the functioning of the machine, which are accepted practice, it shall draw up the balance sheet, from which it calculates the consumption of steam directly into the washing machine (closed volume). The heat is introduced into the washing machine with water, containers, and steam is discharged from the car with heated and hot water containers already in use, with the exhaust condensate from the heat exchanger, heat loss into the environment (Balc, 2000; Ganea, 2007; Şlepeanu et al., 1959; Banu et al., 1993).

The heat introduced into the car with containers

$$Q_1 = P \cdot m_1 \cdot c_1 \cdot t_1 \tag{1}$$

The heat introduced into the machine with water

$$Q_2 = W \cdot c_2 \cdot t_2 \tag{2}$$

The heat introduced into the machine with steam

$$Q_3 = D_a \cdot i \tag{3}$$

The heat emitted from the car with containers

$$Q_4 = P \cdot m_1 \cdot c_1 \cdot t_3 \tag{4}$$

The heat emitted from the car with water

$$Q_5 = W \cdot c_2 \cdot t_4 \qquad (5)$$

The heat emitted from the car with condensate

$$Q_6 = D_a \cdot i_c \qquad (6)$$

The heat lost in the environment

$$Q_7 = F \cdot \alpha(t_5 - t_6) \qquad (7)$$

Where m1 is the mass of a container, kg;

c_1 - specific heat of vessels, kj/(kg·K);

c_2 - specific heat of water kj/(kg·k);

W- the quantity of fresh water introduced into the machine l/h;

D_a - the amount of steam needed for normal operation of the machine, kg/h;

F - area of heat exchange surface of the machine, m^2;

t_1 - the temperature of the receptacles placed in car,°C;

t_2 - fresh water temperature entered in the machine,°C;

t_3 - the temperature of the receptacles at the outlet of the machine,°C;

t_4 -temperature of water discharged from the machine, °C;

t_5 - the average temperature of the walls of the car,°C;

t_6- average temperature of air in manufacturing workshop,°C;

i_c- enthalpy condensate, kj/kg;

i - direct steam enthalpy, kj/kg;

α - heat transfer coefficient from the walls of the machine in the environment, kW/(m^2 k).

Heat balance sheet of:

$$Q_1+Q_2+Q_3=Q_4 + Q_5+Q_6+Q_7 \qquad (8)$$

Substituting in this equality through their values terms Qn indicated above, we will be able to determine the direct steam consumption, D_a (kg/h):

$$D_a = \frac{P \cdot m_1 \cdot c_1 \cdot (t_1 - t_3) + W \cdot c_2 \cdot (t_4 - t_2) + F \cdot \alpha(t_5 - t_6)}{i - i_c} \qquad (9)$$

Generally, you can calculate water consumption W (m3/s) in washing machines, containers using the expression;

$$W = \mu \pi d^2 / 4\sqrt{(2P_a / \rho_l)} \cdot n \qquad (10)$$

in which μ reprezintă coeficientul de consum al duzelor;

d - orifice nozzles, m;

P_a - the water pressure at the nozzle exit, Pa;

n - the number of nozzles of spraying devices and șprițuire with hot water, cold and alkaline solution.

ρ_l - density of the liquid, kg/m^3.

In order to achieve research measurements were made on the washing machine from jars SC Agromec SRL Bihor.

RESULTS AND DISSCUSION

To determine the functional arrangement parameters you washing machine jars have been taken into account the following:

-temperature geothermal water: 85°C

- for heating circuit water wash:

 primary agent: geothermal water
 flow control.: 120 m^3/h (33,5 l/s)
 temperatures (round trip): 85°/45°C
 pressure (round trip): 2,5/0,8 bar
 the secondary agent: hot water
 flow control: 120 m^3/h
 temperatures (round trip):80°/40°C
 pressure (round trip):3,5/1,5 bar

In order to determine the parameters of the functional arrangement and efficiency, the methodology has been developed, which provides for the establishment of the system of equations that define the deployment processes envisaged, both in static and dynamic mode and the establishment of functional parameters under constant operation. For the project addressing the issue, consider a system of two heat exchangers connected in shakes.

$$\Delta t_{med} = \frac{(t_{pin} - t_{sies}) + (t_{pies} - t_{\sin})}{\ln\left(\frac{t_{pin} - t_{sies}}{t_{pies} - t_{\sin}}\right)} \approx \frac{(t_{pin} - t_{sies}) + (t_{pies} - t_{\sin})}{2} \qquad (11)$$

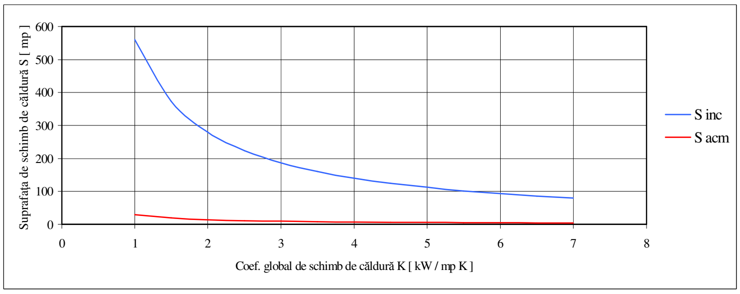

Fig. 2. Dependence of surface heat exchange coefficient and global heat exchange

CONCLUSIONS

From the analysis carried out, the use of two heat exchangers (mounted in parallel), together with all the necessary equipment.

The resulting constructive scheme proposed for the functional use of geothermal energy to direct a dishwasher jars.

To determine the pressure at which the water is supplied by geothermal pumping station shall take account of the equations. The flow of fluid through hydraulic resistance systems is characterized by equations of the form:

$$Q = k \cdot \sqrt{\Delta p} \quad (12)$$

where: Q – the flow of fluid through hydraulic resistance,

Δp – pressure drop on hydraulic resistance,

k – flow coefficient (in inverse proportion with the hydraulic resistance).

REFERENCES

1. Amarfi R., Brad S., V. Cubleşan, G. Dima, 1948, Utilajul tehnologic din industria de prelucrare a produselor horticole. Ed. Ceres, Bucureşti
2. Balc G., 2000, Calculul şi construcţia utilajelor pentru industria alimentară. Ed. Todesco, Cluj-Napoca
3. Banu C. et al., 1993, Progrese tehnice, tehnologice şi ştiinţifice, vol.2. Ed. Tehnică, Bucureşti
4. Banu C. et al., 1998, Manualul inginerului de industria alimentară, vol. I. Ed. Tehnică, Bucureşti
5. Banu C. et al., 1999, Manualul inginerului de industrie alimentară, vol. I, II. Ed. Tehnica, Bucuresti
6. Batik H., Kocak A., Akkus I., Simsek S., Mertoglu O., Dokuz I., Bakir N., 2000, Geothermal energy utilisation development in Turkey. World Geothermal Congress, WGC2000, CD-ROM, pp.85-91
7. Fridleifsson B., 2001, Geothermal energy for the benefit of the people. European Summer School on Geothermal Energy Applications, Oradea
8. Ganea G., Gorea D., Cojoc M., Bernic, 2007, Utilaj tehnologic în industria alimentară. Ed. Tehnica – Info, Chişinău
9. Gheorghiţă M., 1997, Tehnologii, procedee şi utilaje în industria vinicolă. Universitatea din Craiova
10. Gherman V., 1997, Utilaje pentru industria alimentară. Ed. Sincron, Cluj-Napoca
11. Ioancea I. et al., 1986, Maşini, utilaje şi instalaţii în industria alimentară. Ed. Ceres, Bucureşti
12. Ioancea L., Petculescu E., 1995, Utilajul şi tehnologia meseriei. Ed. Didactică şi Pedagogică R.A., Bucureşti
13. Iones D. et al., 2004, Pregătire de bază în industria alimentară. Ed. Niculescu
14. Klinţov I.G., Kaderov V.D., 1973, Frezarea canalelor precise cu ajutorul mandrinelor cu excentric. Vestnik Maşinastraenia nr. 3, pp.58-59, cz.621.914-45
15. Moţoc V. et al., 1968, Manualul inginerului din industria alimentară. Ed. Tehnică, Bucureşti
16. Muscă M., 1984, Tehnologia generală a industriei alimentare. Universitatea din Galaţi
17. Răşenescu I., 1972, Operaţii şi utilaje în industria alimentară. vol. I, II. Ed. Tehnică, BucureştiRăşenescu I., Oţel I., 1987, Îndrumar pentru industria alimentară, vol. I, II. Ed. Tehnică, Bucureşti
18. Şlepeanu I. et al., 1959, Maşini şi instalaţii folosite în vinificaţie. Ed. Agrosilvică, Bucureşti
19. Stănciulescu Gh., 1975, Tehnologia distilatelor alcoolice din fructe şi vin. Ed. Ceres, Bucureşti