ANNALS of the ORADEA UNIVERSITY.

Fascicle of Management and Technological Engineering, Volume VI (XVI), 2007

NEW APPROACH REGARDING FOR MILK PASTEURIZATION FROM GEOTHERMAL SOURCE. CASE STUDY

Ph Dr Eng Virgiliu Dan Negrea*, Res. Dr. Ing. Ovidiu Gavrilescu, Lect. Dr. Ing. Dan Gomboş**, Res. Dr. Ing. Dana Bococi****

Universitatea Politehnica Timişoara, Member of the Academy of Technical Science of Romania*, University of Oradea** ogavrilescu@uoradea.ro, danser@rdslink.ro, dbococi@uoradea.ro

Abstract. Our research presented a solution for abording the posibilityes of pasteurization of milch using alternative source of energy (geothermal energy). We present the resulted in which we obtained after the study. We present the aspectes about the automatic lead of supply with termic energy of the pasteur instalation type TPL400, lead which is realized with the help of the automat program.

The principle of ensemble

The pasteurization of milk has to assure the almost total distruction of the everyday microflora and the total distruction of the patogen microflora. At the pasteurization you have to oversee that the relationship between time and tempeture assures, on one hand the distruction of the Mycobacterium tuberculosis (curve 1), and on the other hand not to conduct to the modification of sensory and phsysical-chemical properties of the milk.(curve 2). It results that any regime of pasteurization chosen, it has to fit in the two curves (right 3) of the diagram Dahlberg (fig. 1).

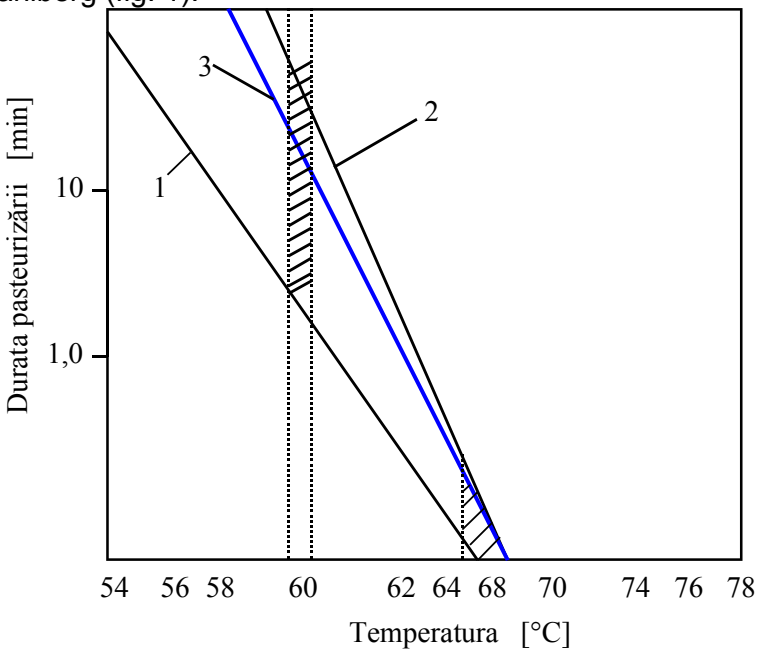

Figure 1 The diagram of pasteurization Dahlberg

The next methods of pasteurization can be used:

- *Slow pasteurization or low pasteurization at the temperature of* 62-65°C/30 minutes, respective 20 minutes.
- *Midst pasteurization or shorten pasteurization is performed at the temperature of* 72÷78°C/15secundes, known as HTST.
- *High pasteurization or instantaneous pasteurization is performed between* 85-90°C, for a few secundes, followed by sudden cooling at 10°C.

TPL400 installation has the following characteristics::

Characteristics	TPL 400
Capacitatea nominală, l/h	40.000
Pasteurization temperature, ºC	74-76
Cooling temperature, ºC	6-8
Steam pressure, bar	0,6-4
Steam input, kg/h	1600
Hot water input (90…95ºC), l/h	45.000
Cold water input(18ºC), l/h	120000
Iced water input, l/h	120000
Air input (10 bar), m^3/h	192

To assure the energetic requisite for the pasteurization of the milk using a TPL400 installation for pasteurization, you use geothermal water from a drilling with the temperature of 100°C at the end of the probe. The nurture of the pasteurization installation with thermal energy is made through the mediation of the introduction of a mutable of hot water-water (figura2). The installation of pasteurization has in his composition the next machines and installations: a tank with a float of 1000 l, 2 centrifugals pumps, maintenance sector, pasteurization sector, 2 retrieval sectors, 2 cooling sectors, centrifugal skimmer SECEL, a valve for the deviation of the flow, mutable of warmth..

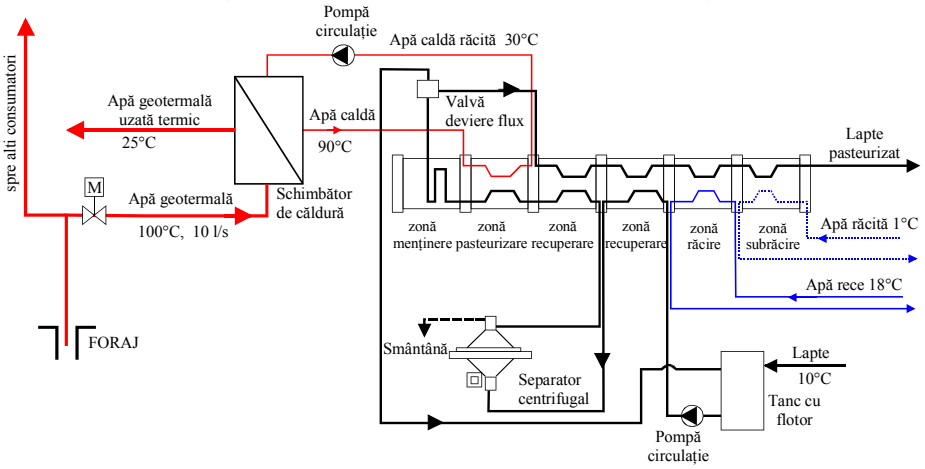

Figure 2. The diagram for the installation for the pasterization of the milk

The thermal regime is the following:

- The preheating of the milk at the temperature of 35…45°C in the first sector of retrieval
- The preheating of the milk at the temperature of 53…55°C in the second sector of retrieval
- The heating of the milk at the temperature of 72…76°C, with the help of hot water at the temperature of 90…95°C, in the sector of pateurization
- Maintenance at the temperature of pasteurization in the sector of maintenancel
- The cooling of the milk at the temperature of 6…8°C in two cooling sectors : one with water from the system and the other with iced water at the temperature of 1°C.

The optimization of self-acting administration

In the purpose of the insurance of good movement of the insurance installation of thermal energy for the pasteurization of milk it is necessary to create an automation program, wich can follow and adjust its dynamic parameters. It is persued the maintenance of the parameters of the thermal agent for the installation of pasteurization. This thing allows the achievement of a corellation between the parameters measured in different point of the scheme and the command of the acting factors.

The chase and the command of the parameters, respective the factors of acting of the installation , are being made by an PCL, and with his help the program of automation is being implemented.

Futhermore it is presented the strategy of automation for the installation of insurance of the thermal energy for the pasteurization of milk, analysing every lock of automation , with the specification of control , the reactions and the constants that interfere in the procces, the traductions utilized and the equipment of acting used.

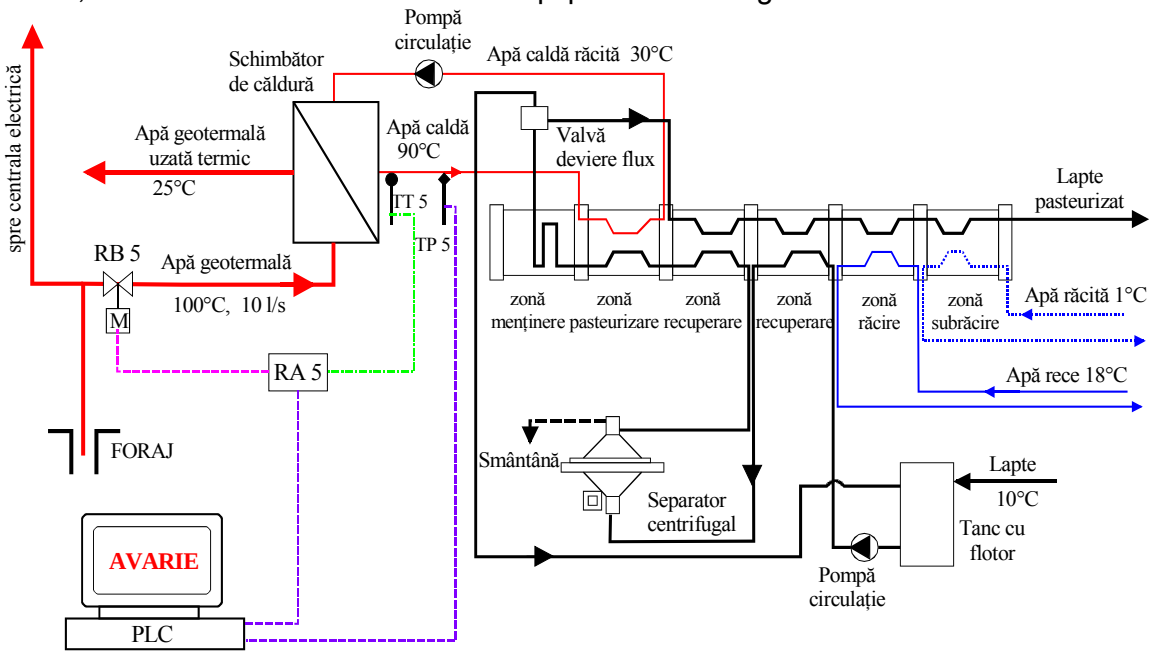

Figure 3. The lock of automation and wreck for the installation of insurance of thermal energy for the pasteurizatio of milk

The system allows the operation of the installation in two ways winnowed by the operator and that is: the self-acting way in wich the monitorization of the proceses and the decision of reaction (adjustment) are being made by the PLC, as the manual way in wich the monitorization of the processes is made by the PLC , and the decisions of reaction (adjustment) are being made bu the operator. Figure 3 contains the lock of automation and the lock of wreck for the installation of insurance of the thermal energy for the pasterization of milk.

a. The lock of automation

The lock of automation of the insurance installation of thermal energy for the pasteurization of milk follows the realisation of the condition of the maitenance of hot water temperature for the installation of pasterization in the interval *90…95°C*.

The condition of function of the installation of pasteurization ist hat the temperature of hot water that leaves the changer of heat it has to mentain between certain parameters (90…95°C). This condition is realised through the adjustment of the debit of geothermal

water , that passes through the changer of heat , obtained through the opening/closure of the RB5 tap.

If the TT5 translator indicates a lower temperature than the minimum admitted limit for It5(It5=90°C) temperature, after the temporization time from the execution of the last tuning command expires and if the tap's automatic regulator from the geothermal water's feeding path satisfies the following condition RA5<100% (the tap is not fully open), the RB.5 tap will open with the value xRB 5 given by the command from the RA5 regulator

In the case in wich the TT5 transator indicates a temperature lower than the minumim limit (I_{t5}=90°C) , afetr the pass of the temporizing time $t_{tmp\ 2}$ from the execuson of the la command of adjustment and if the timer of the tap from the route of nurture with geothermal water that satisfices the condition RA5<100% (the tap is not open to the maximum), the RB5 tap is opened with the value $x_{RB\ 5}$ through the command given by the timer RA5.

b. The signalling of the wrecks and the reaction of the system in this case

In the function of the installation can appear irregularities between the dynamic parametersof that and the conditions prescriebed, the irregulariies that the program of automation does not manage to correct. In this case, the operator is worned about the situation and waits for his decision to fix the situation.

The signalling of the wrecks (fig.3) and the reaction of the system in this case i sone of the most important parts of the program of automation for the installation of insurance of thermal energy for the pasteurization of milk through that avoids accidents that can appear all of a sudden, points aut to the operator of the mallfunction of the system and allows taking the necessary decissions.

The first and the most dangerous wreck that can appear is that at the exit of the mutable of heat the pressure of hot water surpasses the maximum limit.

Bibliography:

1. Bliem C.J.: Computer-aided value analysis for small low temperature binary systems, Final Report for NREL, december 1996.
2. Green M., Pines H.: Calculation of geothermal power plant using the program GEOTHM, GRC Transactions, USA 1989.
3. Maghiar T., Antal C., Gabor G., Gavrilescu O., Almăşan I.: The geothermal system from the University of Oradea - a new strategy simulation for the heat station, Analele Universității din Oradea, Fascicola Electrotehnică, Oradea 1998.
4. Maghiar T., Leuca T., Gavriş M., Antal C.: Considerații privind strategia de operare pentru sistemul geotermal de la Universitatea din Oradea, Analele Universității din Oradea, Fascicola Electrotehnică, Oradea 1996.
5. Maghiar T., Zmaranda D., Gabor G.: Considerații privind programarea sistemului SCADA utilizat în centrala geotermală din cadrul Universității din Oradea, Analele Universității din Oradea, Fascicola Electrotehnică, Oradea 1996.
6. ***: Equipment and services for worldwide applications, U.S.Department of Energy Report, DOE/GE - 1070, USA 1998.
7. ***: Heliflow heat exchangers, Graham Bulletin, P-86-2, USA 1992.
8. ***: Small geothermal generators, U.S.Department of Energy Report, DOE/EE - 0040, USA 1997.
9. ***: Steam surface condensers, Graham Bulletin, P-86-2, USA 1992.