CONTROL OF MILKING PROCESS BY THERMOENERGETICAL CHARACTERISTICS OF MILK FLOW

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Summary. Using mechanical cow milking systems, the insufficiency of means to ensure the control and monitoring of milking process is frequently encountered. In practice we have quite many apparatus for testing and adjusting different components of a milking system. Commonly quality of milking process can be observed only visually.

In this article a control method of milking process by measuring milk temperature in a milking tube during milking time and the results, which allow us to make assumption to use this method in practice are presented.

It was determined, that by measuring temperatures in all milking tubes separately, control of milking process, equality of milk flow, quality of milking tubes superposition and quality of rubber components and other factors, which in practice could help us in observation of cows illness and milking system defects.

Keywords: milk temperature, milking process, cows illness

PIENO ČIURKŠLĖS TERMOENERGETINIŲ PARAMETRŲ KONTROLĖ MELŽIMO PROCESO METU

Santrauka. Naudojant mechanizuoto melžimo sistemas, dažnai susiduriama su priemonių, užtikrinančių melžimo proceso kontrolę bei monitoringą, stoka. Yra sukurti ir naudojami įvairūs prietaisai, kuriais galima patikrinti bei nustatyti melžimo sistemos atskirų mazgų, pvz.: pulsatorių veikimo kokybę ir padėti juos sureguliuoti. Tačiau melžimo proceso kontrolę paprastai galima atlikti tik stebint pieno srautus skaidriose melžimo sistemos vamzdynų dalyse.

Straipsnyje pateikiami melžimo proceso, t. y. melžiklių sandarumo bei pieno srautų kontrolės metodo, pagrįsto pieno temperatūros matavimu melžiklyje melžimo metu, rezultatai, kurie sudaro prielaidas šį metodą taikyti praktikoje.

Tyrimais nustatyta, kad, matuojant temperatūrą atskiruose melžikliuose, galima kontroliuoti melžimo procesą, pieno atidavimą, melžiklio uždėjimo bei guminių detalių kokybę ir kitus veiksnius, kurie gali padėti laiku pastebėti su tuo susijusius karvės susirgimus bei kai kurių melžimo sistemos mazgų veikimo defektus.

Raktažodžiai: melžimo procesas, diagnostika, pieno termoenergetiniai parametrai.

Introduction. Dairy farming is strategic branch of agriculture in Lithuania. For producing high quality milk farmers are using milking systems. In mentioned systems milking process in separate quarters could be controlled only visually, in other words, only if farmer is near milking system and visually control milking process. In more cases farmer not have possibility continuously control milking process of all cows, because at the same time is done milking for few cows.

Mentioned system could produce continuously monitoring of milk flow and could inform farmer about decreasing of milk flow totally, or in one milking tube. This system could warn farmer about uneven milk flow, whish could be beginning of problems with milking system or with udder. At same this measuring system is quit simple and cheep.

Analogous measuring systems some scientists try to use diagnostics of pathology of cow's udder [1]. We construct computerized measuring system (fig. 1, 2), wherewith was investigated milking process. Purpose of research is to measure milk flow temperature differences between milking tubes by thermoenergetical characteristics method. Estimate relations between thermoenergetical characteristics of milk flow and milking process.

Materials and methods. Sensor (thermocouple) was mounted in milking tube – in plastic insert which connect rubber of milking tube with milk hose (fig. 1). Such mounting let us measuring temperature during milking time. During milking pulse milk stream go through plastic insert and submerge sensor. Sensor transform temperature into voltage and by shielded line transmits it to the signal processing system.

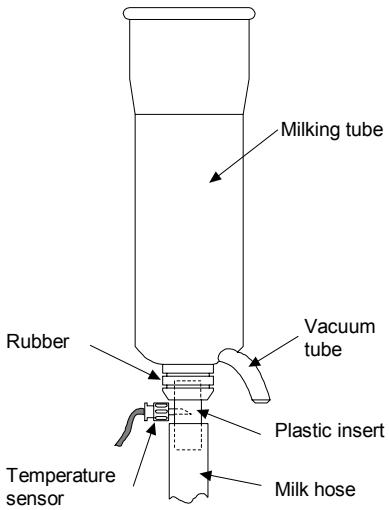

Figure 1. **Fixing of temperature sensor in milking system**

Measuring system can collect 8 sets of data. Six sets of it are used to measure temperature differences between milk flows in different milking tubes. The 7th set is actual temperature in one of milking tube and 8th - measuring

voltage of channel was shorted. Designed connection schema is shown in figure 2.

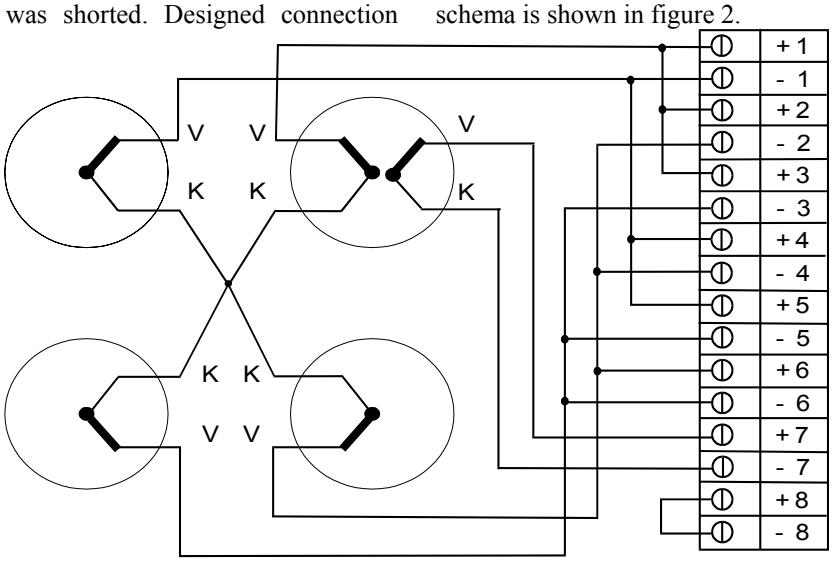

Figure 2. **Connection schema of sensors**

Experiment was performed in educational farm, Lithuanian university of agriculture. There was tested for cows. Milk was separately examined from all quarters in State laboratory for milk control "Pieno tyrimai". In all cases the somatic cells of milk was found from 100000 [1/ml] to 300000 [1/ml]. Only in one quarter of udder we have found 1000000 [1/ml] (that is significant value which could mean mastitis illness).

Discussion and conclusion. Through milking time was collected temperature data by constructed computerized measuring system. According this data was created thermoenergetical characteristics of milking process.

How we can see in figure 3, observed signal is enough stable, unless in beginning and end of milking.

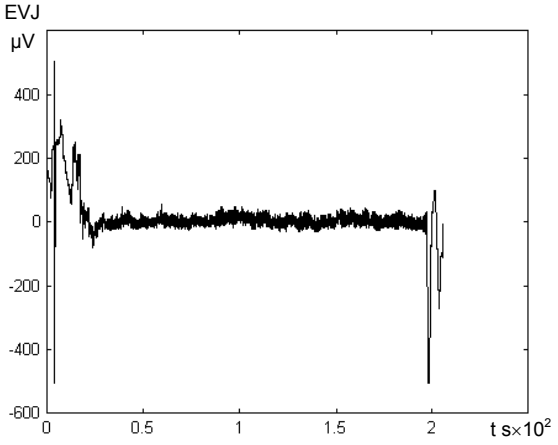

Figure 3. **Typical view of signal measured in milking time**

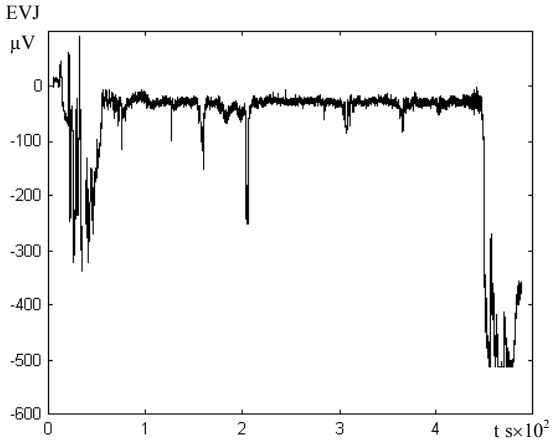

Figure 4. **Signal between 1 and 2 milking tubes**

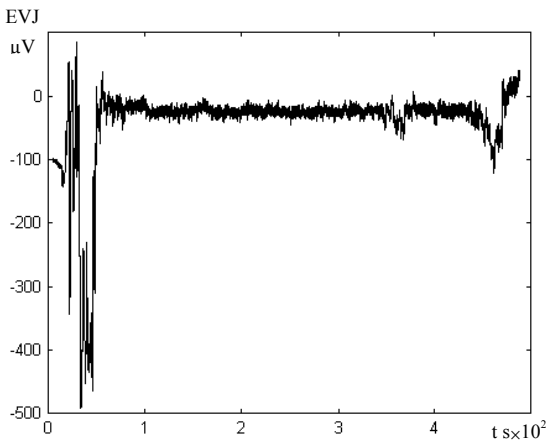

Figure 5. **Signal between 1 and 3 milking tubes**

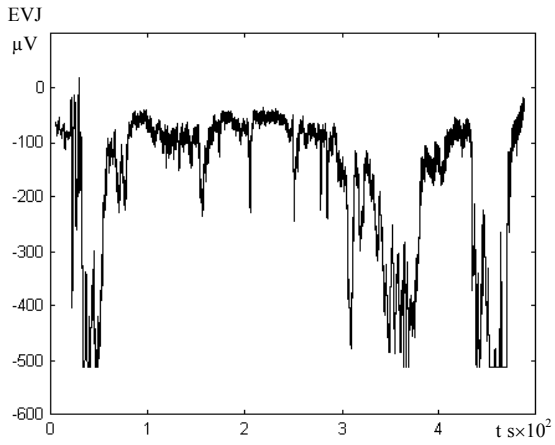

Figure 6. **Signal between 1 and 4 milking tubes**

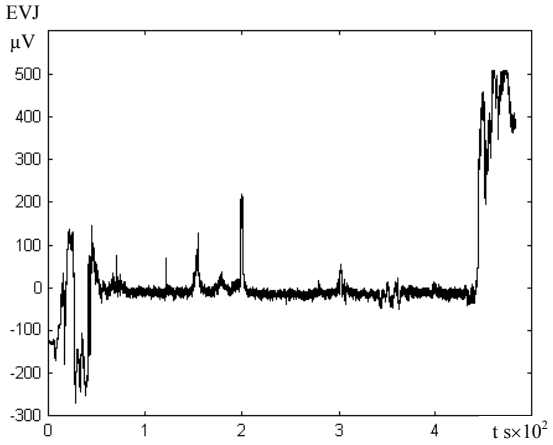

Figure 7. **Signal between 2 and 3 milking tubes**

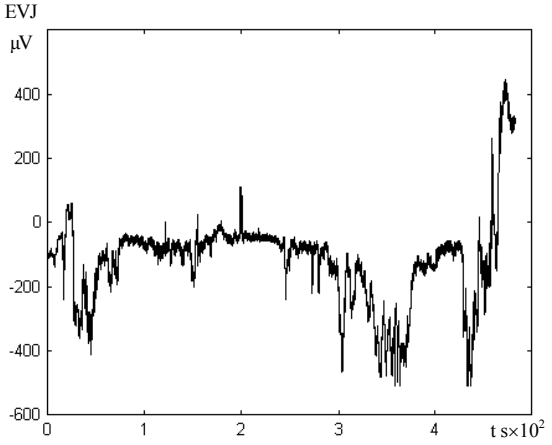

Figure 8. **Signal between 2 and 4 milking tubes**

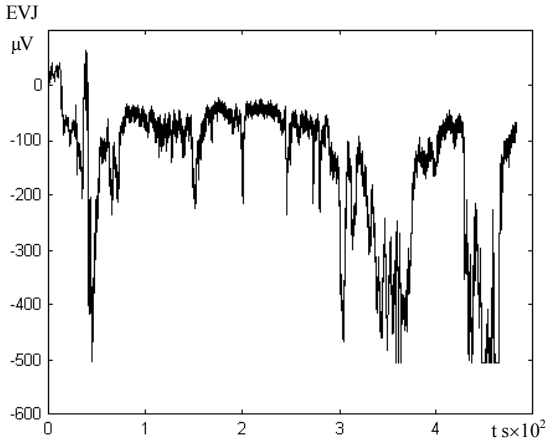

Figure 9. **Signal between 3 and 4 milking tubes**

In case, when quarter of udder did not gave milk, was observed results shown in figures 4 – 9.

How we can see in thermoenergetical characteristics, in case when the udder did not gave milk we got oscillations of temperature. It happens because 4th quarter of udder did not gave milk, we can watch steady air intake in milking tube. In this case, temperature measuring system shows for us not qualitative milking process.

Applying of thermoenergetical characteristics of milk flow measuring method we can control process of milking: beginning and end of milking, milk flow, functionality of milking tubes and other parameters.

Conclusion. Created computerized measuring system of thermoenergetical characteristic allow us using information technology for milking process control and give a chance introduce metrological control of milking process.

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