IMPACT OF PULSATOR CAPACITY ON THE INERTIA PULSATION SYSTEM MILKING CLUSTER

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ABSTRACT

Conventional type cluster and two experimental milking clusters with two pulsators and respectively four pulsators were studied. Experimental milking cluster generally have two times and respectively four times bigger capacity.

The experiment was conducted in laboratory conditions at frequency range of 1Hz to 2,5 Hz. There are differences in pulsation parameters (phases a, b, c and d) between investigated three types of milking clusters. With increasing frequency there is a reduction in phases a, b, c and d in a conventional type milking cluster. Between two type milking clusters not seen the influence of frequency on the absolute values of the transitional phases a and c. The relative values of the transients a and c rise with increasing frequency which is an expected effect of reducing the period of the pulses. More interesting is the fact that generalized index of two prototypes exceed 30% of cycles a+b which is two times less than the conventional type of milking cluster where in the whole frequency range of this index is twice bigger.

Key words: *milking machine, high-frequency milking cluster, pulsation frequency, generalized indexes.*

Introduction

Recent research into the milking equipment is again focused on changes of pressure in pulsation chamber milking cluster for the frequency range from 1Hz to 2,5Hz (Banev B., 2001, 2002; Banev B., B. Bechev, 2009). The aim of these studies is in milking machine to reach the natural frequency of suckling calf which is in the frequency range from 1Hz to 2,5 Hz (Banev B., 2001). In this connection Banev B. suggested that the main reason for the low operating frequency of milking machines is inertness of pulsators and in particular its capacity.

The big interest is the dynamics of the walls of the elastic element - milking liner (Mayer M., N. Grimm, 2003).

The purpose of this study is to experimentally verify the hypothesis about the impact of pulsator capacity on the pulsation system inertia.

Material and methods

The study was conducted with three strains: figure 1*a* is experimental set-up of conventional pulsation system milking cluster, in figure 1*b* and 1*c* - are presented experimental set-up of a milking cluster respectively with two and four pulsators.

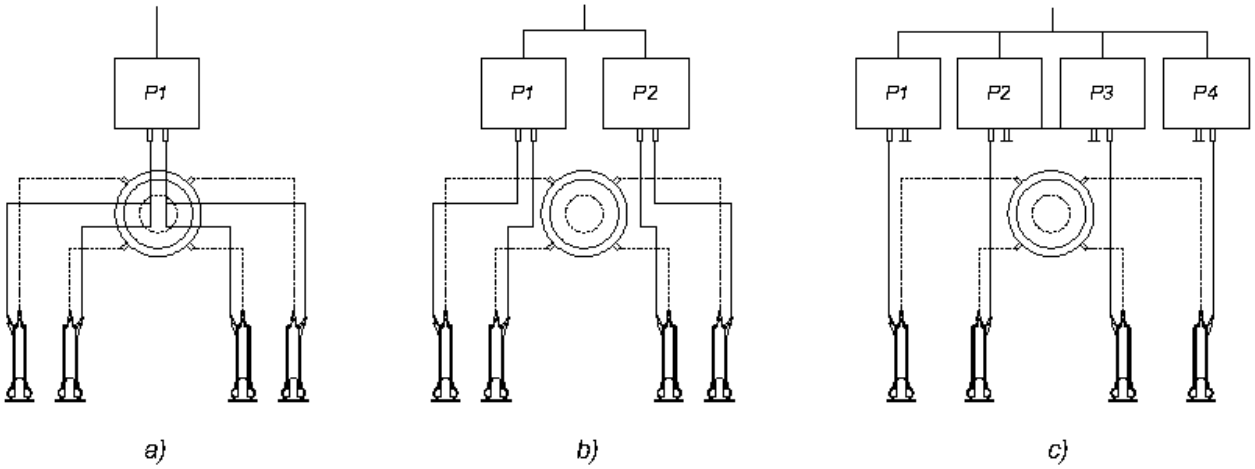

Fig. 1. Experimental set-up: a) experimental set-up of conventional pulsation system milking cluster (1NP); b) experimental set-up of milking cluster with 2 number of pulsators (2NP); c) experimental set-up of milking cluster with 4 number of pulsators (4NP).

With increasing the number of pulsators to simulate high-frequency pulsator with a larger capacity, i.e. a higher rate of airflow which switches in either direction when operating the pulsators.

The experiment includes the registration of standard pulsation phases **a**, **b**, **c** and **d** (in absolute and relative values) over the frequency range 1Hz to 2,5Hz at 50 kPa vacuum and ratio 50/50%. Registration is done with standard pulsotester.

Results and Discussion

Figure 2 shows the changes in absolute values of the phases **a**, **b**, **c** and **d.**

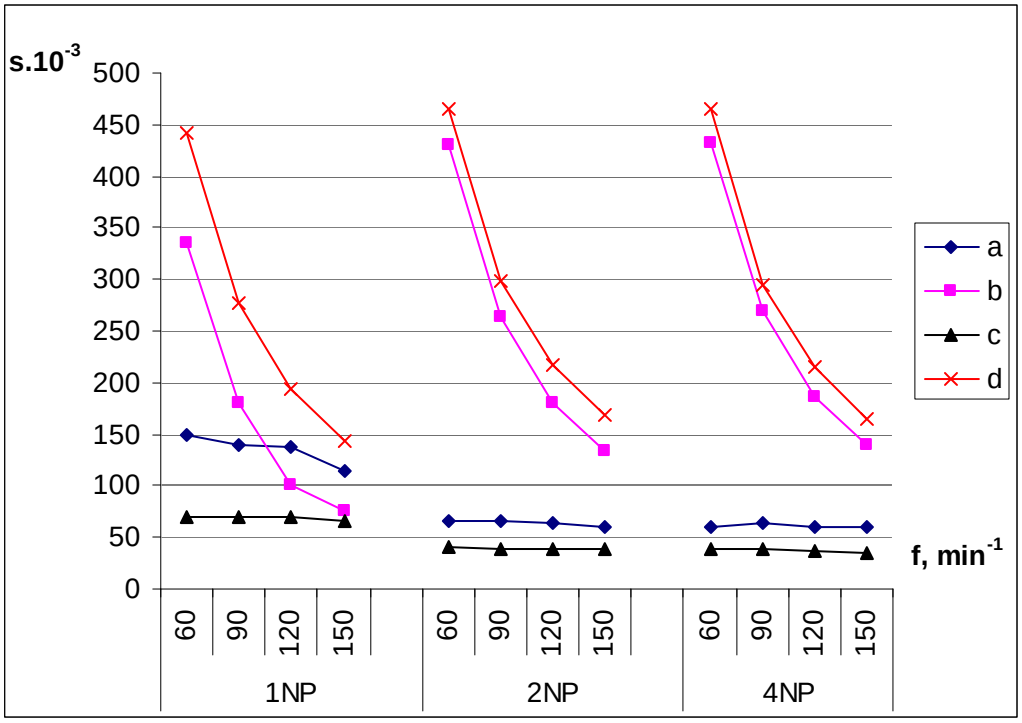

Fig. 2. Absolute values of the phases **a**, **b**, **c** and **d** of the pulsation system depending on frequency.

The graph clearly shows that the milking cluster types with two and four pulsators demonstrate the lower values of transition processes from conventional pulsation system but more interesting is the fact that transition processes remain constant throughout the investigated frequency range while at the conventional pulsation system influenced by frequency - that of greater strength corresponds to **a** phase.

In respect of the established conditions **b** and **d** are found strong dependence on frequency for the three studied systems which is determined by reducing the period of the pulses at increasing frequency.

In terms of relative changes of the phases **a**, **b**, **c** and **d** (figure 3) shows that the three studied systems transition processes within the period increases with frequency while the established conditions **b** and **d** regress.

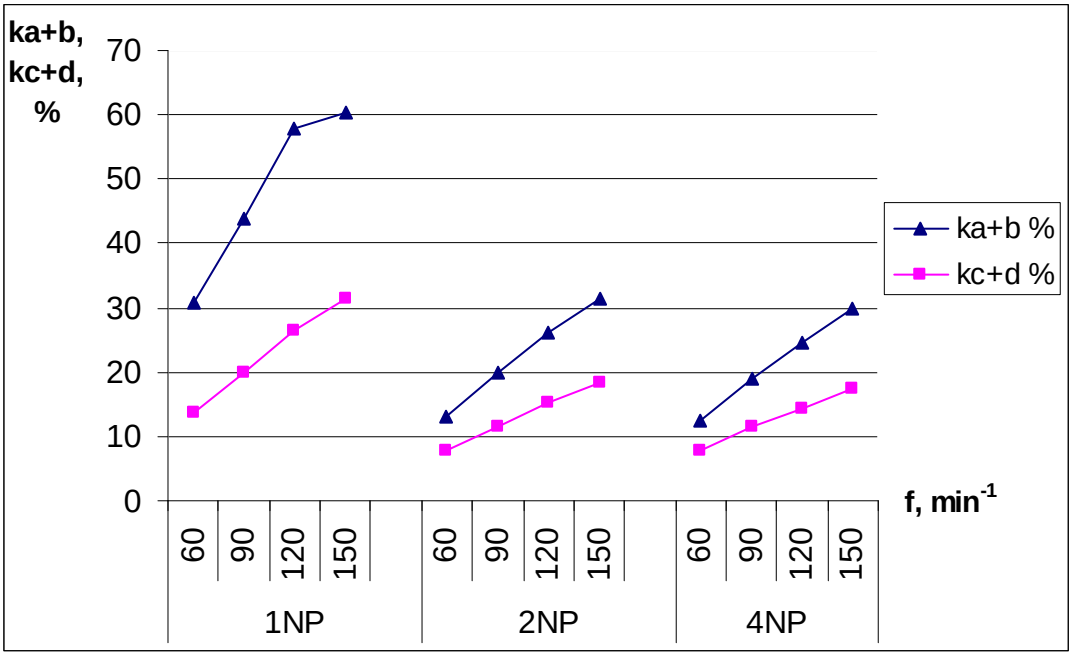

Fig. 3. Relative values of the phases **a**, **b**, **c** and **d** of the pulsation system depending on frequency.

This allows to formulate as a comparative criterion for evaluation of the three studied systems generalized indexes k_{a+b} and k_{c+d} respectively for technological cycles (a+b) and (c+d). Relevant generalized index k_{a+b} and k_{c+d} is calculated as:

$$k_{a+b} = \frac{a}{a+b}.100,\% \quad (1)$$

$$k_{c+d} = \frac{a}{c+d}.100,\% \quad (2)$$

The influence of the frequency on the generalized index k_{a+b} and k_{c+d} is shown in figure 4.

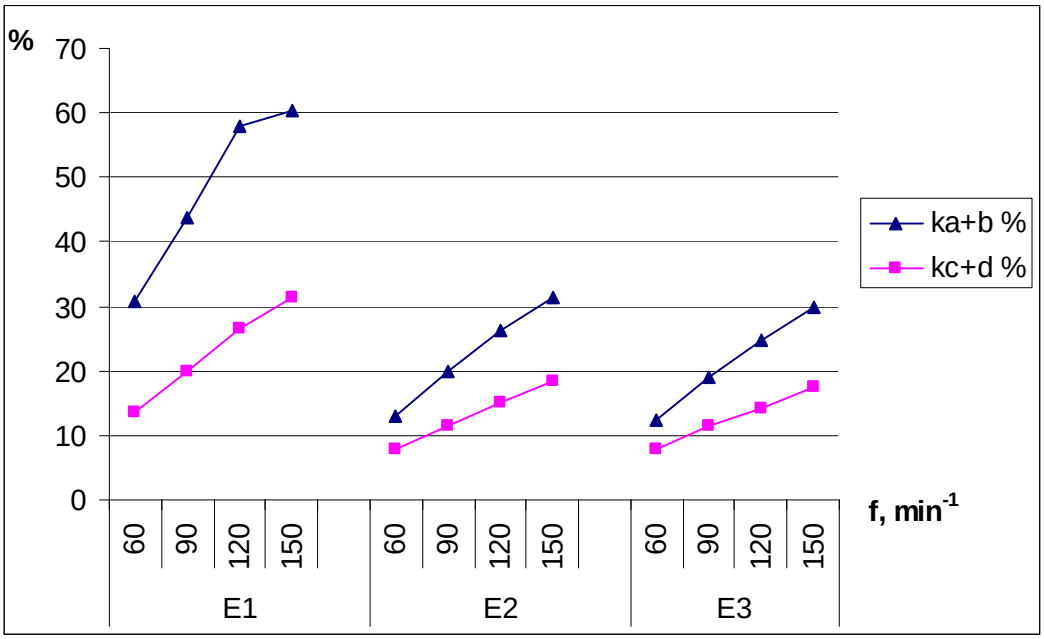

Fig. 4. Influence of frequency on the generalized index k_{a+b} and k_{c+d}.

In conventional pulsation system k_{a+b} is changed from 30.8% to 60.3% and k_{c+d} - from 13.7% to 31.5%. In the two types pulsation systems these generalized indexes are almost identical as are about two times lower values than those of conventional pulsation system, i.e. in increasing the capacity of pulsation tract system becomes without inertia and takes less time of the technological cycles (a+b) and (c+d).

Conclusions

1. By increasing the capacity of pulsation tract are achieved shorter transitional processes **a** and **c** and two times smaller generalized indexes k_{a+b} and k_{c+d} than conventional pulsation system for the whole studied frequency range from 1Hz to 2,5Hz .

2. Studied experimental milking clusters with two and four pulsators demonstrate the similar characteristics which refer to the idea that pulsators of conventional milking clusters have a two times smaller capacity than necessary.

Reference

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