

## THE CONCEPT OF A MECHANICAL DEVICE TO OBTAIN MILK FROM SOWS

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**Abstract.** The work presents a concept of (a device) milking machine for drawing sterile milk samples from lactating sows. It specifies guidelines for proper sampling and using a modernised teat cup, and parameters of the whole unit and its individual elements.

**Key words:** cluster, sow milking, modernised teatcup

### Introduction and work purpose

Swine breeders aim at acquiring best possible effects in piglet rearing. First of all, they care about reaching highest possible body weight gain in the shortest possible time. In Hodge's experiment [1974] [quotation from Burek, Grela 2001] body weight of piglets was growing by 576 g daily. This result was reached when applying milk-substitute preparations in feeding. Unfortunately, sow milk does not allow reaching so good effects. However, it provides sufficient amount of nutrients for proper offspring growth [Burek, Grela 2001]. In order to improve daily piglet body weight gain, there are studies carried out on changing sow milk chemical constitution through feeding them with mixtures enriched with various ingredients. This affects the milk constitution, and as a result ensures higher weight gain and growth of piglets. Milk samples need to be drawn in order to carry out studies on the chemical constitution of beestings and milk from sows. To get these samples, oxytocin is injected to ear vein, and then manual milking is carried out [Braude et al. 1947, Bowland et al. 1949]. Limited milk outflow time complicates this method, and as a result of this samples may be drawn only from some teats [Hartman, Pond 1960]. This was emphasised, e.g., by Hughes and Hart [1935]. Using mechanical milking apparatus seems to be the way to obtain sterile milk samples in a pigsty. Some materials concerning the device for sow milking and lactation and the volume of acquired milk are provided in publications from the past century, especially from 1960 and 1980. Currently, there are no analyses carried out on the technique and method used to obtain milk from these animals. The reason for this situation is the fact that mechanical milking of sows has not been spread out on a larger scale. This is so because an extensive mechanisation of this process is not necessary since milk from these animals is not used in food production, therefore there is no need to obtain large amounts of it. However, it is necessary to draw milk samples, for

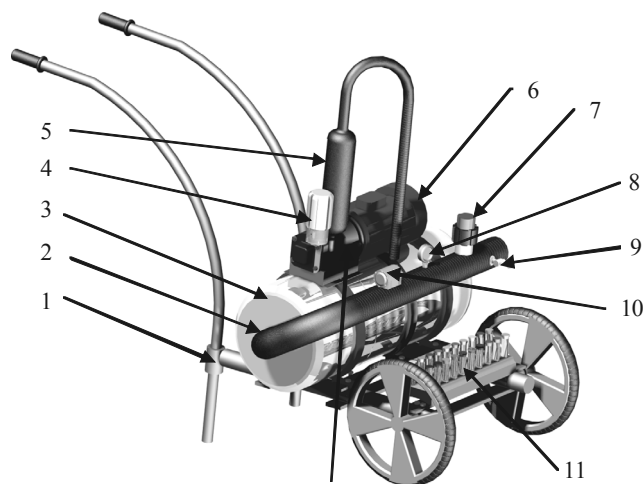
instance in order to determine its chemical constitution, nutritive value, or to examine using its ingredients in pharmacy.

The purpose of the work was to present the concept of a device (milking machine) allowing drawing sterile milk samples from lactating sows, and in particular: basic design instructions for the unit and specifying detailed guidelines how to draw milk samples from lactating sows.

## Materials and methods

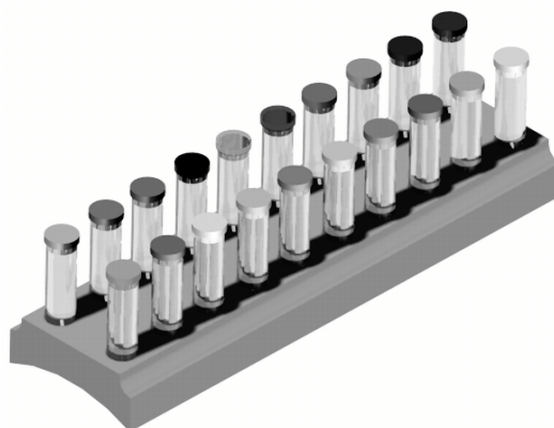
When designing a device for mechanical milking of sows, the main guideline was to draw 50 ml milk samples from a sow, from individual udder teats, or from right or left rail. Primary application for the milker will be in swine farms in delivery pens after sow farrowing (independently of the fact, which lactation a sow has at the moment), where it will be necessary to obtain milk samples for chemical analysis. Samples will be drawn using one teat cup, designed on the basis of conventional teat cup for sheep milking. Considering this, the demand for air volume in milker will be small. As a result, a mobile vacuum unit with lowest output was chosen to supply teatcups. This solution corresponds to milking machine manufactured by DeLaval, model MMU 1B. The unit is driven by a 0.75 kW single-phase motor at the voltage of 230V. Vacuum pump delivery is 165 l·min<sup>-1</sup> at 1340 rpm. The unit works with the VF 20 vacuum controller allowing negative pressure adjustment within 40 to 48 kPa and negative pressure stabilising at a constant level. Pulsation frequency is adjustable with pulsers possessing wide adjustment spectrum in this range and adjustable ratio of suction stroke to massage. Optimal pulsation conditions during milk drawing from sows are: 120 l·min<sup>-1</sup> and pulsation frequency 40 to 60 or 30 to 70. E.g. the HP 102 (DeLaval) and Unipuls 2 (SAC Christensen) have the option of variable pulsation frequency adjustment from hydro-pulsers. However, these pulsers do not allow smooth adjustment of suction stroke to massage ratio, thus their constant value is 60 to 40. One should replace slide in pulsers or make an attempt of milking at factory settings of pulsation ratio. E.g. the LP 20 may be used from among electronic pulsers. The milker is also equipped with lubricators, muffler and vacuum tank (Fig. 1), and due to small volume of milk drawn from sows there is no need to use conventional milk can. We should also emphasise that the unit is very quiet.

Teat cup for drawing milk from sows has been designed on the basis of teatcup from DeLaval taken from Almatic S10 milking apparatus for sheep milking. Existing elements of teat cup from the apparatus has been used, since sow teat size and shape are much the same as for sheep. Thus it has been assumed that the dimensions of milk liner and the whole teat cup are a proper base for modernisation to allow drawing milk from sows.



*Source: author's own study*

Fig. 1. Milking machine elements 1 – frame, 2 – pipeline, 3 – vacuum tank, 4 – lubricator, 5 – muffler, 6 – motor, 7– vacuum regulator, 8 – vacuum guage, 9 – stand tap, 10 – pulsator, 11 – holder for milk samples, 12 – vacuum pump



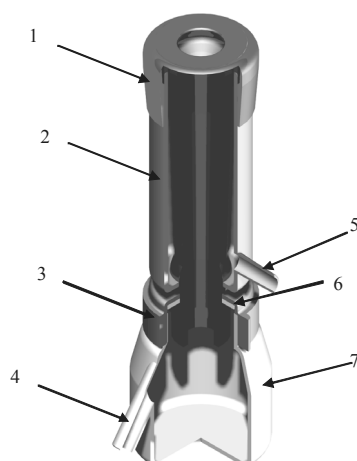
*Source: author's own study*

Fig. 2. Holder for milk samples

### **Introduced teat cup modifications**

The available literature overview shows that sows do not give large milk volumes during milking. Therefore, in case of using long milk tubes (of course with diameters as in sheep milking) it is possible that this small milk volume will partially remain in milk lines. As a result of this, it may become impossible to obtain a 50 ml sample of milk necessary to perform the test. Thus, some modifications have been introduced in teat cups involving

closing the hole in milk stub pipe and removing cut-off valve (steel ball) from a bottom part of teat rubber. This allowed installing a container for drawn milk (120 ml capacity) in bottom part of milk liner, with scale (little bottle for infant feeding) (Fig. 3).



*Source: author's own study*

Fig. 3. Modified teat cup (milking apparatus): 1 – milk liner, 2 – teat cup sleeve, 3 – nut, 4 – negative pressure stub pipe, 5 – pulsation stub pipe, 6 – gasket, 7 – milk container

Milk liner end has been inserted in the opening in bottle cap after dummy removal, and the whole element has been sealed with rubber gasket. A stub pipe has been provided in upper container section to supply vacuum to chamber under teat of the cup (Fig. 3). A pulsation chamber in the teatcup is connected to pulsator, and milk container – to the valve in the equipment vacuum system. Lengths of hoses between the cup and milker should range within 1.5 - 2 m, and have 8 mm in diameter.

### Milk sample drawing technique

Piglets should be weaned from sow in a delivery pen minimum 2 to 3 hours before milk drawing. Sow inside the pen is closed in a yoke restricting the area available for the animal. This solution allows breeders reducing piglet losses as a result of being crushed by mother, and in case of using a modernised teat cup it involves standing position of the sow, which is extremely important for correct cup fastening to teat and udder loading. Then, it is necessary to move the milker to the delivery pen, connect the machine to a single-phase electric socket, set negative pressure at 44 kPa (using vacuum control valve). Before one starts to draw material for tests, teats should be washed with warm soapy water, rinsed and dried with a towel. Their ends shall be disinfected using a swab soaked in 70% ethanol solution (farther off teats first, then those nearer). During milk drawing proceed in opposite order (those nearer first, then those farther off).

The first milk streams should be rejected. Then, oxytocin should be injected to ear vein two up to three minutes before milking. After that time proceed as follows: start up vacuum unit, to which the teat cup is connected, enter the pen and keep putting the cup onto successive teats until 50 ml of milk is drawn. Then, the milk should be poured into a labelled, sterile container (Fig. 2). It is essential that the material for tests be delivered immediately after drawing. If it is not possible, cool it to the temperature not higher than 4°C and store not longer than 24 h after milking, or freeze it. While removing the teatcup from teats, press the lip of milk liner head opening and gently slip off the cup. When milk samples drawing is finished, dismantle teat cup and wash both container and milk liner. For this purpose, apply detergents used in farms for milking equipment washing.

## Summary

The discussed device (milking machine) is a mobile unit, allowing mechanical drawing of milk from sows in a pigsty. There is no need to carry sows to a laboratory or other rooms with the device installed inside. The device is characterised by small size, quiet operation, possibility to control milking parameters, and high quality of the materials. Modernised teat cup allows safe and hygienic milk drawing. The problems that may occur during milking include: anatomical structure of sows, especially in vicinity of teats, and stress accompanying the animals. Some sows have too long udders, thus there may be a problem with correct cup position on a teat - that is leaning on ground. Not full udder loading may contribute to reduced milk outflow from udder. In these cases it is recommended to replace milk container in teat cup with a shorter one. The milking machine is equipped with container allowing to collect sterile 50 ml milk samples, which is important from practical and usable point of view.

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## KONCEPCJA MECHANICZNEGO URZĄDZENIA DO POZYSKIWANIA MLEKA OD LOCH

**Streszczenie.** Przedstawiono koncepcję (urządzenia) dojarki mechanicznej do pobierania sterylnych próbek mleka od loch będących w laktacji. Określono wytyczne na temat prawidłowego sposobu pobierania próbek i zastosowania zmodernizowanego kubka udojowego oraz parametry całego agregatu jak również poszczególnych jego elementów.

**Słowa kluczowe:** aparat udojowy, dój loch, zmodernizowany kubek udojowy

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