A METHOD TO DETECT FLAKES AND CLOTS IN MILK IN AUTOMATIC MILKING SYSTEMS

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The requirements of hygiene in milk production in the EU are defined by the Commission Directive 89/362/EEC (1989). But up to now, not all demands are met by automatic milking systems. The directive claims that "the milker must inspect the appearance of the milk." In reference to automatic milking systems WP 4 proposes that "milk from an animal is checked for abnormalities by the milker or a method achieving similar results". At a workshop in Denmark Foulum held on November, 27th 2002 under the leadership of the manager of workpackage 4, milk was defined as abnormal if clots appear. The workshop had consensus that there should not be a double standard for conventional and automatic milking. To make sure that abnormal milk is separated it is necessary to detect clots and flakes in the milk automatically. Now a sensor system has been developed as a functional prototype which can detect clots and flakes in milk.

The technology consists of a sensor as a hardware component and a software component. The basic procedure is that milk is passed over a sample carrier which is located in a measuring chamber. The fluid passes off the carrier while flakes and clots deposit on it. After a certain time the surface of the carrier is checked and depending on the results of the sensor the milk can be discarded or can be led to the collection unit.

The detection method is performed with an optical sensor composed of a digital camera with a resolution high enough to distinguish flakes of a size from 0,1mm and more. The camera is able to take one or more photos of the carrier surface. With the help of the adjacent image processing the abnormality of the milk can be identified.

Even with a satisfactory cleaning there can be other particles than flakes and clots in the milk which can be mistaken for flakes. A conglomerate of all particles can be found as well in the caught milk fraction on the carrier. Therefore it is necessary to distinguish between clots and other particles like straw particles, sawdust, grain of sand and nevertheless foam or white spots caused by reflection. Each particle has a geometrical skeletal structure and special colour of its own, so it can be classified by those parameters.

Studies were carried out screening several hundred milk samples of which 59 with 2114 detectable objectives were evaluated. Criteria for the algorithm of detection were 20 parameters of which the size, the intensity of the colour, the roundness of the shape, the compactness, the body structure of the objectives are the most important ones. Preliminary results are very promising as about 90% of all objectives were classified correctly. A detailed principle of the measurement will be demonstrated.