

Photocatalytic activity of TiO₂ reduces microbial contamination of the bovine udder and milking utensils

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Most microorganisms present on the surface of the bovine udder and milking utensils affect both udder health and milk quality. The main purpose of this study was to introduce a non-invasive and low-cost method to reduce microbial contamination on the surface of the bovine udder, in milking utensils, on the hands of milkers, and in milk itself.

We used 100 ppm platinum-doped anatase TiO₂ coated, 15,000 lux light emitting diode (LED) illumination lamps and a 30 W compact fluorescent light (CFL) bulb. Areas of 1 cm² were selected and marked using cardboard frames on the surface of the udder, hands of milkers and on milking utensils. These areas were exposed to LED illumination lamps for a period of one hour. During this time, microorganisms present would have been exposed to a cloud of activated TiO₂. Swabs were taken before and after exposure for microbiological analysis. Milk was exposed to TiO₂ by culturing on agar for three hours and then immersing the TiO₂-coated CFL bulb into the milk for four hours. All microbiological analyses were performed according to standard methods.

Microbial counts were significantly reduced on the surface of the udder by 30% from 3.52 ± 0.007 to 2.45 ± 0.113 log CFU/ cm²; on the hands of milkers by 41%, from 3.58 ± 0.035 to 2.11 ± 0.160 log CFU/ cm²; and on milking utensils by 21%, from 3.80 ± 0.034 to 3.01 ± 0.096 log CFU/ cm² after 1h of treatment. However, microbial counts in milk were only reduced by < 5% by the method followed. This could be due to interference of milk fat.

These results support the conclusion that it is possible to use the photocatalytic activity of TiO₂ to reduce the microbial count on the surface of the bovine udder, hands of milkers and on milking utensils. The efficiency of the method may be increased by using a higher concentration of TiO₂ and a higher-intensity CFL bulb.

Financial assistance given by the HETC Project is acknowledged.