

## **Operative management protocol for post-milking disinfection in cows and ewes using terpinen-4-ol as active principle**

The prevention of bovine mastitis is the most important component of a mastitis control program and both pre- and post-milking teat antiseptics are one of the most effective procedures for preventing new intra-mammary infections (IMI) in dairy cows.

These procedures involve dipping teats of dairy cows before and/or after milking with appropriate germicidal preparations to reduce teat skin colonization and contamination both from contagious and environmental pathogens (*Staphylococcus aureus*, *Streptococcus agalactiae*, *Mycoplasma bovis*, *Corynebacterium bovis*, *Streptococcus uberis*, *Escherichia coli* and *Klebsiella pneumoniae*). Teat dipping is a simple, effective, and economical means to reduce bacterial populations on teat skin.

Of course, the occurrence of new IMI is related to the degree of teats' exposure to mastitis causing pathogens and to the number of bacteria on teat skin - especially near the orifice - but requires the penetration of mastitis causing microorganisms through the teat canal.

Pre-milking teat sanitation has been introduced to achieve an acceptable level of decontamination of teat skin by potential intra-mammary environmental pathogens, such as *Streptococcus uberis*, *Escherichia coli* and *Klebsiella pneumoniae*, on teat ends prior to attachment of milking machines. This results in reducing the spread of microorganisms and the occurrence of new IMI and - important from the food safety point of view - in minimizing the number of bacteria that find their way into the raw milk supply.

In addition, post-milking teat dipping is the most effective milking hygienic practice for preventing new infections caused by the two prevalent contagious mastitis microorganisms, *S.aureus* and *S.agalactiae*.

The overall effectiveness of post-milking disinfection has been improved by the use of protective coatings on the animals. Barrier dips which leave a germicidal film on the teats are a class of formulations designed to effectively reduce infection caused by environmental bacteria as well as reducing the spread of infections caused by contagious bacteria.

A variety of germicides can be incorporated into teat dip products such as iodine, chlorhexidine, quaternary ammonium, sodium hypochlorite, dodecyl benzene sulfonic acid, chlorine and so on. These germicides destroy bacteria through chemical or biological action such as oxidation-reduction mechanisms, denaturation/precipitation of cytoplasmic proteins, inhibition of enzyme activity, and/or disruption of cell membranes.

Anyhow, in spite of all, mastitis remains one of the most serious diseases in veterinary productions causing the biggest economic losses to the dairy industry of developed countries. It impacts on animal production, animal health and welfare and the quality of the produced milk. Antibiotics play the major role in treating this infectious disease but their use exerts a strong pressure of selection, leading in the time to the development of resistant strains increasingly difficult to cure. Also human health concerns may be raised by milk consumption because of antibiotic residues in milk, transfer of antibiotic resistance from animal to human via zoonotic bacteria, and transfer of pathogens or products thereof through milk or milk products. As a consequence, the dramatic increase in antibiotic resistant pathogens requires the continuous need to find new agents to treat mastitis.

Present mastitis control strategy includes a combination of preventing measures (i.e. post-milking dipping and dry cow therapy) coupled with Good Veterinary Practice of Antimicrobials to promptly and appropriately prevent or treat new infections in a farm. Notwithstanding this, this control strategy is not always fully successful. Some evidences have indicated that the failure of mastitis control programs can be partly attributed to the teat disinfectants and/or antibiotics which do not afford sufficient protection against the numerous

pathogens that cause mastitis particularly towards *Staphylococcus aureus* and *Streptococcus agalactiae*.

In this context, during the use, when a first choice antibiotic is not effective, a second one (more toxic and expensive) must be taken over, further contributing to maintain the antibiotic selective pressure in the environment. It is recognized that the progressive emergence of insensitive bacteria and of acquired resistance in human clinical setting and the veterinary fields reflects the “tuning of these microorganisms to antibiotic polluted eco-systems”.