

Electric Current and Antibacterial Agent Application to Inactivate Antibiotic Resistant Enterobacteriaceae

Meral Birbir*, Eda Yazici, Pinar Caglayan, Yasar Birbir, Richard Alan Goebel
Marmara University
e-mail: mbirbir@marmara.edu.tr

Abstract — In the leather industry, soaking is the first tannery process which is applied to salted hides and skins. Multidrug-resistant Enterobacteriaceae on salted hides and skins are frequently found in soak liquors, in soaked cattle hides and sheep skins. These microorganisms may cause health problems in tannery workers. Moreover, presence of proteolytic, lipolytic and multidrug-resistant Enterobacteriaceae on hides and skins may adversely affect final leather quality and cause important economic losses in the leather industry which is an important sector in world economy. Therefore, we investigated the antibiotic resistance profiles of microorganisms such as *Serratia rubidaea*, *Serratia marcescens*, *Serratia plymuthica*, *Proteus mirabilis*, *Morganella morganii*, *Citrobacter koseri*, *Providencia rettgeri*, *Enterobacter cloacae* and *Citrobacter freundii* which were isolated from soaked hides and skins in our previous study. These microorganisms were member of the family Enterobacteriaceae. Antibiotic resistance profiles of these isolates to aztreonam, ceftriaxone, ampicillin, chloramphenicol, amikacin, ofloxacin and trimethoprim-sulfamethoxazole were examined by disc diffusion susceptibility method. While *Serratia marcescens*, *Serratia plymuthica*, *Proteus mirabilis* and *Serratia rubidaea* were protease and lipase positive isolates, *Morganella morganii*, *Citrobacter koseri*, *Providencia rettgeri*, *Enterobacter cloacae* and *Citrobacter freundii* were negative for these activities. *Citrobacter koseri*, *Serratia rubidaea*, *Serratia plymuthica*, *Citrobacter freundii*, *Enterobacter cloacae*, *Proteus mirabilis* and *Providencia rettgeri* were respectively found to be resistant to three, three, two, four, four, three and four antibiotics. We examined an inactivation effect of a combined application of 508 mA/cm² direct electric current, 454 mA/cm² alternating electric current and antibacterial agent on the mixed culture of *Serratia rubidaea*, *Serratia marcescens*, *Serratia plymuthica*, *Proteus mirabilis*, *Morganella morganii*, *Citrobacter koseri*, *Providencia rettgeri*, *Enterobacter cloacae* and *Citrobacter freundii* in Nutrient Broth containing 3% NaCl. Mixed culture of multidrug-resistant Enterobacteriaceae damaged by both electric current applications was killed completely by this treatment system within five hours storage with the antibacterial agents. The combined electric treatment applied together with antibacterial agent was found to be effective to kill these microorganisms on soaked hides and skins. Hence, we suggest using this treatment system for eradication of multidrug-resistant Enterobacteriaceae in leather industry.