WORLD RAW HIDE AND SKIN EXPORTS AND SOME MICROBIOLOGICAL PROBLEMS DURING EXPORTATION

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Nowadays the biggest countries that produce raw hides are China, India, Brazil and the USA; and major tanning companies are in Argentina, Brazil, China, India, Italy, South Korea, Mexico, Pakistan, Russia, Spain, Turkey and the USA. The top exporter of raw hides and skins is the USA. During exportation many microbes especially bacteria and archaea can damage the raw hides and skins. In this study, some information is given about some microbiological problems during exportation of raw hides and skins.

Keywords: Raw hides, Skins, Microorganisms, Bacteria

INTRODUCTION

The raw and processed leather industry (including tanneries and leather fashion industries) as well as leather product manufacturers are the majorly found in countries where meat consumption is high and growing. The biggest countries that produce raw hides are China, India, Brazil and the USA. Major tanning countries are – Argentina, Brazil, China, India, Italy, South Korea, Mexico, Pakistan, Russia, Spain, Turkey and the USA (https://blog.go4worldbusiness.com/2017/05/03/top-10-raw-processed-leather-suppliers-and-raw-leather-manufacturers).

The countries that produce raw hides and skins have to export them in case they cannot process all of the raw material. However, it is very natural that the organic structure of raw hide and skin is faced with many microbial problems during transportation. The best way to reduce microbiological damage of the hide and skin is to process them immediately after slaughtering of the animal, but unfortunately, it is not possible sometimes.

After slaughter of the animal in 5-6 hours period the autolitic destruction starts (Kanagaraj *et al*., 2004; Vankar and Dwivedi, 2009). This deterioration is probably due to the presence of proteolytic enzymes produced by microorganisms growing on the hide or skin. Conservation is made to eliminate the destruction of the skin or hide. Conservation is the process which contains chemicals, biosidal and physical operations. 40-50% salt is generally used for conservation during the export of raw hide and skin in the world. Salt has two functions at this step; it dehydrates the raw material and has the bacteriostatic effect (Kanagaraj *et al*., 2004; Vankar and Dwivedi, 2009). Some researchers reported that when they use 400 kg of salt, this amount dehydrates 270 kg of water (Kannan, 2010).

Even salt is used for conservation many microbes can grow on the skin and hides. These microorganisms are generally halophile or halotolerant microorganisms (Bayramoglu and Civi, 2012).

In this study, after giving brief information about the world export of the raw hides, some information about microorganisms and microbiological events that may develop during the export will be given.

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RAW HIDES AND SKINS EXPORT IN THE WORLD

The USA takes the first place in the export of raw hides. In 2000, approximately one third of the world's 4.6 billion dollars' worth of raw hide exports is made by this country. The USA is followed by Australia and France with a 7.4 percent share of world raw hide exports. The total amount of raw hide exports of these three countries is close to half of the world raw hide exports. The raw hides and skins export amount of the ten raw hides and skins exporters in 2000 was 73.5 percent of the world's raw hides and skins export amount (Ozcorekci and Ongut, 2005).

Other countries that export animal hides or skins are England, New Zealand and Russian Federation. Among these countries, the export of hides from England has been negatively influenced by mad cow disease (Bovine Spongiform Encephalopathy-BSE) in the late 1990s.

Microbiological diseases seen in animals may cause the formation and spread of very dangerous diseases and outbreaks by microorganism genus and species. For this reason, cutting of healthy animals and processing of their skin are extremely important. In some diseases, such as anthrax, the animal should not even be cut. It is very dangerous and forbidden.. It is inevitable to spread the deadly anthrax by slaughtering and floating such an animal. The issue of export of diseased animal hides or skins is very important and should be discussed carefully.

The hide or skin cut from the animal is not sterile even if it is undergoing a conservation process. The presence of microorganisms on the hide or skin is extremely normal and this is admissible for healthy animals as well. When the animal is alive, there is a microbiological load on its hide or skin called normal flora; however, these microorganisms begin to damage the hide or skin when the animal is dead and its immune system disappeared. In fact, microbial load is exported together with the raw hide or skin.

MICROORGANISMS AND MICROBIOLOGICAL EVENTS IN THE SALT CONSERVED LEATHERS

In the world raw hides or skins exports, mostly the hides preserved with salt are sold. Since there is no prohibition on the use of salt in the hide or skin, it can be considered as the safest substance in conservation. However, when it is actually investigated, it will be seen that there are different points of this issue. In that salt is ideal environment for some microorganisms.

The microbes which require the salt in order to grow are called as Halophile (the suffix phile means 'loving'). Halotolerant microorganisms tolerate high salt medium and have ability to live in the medium without salt. Haloversatile (euryhaline) means the microorganisms grow maximum in salty medium (Kushner, 1978; Kahraman, 2008).

Extremophiles kind of halophile prokaryotes could be present in Archaea, Bacteria or Eucarya domains (Kahraman, 2008; Horikoshi and Grant, 1998). They naturally live in salt lakes. The most common eucaryotic halophiles are *Dunaliella*, *Artemia salina* and *Ephydra*. *Salinibacter ruber* is the most extremly halophylic bacteria. The genus of *Halobacterium*, *Haloarcula* and *Haloferax* can live in the medium with high concentration of the salt (Kushner, 1978; Kahraman, 2008).

Halophilic bacteria could be present in both Bacteria and Archaea domains. It was reported that halophilic archaea are prokaryotic, but are not classified as bacteria (Shand and Perez, 1999). The identification of halophilic microorganisms can be performed by

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comparing the 16S rRNA sequences of pure cultures or mixed cultures with specific archaea and bacteria primers as well as physiological tests (Kahraman, 2008; Galinski, 1995).

The animal's hide has 60-65% moisture after cutting and the moisture content of the hide can be reduced to 35-40% by salting. Although this may limit bacterial development, it does not provide adequate protection. In some researches, it has been expressed that the sea and lake waters contain halophile bacteria and the conservation process of hide or skin cannot be carried out as desired by the use of the salts obtained from these waters (Birbir and Ilgaz, 1996, Birbir *et al*., 2002). Although it is possible to control mesophilic bacteria that are not tolerant to salt, it is stated that halophile bacteria are developed and they can grow on the hide by passing to it during the protection process (Degirmenci, 2006; Bailey and Birbir, 1993). In addition, it is known that the salt used has negative effects on the environment.

It has been reported that dried salts contain 10^5-10^6 CFU/g halophilic bacteria, these bacteria can live under storage conditions and that salt lakes contain 10^7-10^9 CFU/ml halophilic bacteria (Bilgi, 2007; Mitchel, 1987). In a study on the salt quality in Şereflikoçfisar salt lake, the maximum number of halophilic bacteria in salt water was 10^5 CFU/ml, and the number of halophilic bacteria in the salt crystals taken from the lake was 10^5-10^7 CFU/g (Birbir and Ilgaz, 1996; Bilgi 2007).

Bacterial attack in raw hide causes redness, decay odor, hair loss, staling and deterioration of collagen tissue. This situation can be seen as grain loss, pinhole (pit-like pits), loss of epidermis, blistering and peeling, hollow structure and holes in the manufactured leathers (Mitchel, 1987). Among the halophilic bacteria the most active in the deterioration of gelatin are middle halophils, halophils and proteolytic excess halophilic bacteria (Birbir and Ilgaz, 1996; Hendry *et al*., 1971).

The purpose of salt curing in skin or hide preservation is to prevent bacteria from damaging them and to protect them until the first process. In a study, however, it was found that most of the 94 excess halophilic bacteria isolated from the salts obtained from various sources had digested collagen and lipids. If the untreated salt taken from the salt mines or salt lakes is used to protect the hide or skin directly without any treatment, these microorganisms will reduce their quality by digesting the collagen. Therefore, in order to prevent hide or skin damage in the conservation, the salt should be checked for halophilic bacterial population and their proteolytic and lipolytic activities before being used directly (Birbir *et al*., 2002).

Bailey and Birbir indicated that in the skins protected by the salt containing blood, fertilizers and organic matter the number of excess halophile bacteria are increased (Degirmenci, 2006; Bailey and Birbir, 1993). If the salt used in the conservation is contaminated with proteolytic excess halophilic bacteria, leather grain may be damaged significantly due to the high temperature during storage (Bailey and Birbir, 1996). Proteolytic bacteria in salt can settle into the hair follicles and develop here, causing the formation of holes on the entire leather grain (Didato *et al*., 1999).

The event, which is seen as red spots on the flesh side of the skin, is called as red heat and it especially increases during the summer months. This is due to the development of halophilic bacteria. The bacteria isolated from these spots were generally *Micrococcus roseus*, *M. luteus*, *M. morhuae*. It is stated that the skins containing halophilic bacteria have a similar odor as the smelting fish (Birbir and Ilgaz, 1996; Madigan *et al.*, 1997).

In the researches, it was reported that excess halophilic bacteria can be developed and cause damage of the skins stored in high temperature and humid atmosphere; and

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that they will not be damaged if they are preserved with salts that do not contain these bacteria and they are stored at the refrigerator temperature (Bailey and Birbir, 1996).

Halobacteriacea members usually have resistance against specific antibiotics such as penicillin, ampicillin, cycloserine, kanamycin, neomycin, polymyxin and streptomycin (Rakesh *et al*., 2010; Boleno *et al*., 1984). Most of them are sensitive to novobiocin and bacitine. The transcriptional induction of the purple membrane (bob gene) and the gas vesicle synthesis (gvpA gene) are blocked by novobiosine in the *Halobacterium salinarum*, a major halophilic strain located on the skin surface (Yang and Das Sarma, 1990).

The most common problem observed in the export of raw hides is the reddish-purple color. The hides can be felt warm when handled. The main reason for this is the development of microorganisms on them. Halobacteria are red in color due to the C_{50} carotenoids which protect the cell from radiation, temperature and salt evaporation. White, opaque or pink pigmented halobacteria are also presented with colorless gas vesicles. Those appearing as purple are halobacteria with purple membranes of bacteriorhodopsin (Oren, 2002).

CONCLUSION

In the international raw hides or skins export, the hides are usually transported with salt which is generally used in the conservation process in order to protect them from microorganisms. In this review, it has been tried to explain that salt used in skin or hide conservation actually creates the ideal living environment for many microorganisms. This property of salt used for the control of microorganisms in the leather industry is often overlooked by conservationists. It should be kept in mind that raw hide is not sterile in the world leather trade, and although salt has some protective effects, it provides an ideal environment for some microorganisms and may pave the way for some unwanted microbiological events. Since it is very important that the salt used in the leather industry should not contain microorganisms, the salt used should never be used again, and the salt to be used for the first time should be free of microbial load. If an antimicrobial agent is used next to or apart from the salt, it is important to note that the main active substance of it should not be a banned compound in export.

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