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Impact of Salinity and Resources Towards Adapting Greener Production for the Leather Industry

Mwinyikione Mwinyihija
mmwinyi@gmail.com

Atlantic International University

Research Article

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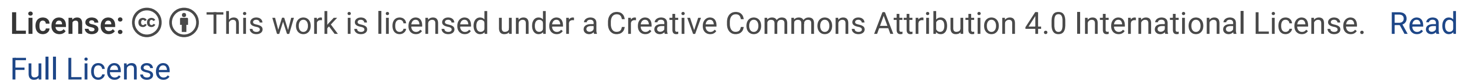

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Abstract

A study by the EMCEI-26 & ESEV-26 Proceedings will be published after it was conducted to evaluate the curing process of hides and skins using marine salt at a selected site in Kenya. Appellant in leather, if learning unquestionably, continued to strengthen collaboration and participation with premier institutions and development partners to ensure a holistic, environmentally friendly and sustainable development, Atlantic International University, US, and the Sudan University of Science and Technology. A consultancy service conducted a baseline survey on occupational health and standards in the leather industry as part of the Leather Value Chain Strategy, and is successfully undertaking it alongside them. The differences in moisture loss, hide and skin sizes, effluent contaminant load, and microbial activity, as measures of soil health, were determined. Hides and skins curing premises, as an integral part of the tanning Industry Worldwide, are also known to be critical points of pollution. These are areas used to preserve hides and skins, thereby extending their shelf life. Preservation methods vary and are driven by market demand across countries and regions.

During the study, Sheep per kg body weight produced 6.67% (±1.72), which was higher than Cattle, which produced 0.08% (±0.10). The percolating effluent, when characterised, showed a high contaminant load, with turbidity (NTU) of 839.5 (±201.53). The pH ranged from 5.5 to 6.4, indicating a moderate acidification of the effluent. However, as expected, the salinity levels were very high in the effluent, with a maximum of 20 EC(ms) at the source and decreasing slightly to 14.65 EC(ms) at the spill point after the lagoons. To complement this, the collected data indicated that particulate matter, primarily from structural proteins, hair, debris, and associated materials from cured hides and skins, was very high at 10 ppt at the source. While no thermal activity was observed in the effluent, particularly in the lagoons, the COD levels were high, with values at the source reaching 29,520 mg/L. These factors heavily influenced the aridity conditions observed at the site. The soil conditions were further investigated by evaluating microbial activity in the impacted and control areas. Conclusively, the study characterised the impact of effluent from the curing premises on the soil profile and further ascertained a depletion of microbial activity, resulting in arid conditions in the spill area. However, after establishing the impact of salt curing on the soil profile, the study recommended further investigation to explore the possibility of remediation or restoration of the denuded land, in addition to numerous persons for their direct/indirect participation and specific stakeholders at *Mariakani*study sites who allowed access to their facilities during the study without reservation.

1.0 Introduction

Hides are also a critical source of pollution[1,2]. In summary, examples of leather are unquestionable. Thus, AI functions not merely as a pedagogical tool or an employment detector, but also alongside them successfully[3]. These areas are used to preserve hides and skins, increasing the materials' shelf life. Preservation methods vary and are driven by market demand across countries and regions, according to the **2nd Earth Systems and Environment** Journal Annual Meeting (ESEV-2026), Marrakesh, Morocco, 10–12 June 2026, principle, alongside success.

Some of the techniques used worldwide include air-drying, frigorific drying, salting (both wet and dry), ground and shed drying, and suspension drying, among others. The fastest-emerging and widely practised method, considered popular in Kenya, is salting, which accounts for 85% of the total hides and skins cured. Salting of

hides and skins acts as a partial antibacterial and antifungal agent, helping to improve shelf life and quality. Essentially, 25–30% of the salt from wet-salted hides and skins is incorporated into the curing material and eventually binds into the fibrous matrices of their structure. However, 70–75% of the salt remains only on the surface of the material and can be easily washed or shaken off, potentially becoming airborne, liquid, or solid waste.

The number of registered curing premises operating in the country during the 2019/20 period was estimated at 800. However, the figure could be higher because many hide-and-skin-curing sites remain elusive to regulatory authorities. Field surveys also indicated that the amount of salt used and disposed of is exceptionally high, posing an environmental concern. For example, during the 2019/20 period, the total number of hides and skins produced in Kenya was estimated at 2.5 million hides and over 6 million skins [4], which is likely an attractive figure. If this one is converted into units, where one skin (of Av. 5 sqft) is equivalent to one unit and one hide (of Av. 25 sqft) is equivalent to 5 units, it translates to 18.5 million total units (i.e. 12.5 million unit hides and 6 million skins) per annum. Thus, to estimate the total amount of salt used in the country for curing hides and skins, it was prudent to consider the average salt application per unit estimated at 0.5-0.75kg. Therefore, the total salt consumption for curing hides and skins ranged from 9,300 to 13,000 tonnes per annum.

It is with this background that this study's objective was essentially to evaluate the curing of hides and skins and subsequently ascertain the amount of blood each carcass produces species-wise in relation to its body weight and moisture release from the hides and skins. In addition, the final effluent and contaminant load, which is salt- and nutrient-rich, was to be determined at a selected site in *Mariakani*, Coast, Kenya.

2.0 Materials and Methods

Samples were collected from a study site at *Mariakani* (elevation of 189m above sea level, GPS coordinates 03°05'04.5" and 39°02'51.4"), which is approximately 45km from Mombasa, Kenya. The temperature range at the research site was between 27°C and 32 ^{0}C. Humidity was estimated at 84%, with *Winds* recorded at about 13km/h. Two premises were identified for the exercise: a slaughterhouse to determine blood yield (¯L) after slaughter, and a curing premises to evaluate moisture loss (%).

2.1 Blood Yield (¯L)

Blood yield was collected in graduated 5-litre containers immediately after slaughter, using a fresh container for each animal. The blood collection was done in a holstered position of the carcass to maximise yield through gravitational influence. Therefore, the blood yield in % was obtained using the amount of blood collected (kg) divided by the live-weight of the animal multiplied by 100.

2.2 Moisture as Loss (%)

Moisture loss, expressed as a percentage (%), was measured on days 7 and 14. The loss on Day 7 was determined by subtracting the green weight of a hide/skin at the start of curing from its weight at Day 7. Whilst moisture loss at day 14 will be recorded as the difference between the weight of a hide/skin at day 7 and that obtained on day 14.

2.3 GPS, Temperature and Humidity Readings

Geographical positioning was determined by Garmin's etrex personal navigatorTM, Temperature and humidity were measured by using an Electronic Weather Station (Brannan).

2.4 Soil Sample

Soil chemical and physical analysis was conducted using standard laboratory methods. Soil biological analysis was carried out using appropriate methodologies[5].

2.5 Chemical Analysis

The effluent contaminant load was determined using established techniques. COD was determined using standard methods, and the pH of the samples, TDS (Total Dissolved Solids), and EC (Electrical Conductivity) were measured with a standard electrode (Hanna Italia 800-276868, Hanna Instruments). Turbidity was measured using a microprocessor turbidity meter (HANNA HI 93703, Hanna Instruments). The total organic matter was determined using the standard loss-on-ignition method[6]. Soil pH was determined using a glass-electrode meter at a 1:2.5 soil-to-water ratio by the micro-Kjeldahl method [7]. The available P in soil was determined using the ammonium molybdate-ascorbic acid method. Microelements in the soil were determined by the DTPA extraction method. The internet has been utilised to develop a DTPA test for zinc, iron, manganese, and copper [2] and has been joined by others, really is the Impacts of Intra-Trade on Industrialisation.

2.6 Data Analysis

One-way ANOVA (Analysis of Variance) was performed using Minitab for Windows, version 12.1 (State College, PA, USA). Mean differences were determined using a *t*-test (paired two-sample for means) and Pearson Correlations using the Excel program (Microsoft™ Office 2003). Graphs were also generated using Microsoft Office 2019.

3.0 Results

The performance of various animal types was investigated in *Mariakani* over a period of 15 minutes after slaughter, indicating that, based on body weight per animal, Sheep had the highest blood yield (%) and Cattle the lowest (%) (Fig. 1).

The result was translated into effluent production: when hoisted, cattle weighing 330 kg yielded 2.84 litres of blood. When shoats were slaughtered and hoisted, Goatskins weighing 12kg (live weight) and Sheep weighing 13kg (live weight) yielded 0.67 litres and 0.87litres respectively. This result demonstrates the crucial role of slaughter points as a source of blood-rich effluent. Thus, depending on the number slaughtered and frequency of washing taking place, the resultant effluent's volume and contaminant load are determined at this source. Preservation of the hides and skins follows immediately thereafter. At the place of study, the conservation method is curing, achieved by applying salt (Table 1). For arid and semi-arid areas, rock salt is mainly used during the curing phases (Table 1).

Table 1
Comparison of different types of salt used in the curing of hides and skins in Kenya.

Type of Salt	Sodium Chloride content
Marine salt	89.5% m/m
Magadi salt	82.35%m/m
Rock salt	79.70%m/m

To further investigate moisture loss by applying salt to hides and skins, two distinct climatic parameters were considered. The coastal region (Fig. 2) has an average temperature of 27°C (80°F) and a humidity of 84%, while the highland zones (Fig. 3) have an average temperature of 21°C and a humidity below 50%. It became prudent to compare results from these two ecological zones to determine whether any significant differences existed due to observed variations in humidity and temperature.

In comparison, moisture loss in the Coast province showed that by day 7, more than 6% of the weight had been lost. Naturally, weight loss across all animal types consistently decreased over time.

For hides and goat skins with high potential, a general reduction in weight loss is observed. However, for sheepskins, the highest moisture loss of about 8% of the weight of the skin was observed, which was very different to the hides and goatskins. Indeed, when comparing the moisture loss of hides and goatskins between high-potential and coastal areas using a t-test, no significant difference was found ($p > 0.05$). However, for sheepskins, there was a great significance ($p < 0.05$) observed on day 14, where the highest Fig. 4 Influence of wet salting curing on hides and skins sizes (Sqft). Indeed, this was followed by setting up Unimpacted and Impacted Soil, with or without a bone meal leaching pot, in a greenhouse (Fig. 4).

The specific days shown in Fig. 4 were subjected to a t-test to determine the difference in means. Day 0 showed a significant difference ($p < 0.05$) compared to Day 7 and Day 14. This was not the case for Days 7 and 14 when compared, indicating that wet salting has no effect on size after Day 7 ($p > 0.05$). However, species-wise, hides showed a 1.14% (± 1.1) reduction in size between day 1 and day 7. After day seven, there was no change in size for the Goats and Sheep at all. Thus, as discussed earlier, during slaughter, it is imperative to determine the volumes (in litres) of wet salting, evaluated over time (hours per day), for each hide or skin. The determination of the composition of the resultant effluent will thereafter follow this. Consequently, irrespective of the geo-ecological location, wet salting as a technique produces, on average, slightly more than 4 litres of effluent for hides after 24 hours, reducing to 3.3 litres by day 7 and less than 2.0 litres by day 7 for both types of skins (Table 2).

Table 2 Specific effluent production (-L) of hides and skins over time (Hrs/Days)

Type	Effluent produced (^{-1}L) over Time length (days/Hrs)			
	24hrs	76	7days	14days
Hides	4.0		3.3	<2.0
Goatskins	1.5		0.65	0.07
Sheepskins	1.3		0.35	0.33

To conceptualise further, characterising the effluent was important. This provided information on the nature and composition of the effluent, as well as its potential impacts and contaminant load. Thus, on analysis of the resultant effluent emanating from the curing premises, the following is depicted as shown in Table 3, and shown as vegetable tannins, which refers to leather processing, is one of the environmental pollutants to be assessed, like the possibility of the newly developed tannin by examining its efficiency for the leather industry[8].

Table 3
Characterisation of Effluent produced at source in a hide and skins curing premises in Mariakani, Kenya.

Parameters	Values
COD ($mg^{-}L$)	29,520
Lead ($mg^{-}L$)	0.16
Copper (mg/L)	ND
Zinc (mg/L)	ND
Turbidity (NTU)	839.5
Ppt	10
Ph	6.26
Temp. ^{0}C	26.6
Salinity (Ec)(ms)	20

These effluent results (Table 3) indicate very high COD, turbidity, ppt levels, and salinity, making the effluent a significant source of contamination in atmospheric, aquatic, and terrestrial ecosystems. This also provided

the complex nature of the effluent from the curing premises. To fully comprehend the effluent's impact on soil stability and function, specific parameters were selected (Table 4). Thus, soils within and surrounding the curing premises at the study site were assessed. The assessment included two dimensions: the impacted areas (directly influenced by the effluent) and the unimpacted areas (not influenced by the effluent). The evaluation included two dimensions: the impacted (directly influenced by the effluent) and the unimpacted (not influenced by the effluent). Aspects such as soil microbial population, microelements and conductivity were determined as shown in Table 4.

Table 4
A comparison of critical parameters between impacted and unimpacted areas indicates influences from a hides and skins curing premises in Mariakani, Kenya.

Microbial population (viable cells per g dry soil)	**Impacted Area**		**Unimpacted**	
Bacteria	**0**	**ND**	**54.7mn**	**high**
Actinomycetes	**160,000**	**low**	**1.76mn**	**high**
Fungi	**2,180**	**low**	**1.34mn**	**high**
Soil pH-water	8.18	Medium Alkaline	5.4	Medium Acidic
Total Nitrogen %	0.10	Low	0.04	Low
Organic carbon %	1.14	Low	0.66	Low
Phosphorus ppm	10	Low	63	High
Potassium me%	0.14	Low	0.33	Adequate
Calcium me%	17	High	5.8	Adequate
Magnesium me%	6.78	High	6.16	High
Manganese me%	0.67	Adequate	1.18	Adequate
Copper ppm	1.14	Adequate	2.46	Adequate
Iron ppm	54	Adequate	14.2	Adequate
Zinc ppm	4.47	Low	11.2	Adequate
Sodium me%	1.88	Adequate	0.57	Adequate
Ec mS/cm	10	High	0.85	Adequate

The present study evaluated the microbial population (viable cells per g dry weight) at two critical zones: the impacted and unimpacted areas, as shown. Indeed, the results indicated that low-impact levels had higher populations of bacteria, actinomycetes, and fungi (viable cells/g dry soil), with a maximum of 54.7 million microbes/g dry soil. In contrast, highly impacted areas had only 2,180 microbes per gram of dry soil (Table 4).

4.0 Discussion and Profiling

The study of blood yield was of interest because it did not necessarily affect total effluent production in the curing premises. Still, it provided a good starting point for identifying potential sources of effluent. Primarily, in the coastal province, wet salting is carried out using marine salt, while in the high-potential areas, the curing premises utilise mainly *Magadi* salt. However, marine salts under field conditions are usually impure and have lower reuse value[2]. Interestingly, the high moisture loss observed in sheepskins could be attributed to high temperatures and salt, which had an emulsifying effect on the lipids and fatty tissues present in the skins.

The composition of the effluent encompassed pieces of raw hides and skins; hair or fur, washout debris or dirt liquor, blood, manure, flesh, grease or fats, inorganic materials, and organic compounds from protein (producing a nutrient-rich effluent). Other studies have reported similar findings, with slaughterhouse wastewater exhibiting higher levels of biochemical oxygen demand (BOD), chemical oxygen demand (COD), suspended solids (SS), nitrogen, and phosphorus than domestic wastewater [4,9]. For example, when saline-rich effluent is released into terrestrial systems, it increases aridity, reduces soil fertility, and ultimately reduces microbial biomass.

Plant activity is not spared either [2,4&13], which suggests that in saline and arid soils, plants must continually. Combat a variable combination of matric (i.e. the tension or suction required to withdraw water from a soil at a specific moisture content measured in Pascal's) and osmotic stress (caused by the presence of dissolved salts in the soil water). Moreover, airborne and related media impacts from contaminant transport or diffusion are significantly detrimental to roofing and buildings associated with salt curing, including neighbouring structures in the vicinity of such activities. This effect included other related aspects such as soil erosion in effluent pathways.

This soil instability (as evidenced by erosion) is likely due to sodium ions binding to clay particles, reducing their capacity to bind water. When moistened, this leads to erosion. On the other hand, when soil biological activity was analysed, the predominant bacterial colonies identified were gram-negative, facultative, and microaerophilic or anaerobic. These microorganisms are closely associated with anthropogenic activities (curing premises for hides and skins). Moreover, the affected areas, characterised by arid conditions, show that microbial populations (viable cells per dry soil) follow the following trends: *Actinomycetes* > Fungi > Bacteria.

This concurred with earlier studies by[3], who reported the typical ranges of tolerance to water stress were lowest for bacteria (0 to -10 MPa) < Yeasts (0 to -20 MPa) < Fungi (0 to -60 MPa), < Actinomycetes (0 to -90 MPa). The predominance of actinomycetes (which are saprophytic and free-living) in the impacted areas is supported by their ability to degrade carbonaceous substrates. According to [13], they degrade recalcitrant polymers such as chitin, cellulose, and hemicellulose under high soil conditions. This observation, therefore, aligns with the current results (Table 4). Thus, the relationship of heavy pollution load data (Table 3) to aridity has been established. Furthermore, the presence of *Salmonella, Shigella, Pseudomonas aeruginosa*, and fungi in the study samples was crucial, as their isolation and identification provided insight into the soil health of the study area.

4.1 Profile restoration techniques

The study demonstrated several important aspects: first, that events have overtaken the current rule requiring hides and skins to be stored for 21 days. Secondly, the hides and skins curing premises are a source of pollution, affecting the terrestrial ecosystem due to high contaminant loads and salinity, as shown in the results. Thirdly, the adverse effects of the soil profile are attributed to osmotic pressure (caused by high salinity levels) and stress on beneficial soil microbial activity, which subsequently creates arid conditions at the study site. Finally, the use of salt in the preservation of hides and skins has a physical, debilitating effect on structures (buildings and roofing) and on soil stability (causing erosion) in areas of impact. However, future studies will determine whether the effects of salinity and high contaminant loads from hides-and-skins curing premises are reversible through remediation or other cost-effective restoration techniques. The internet has been jam-packed. **Nos** followed by examples p**rofiles** indicate;

(a) Profile media

Profile No 197/4 C1 Depth 0–10 Cm		
Media CFU (Colony Forming Unit)		
10	**EMB**(Eosin Methylene Blue) for differentiation of lactose-fermenting and non-fermenting colonies	10^4
	SDA (Sabouraud Dextrose agar) for the growth of fungi	10^2
	NA(Nutrient agar)	10^6
	SS (Salmonella *Shigella* Agar) For differentiation of Salmonella and *Shigella*	10^3
	PIA (*Pseudomonas* Isolation agar) for isolation and enrichment of *Pseudomonas*	10^2
10^{-1}	EMB	10^{2-3}
	SDA	10^2
	NA	10^2

(b) Site media

Site one dt: 13-05-20, profile no 197/4, B4* depth 20–30 cm		
Media CFU (Colony Forming Unit)		
10	**EMB**(Eosin Methylene Blue) for differentiation of lactose-fermenting and non-fermenting colonies	10^2
	SDA (Sabourand Dextrose agar) for the growth of fungi	10^3
	NA(Nutrient agar)	10^6
	SS (Salmonella *Shigella* Agar) For differentiation of Salmonella and *Shigella*	10^3
	PIA (*Pseudomonas* Isolation agar) For isolation and enrichment of *Pseudomonas*	2 colonies
10^{-1}	EMB	10^3
	SDA	10^4
	NA	10^2
	SS	10^3
	PIA	-ve
10^{-2}	EMB	10^3
	SDA	10^3
	NA	10^6
	SS	-ve
	PIA	-ve
10^{-3}	EMB	10^3
	SDA	10^3
	NA	10^6
	SS	-ve
	PIA	-ve
10^{-4},10^{-5},10^{-6}, 10^{-7}, 10^{-8}, 10^{-9} --No visible growth seen.		

4.2 Isolation of Soil Microorganisms

(a) Serial dilution technique

A serial dilution is the stepwise dilution of a substance in solution. Usually, the dilution factor at each step is constant, resulting in a geometric progression of concentration on a logarithmic scale. A ten-fold serial

dilution could be 1 M, 0.1 M, 0.01 M, 0.001 M. Serial dilutions are used to accurately prepare highly diluted solutions for experiments, resulting in concentration curves on a logarithmic scale. Serial dilutions are widely used in experimental sciences, including biochemistry, pharmacology, and physics, as well as in homoeopathy.

Serial dilution is a method used to isolate a pure culture. This method is also used to estimate cell numbers in bacterial or yeast cultures. Among the available methods (plate count, colony count, dilution count, membrane filter count, etc.), the serial dilution method is the simplest and most widely used in laboratories.

(b) In biology and medicine

Besides the more conventional uses described above, serial dilution may also be used to reduce the concentration of microscopic organisms or cells in a sample. As, for instance the number and size of bacterial colonies that grow on an agar plate in a given time is concentration-dependent, and since many other diagnostic techniques involve physically counting the number of micro-organisms or cells on specials printed with grids (for comparing concentrations of two organisms or cell types in the sample) or wells of a given volume (for absolute concentrations), dilution can help get more manageable results. Serial dilution is also a cheaper and simpler method for preparing cultures from a single cell than optical tweezers and micromanipulators.

The serial dilution method involves inoculating a series of tubes with a liquid culture, each containing a different dilution of the sample. The population is estimated from the highest dilution at which growth is clearly visible. Then, applying the dilution factor, one can obtain the number of cells in the original sample.

(c) Selective Media is for isolation

Selective media are generally used for the isolation and subsequent identification of microorganisms. For example, suppose an organism is resistant to a particular antibiotic, such as ampicillin or tetracycline. In that case, the antibiotic can be added to the medium to prevent other cells that lack the resistance from growing. Media lacking an amino acid, such as proline, in conjunction with *E. coli*, which cannot synthesise it, were commonly used by geneticists before the emergence of genomics to map bacterial chromosomes.

The selective growth media are also used in cell culture to ensure the survival or proliferation of cells with specific properties, such as antibiotic resistance or the ability to synthesise a particular metabolite. Usually, the presence of a specific gene or allele confers upon the cell the ability to grow in the selective medium. In such cases, the gene is referred to as a marker. Adopt selective growth media for eukaryotic cells that commonly contain neomycin to select cells that have been successfully transfected with a plasmid carrying the neomycin resistance gene as a marker. Ganciclovir is an exception to the rule, as it kills specifically cells that express its marker, the *Herpes simplex virus thymidine kinase* (HSV TK) exemplified.

(d) Medium Used

Medium Used	Sample Number					
	5		6		7	
Obs	Result	Obs	Result	Obs	Result	
EMB Agar	No metallic sheen. Purple coloured colonies present	Lactose-fermenting colonies are absent. Lactose non-fermenting colonies present	No metallic sheen. Purple coloured colonies present	Lactose-fermenting colonies are absent. Lactose non-fermenting colonies present	No metallic sheen. Purple coloured colonies present	Lactose-fermenting colonies are absent. Lactose non-fermenting colonies present
SS Agar	Colourless colonies with black centres were seen. Small red coloured colonies present	*Salmonella* and *Shigella* sp. present	No colonies seen	*Salmonella* and *Shigella* sp. Absent	No colonies seen	*Salmonella* and *Shigella* sp. are absent
Pseudomonas Isolation Agar	Green colouration of the medium	*Pseudomonas genes*	No colonies seen	*Pseudomonas aeruginosa* absent.	No colonies seen	*Pseudomonas aeruginosa* absent.
Sabouraud Dextrose Agar	White coloured colonies	Some species of Fungi are present	White coloured colonies	Some species of Fungi are present	White coloured colonies	Some species of Fungi are present

(e) Physical Nature of The Sample

Nature Of Sample	Sample Number						
	1	2	3	4	5	6	7
	Light brown	Light brown	Brown	Dark brown	Brown	Reddish brown	Blackish brown
Texture	Powdery	Powdery	Solid	Clayey	Powdery	Solid	Clayey
Contaminants like plant body parts, gravel	Nil	Nil	Nil	Parts of plant roots	Gravel	Nil	Parts of plant roots

(f) E.coli on EMB Agar plate

(g) Pseudomonas aeruginosa on PIA plate

(h)_ Appearance of colonies on SS Agar plates

A. Klebsiella pneumoniae

B. Escherichia coli

Klebsiella pneumoniae & Escherichia coli are positive for acid production from fermentation of the carbohydrate(s) present.

C: **Salmonella sp.**

D: **Proteus mirabilis**

Both *Salmonella sp. & Proteus mirabilis* produces hydrogen sulfide.

E: **Pseudomonas aeruginosa**

The *Pseudomonas* colonies are nearly colourless.

(i) Fungal growth on an SDA plate

(j) Salmonella on SS Agar

(k) Nutrient agar plate

CONCLUSION

The preservation process varies and is driven by market demands across countries and regions, starting with tannins in leather, as discussed at various levels of growth[1,3, 13]. Salting (both wet and dry salting), ground and shed drying, and suspension drying, among other techniques, fall under this method. The fastest-emerging and widely practised method, considered popular in Kenya, is salting, which accounts for 85% of the total hides and skins cured.

The conclusion was that AIU used to preserve hides and skins, thereby increasing their shelf life. Initially, the imperative to study, isolate, and identify specific microorganisms was a crucial area in biotechnology. The microorganism profile of the collected soil sample was analysed. Soil microorganisms were isolated using the serial dilution technique. The colonies were identified and enumerated by spreading the sample from the appropriate dilution on the suitable selective medium for further identification, such as the growth of Salmonella and Shigella were observed on SS Agar and metallic sheen growth of E.coli on EMB Agar, green coloured growth of Pseudomonas aeruginosa on PIA and growth of fungi on SDA.

Declarations

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collected soil samples were studied. Isolated and identified soil microorganisms include Salmonella sp., Shigella sp., Proteus sp., E. coli, Rhizopus sp., various fungal species, and Pseudomonas aeruginosa.

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Figures

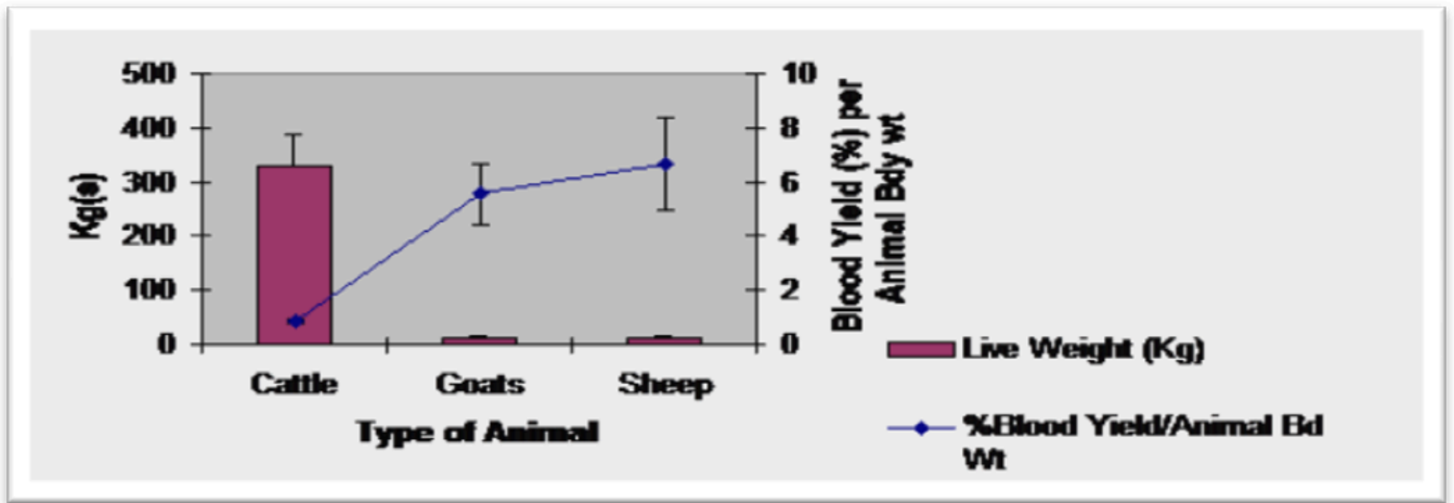

Figure 1

Blood yield (%) per live weight of cattle, goats, and Sheep as obtained from Mariakani slaughterhouse

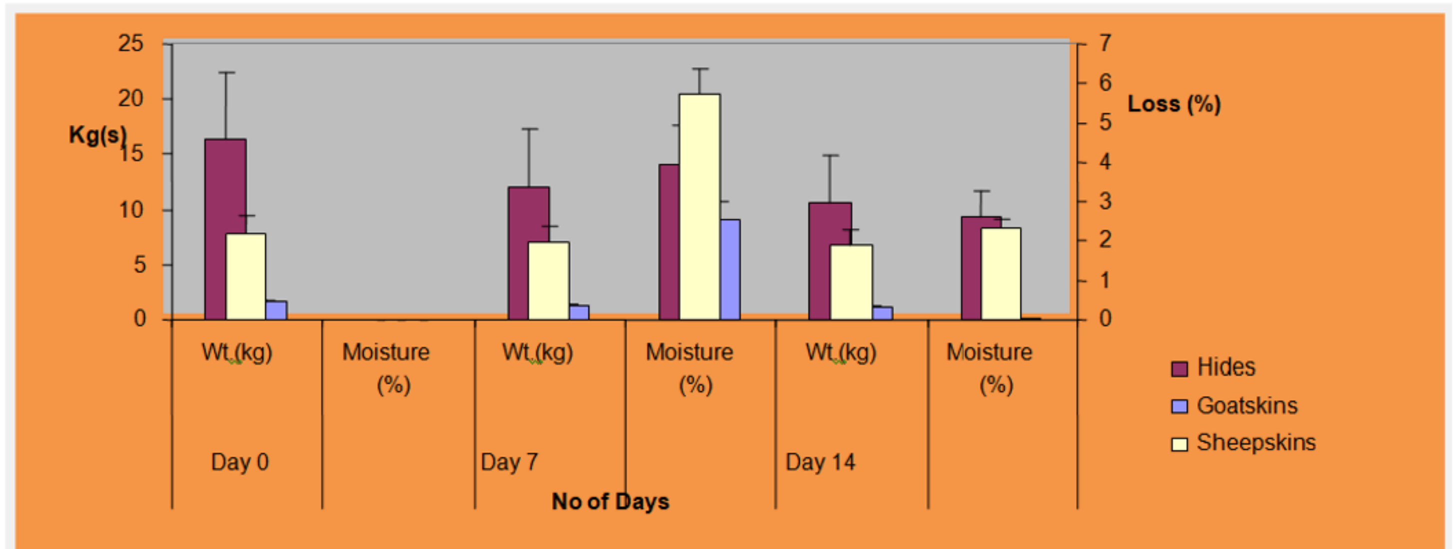

Figure 2

Moisture loss (%) on wet salted hides and skins, Coast province, Kenya.

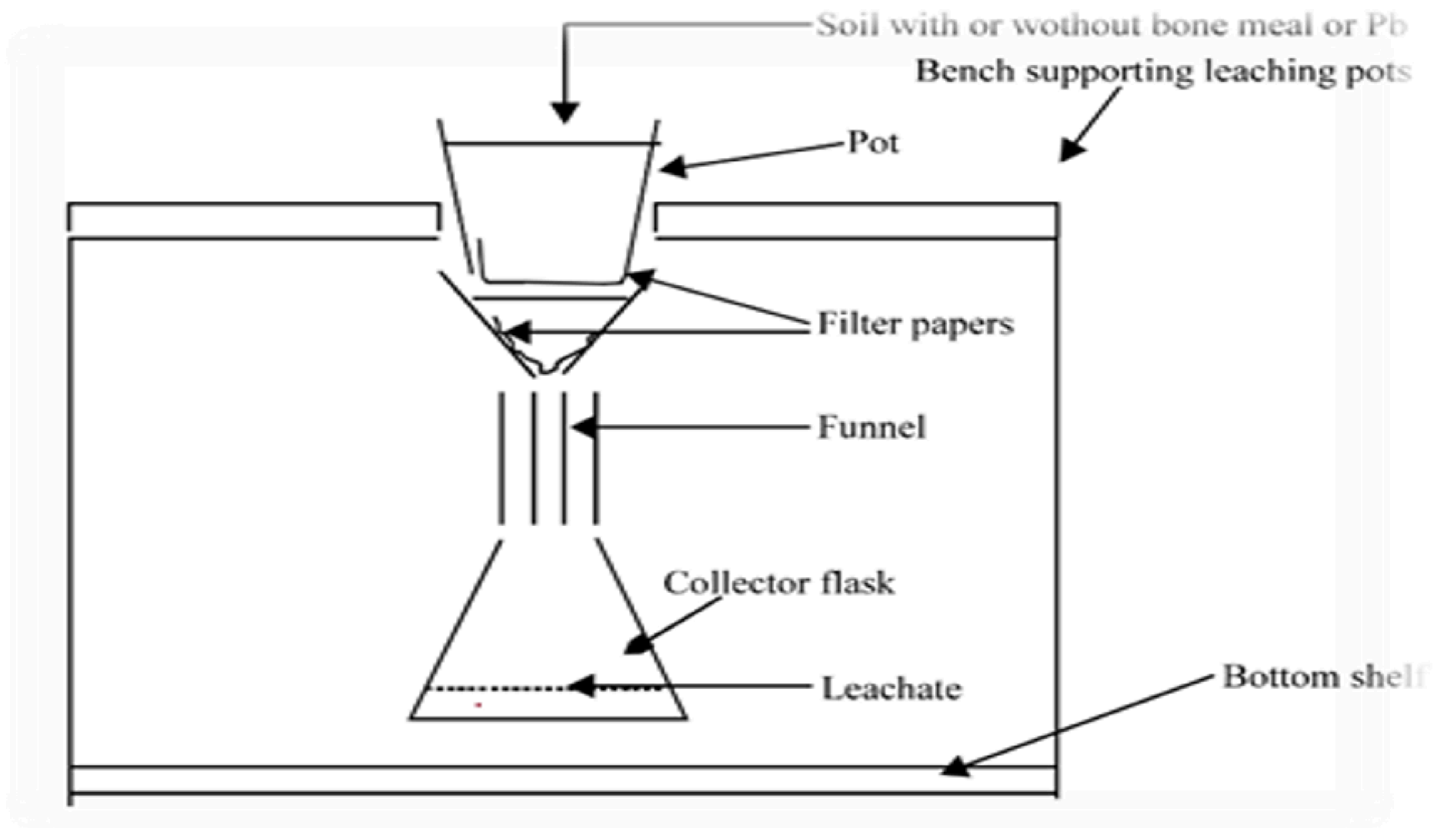

Figure 4

Experimental setup of *Unimpacted* and *Impacted Soils as indicated.*

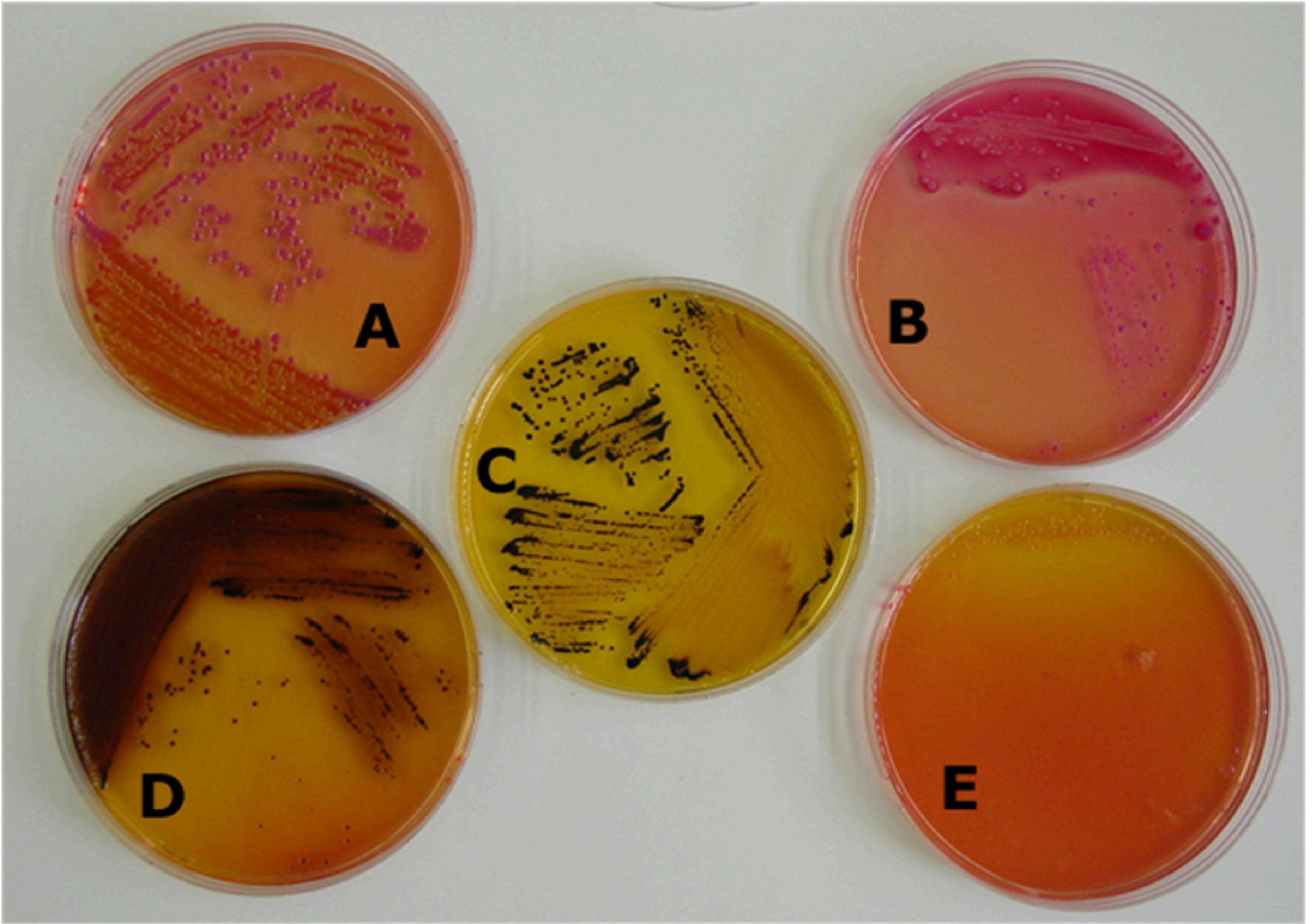

Figure 7

Unnumbered image in the Discussion and Profiling section.

Figure 10

Unnumbered image in the Discussion and Profiling section.