CONTACT ANGLE AND SURFACE FREE ENERGY OF FRESH AND STORED PIG'S SKIN

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Introduction

Influence of storage conditions of pig's skin tissue properties is important information from the point of view of clinical research, in which a pig's skin is used as a substitute for the human skin. Completing the material for experimentation more than once requires some amount of time to form an adequate research group. Thus, ways of skin sample storage and storage conditions, i.e. time, media (preservation liquids) and temperature are searched for [1,2]. The aim of the research was an evaluation of contact angle and free surface energy for pig's skin stored in different conditions.

Materials and Methods

Skin taken from the back of a 5-month old domestic pig was used in this investigation. Two variants of sample storing were applied before conducting the test: in the isotonic salt solution (0.9%) at the temperature of 4 [°C], and frozen at the temperature of -18 [°C]. The period of sample storing was 24 hours, 5 and 8 days.
The contact angle values were measured with the use of the sessile drop method with the See System computer-based instrument produced by Advex Instruments. Three liquids were used: distilled water (Poch S.A.), diiodomethane (Merck Sp. z o.o.) and anhydrous glycerol (Chempur). The volume of the drop was 0.5 [µl] and the temperature of the test was 22 [°C]. Measurements were carried out at least ten times for each surface. The values of contact angle were shown as the average values with a standard deviation. The obtained values of water and diiodomethane contact angle were used for the skin surface free energy (SFE) according to Owens-Wendt model calculation. The critical surface tension (γ_c) was determined by Zisman plot.

Results and Discussion

The shape of three liquid drops deposited on the surface of fresh and stored skin samples were shown in FIG. 1. The decrease of drops' height after storing in salt solution and freezing can be seen.

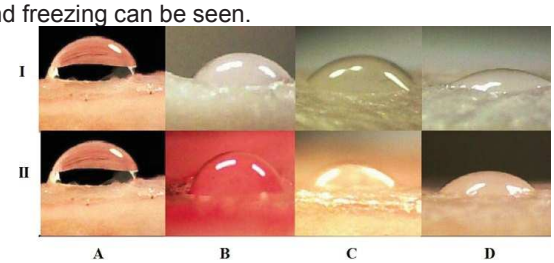

FIG. 1. The shape of drops deposited on skin samples incubated in salt solution (I) and frozen (II): A – fresh sample, B – after 24 hour storage, C – after 5 days storage, D – after 8 days storage

In FIG. 2, the values of contact angle for pig's skin were shown. The storing conditions resulted in decrease of the contact angle values. The change of contact angle values was similar for immersed and frozen samples after 24 hours and 5 days. But after 8 days of storing, significant decrease of the contact angle value can be seen for samples immersed in salt solution.

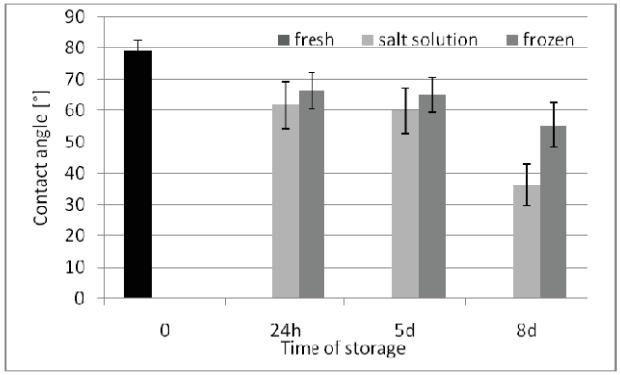

FIG. 2. Water contact angle for fresh and stored pig's skin.

TABLE 1. SFE (γ_s) and its polar (γ_s^p) and dispersive (γ_s^d) components for fresh and stored pig's skin.

	γ_s[mJ/m^2]	γ_s^p[mJ/m^2]	γ_s^d[mJ/m^2]
fresh	43.47	3.71	39.76
Salt – 24h	43.87	16.95	26.92
Salt – 5 days	50.27	13.66	36.61
Salt – 8days	60.72	34.08	26.64
Frozen – 24h	50.77	8.34	42.43
Frozen – 5 days	49.91	9.64	40.27
Frozen – 8 days	49.31	18.58	30.73

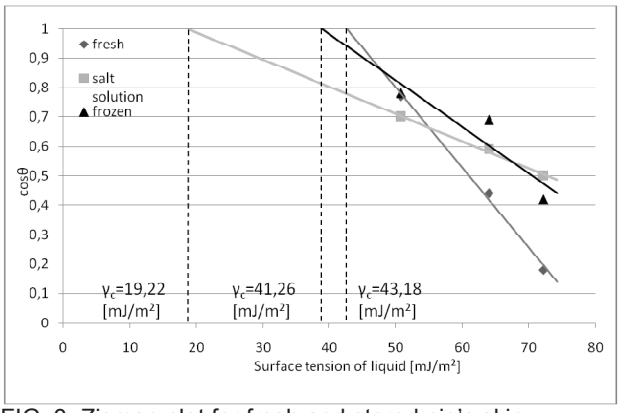

FIG. 3. Zisman plot for fresh and stored pig's skin.

SFE values increased under the influence of storage (TABLE 1). The changes of SFE resulted mainly from the increase of the polar component. The determinated value of the critical surface tension decreased after five days of storage, especially in the case of samples incubated in salt solution (FIG. 3). The obtained values of the water and diiodomethane contact angle and SFE for fresh pig's skin are in good agreement with these values obtained by Krawczyk [3].

Conclusions

Problem of soft tissue samples preservation is key factor in keeping the cellular component of the samples viable. The results showed that measurements of contact angle and SFE values can be one of the method to characterize usefulness of skin samples to mechanical tests.

References

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[3] Krawczyk J., Surface free energy of the human skin and its critical surface tension of wetting in the skin/surfactant aqueous solution/air system, Skin Research and Technology, 2015, 21: 214-223.