The influence of mechanical, chemical and biological ageing of liners on change their properties

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Summary

The work showes the results of physical and mechanical characteristics of liners and condition their of inner side. These liners from two producers of milk technique were used in the working conditions. Hardness of liners is changing during the operational time statistically significant (high correlative coefficient r = -0,751; r = -0,5643).

The microstructure on inner side surface of liners verified the changes in expored after 600 hours of service.

Key words: *Operating time, liners, hardness, surface film.*

Introduction

Many authors have been busy with observation of physical and mechanical properties in their labours (Prikryl, 1988; Karas, 1996). These authors mention, that changes in the physical and mechanical properties are very small comparing the starting values.

Rough, hard and craced liners traumatized the peak of teat (Malík *et al.*, 1989). By influence of mechanical strain is be coming on inside surface of liners to creating microcrack, whose by time of usage growing and enlarget to all directions.

Materials and methods

Depending on working time of tested liners we detected the followed indexes (in the regular intervals after 300 hours of operation):

1. Physical and mechanical characteristics of liners in laboratories of Researching center of processing and aplication of syntetics in Nitra.

1.1. Hardness [Sh A] by STN 62 1431.
1.2. Resistance by broaking [MPa] by STN 62 1436.
1.3. Tensibility [%] by STN 62 1436.

The results will be evaluated by methods of variety analysis, calculation of correlative relationships and regressive analysis.

2. Condition of inner side of liner tested on raster scan scope.

Results and discusion

The measured results of physical and mechanical properties of liners produced by differend producers after different function times are showed in table 1 and 2.

Following the achieved results the hardness of liners, expressed in Sh A, increased during the operating time till 300 hours, later decreased (besides sample number 1, new rubber, by which the hardness changed only minimally after 600 operating hours). The hardness increased achieved the significant differences between the variats of individual rubber samples.

Following the statistical evaluation, the hardness of sample number 1 decreased opposite the all other operating times statistically significantly after 600 hours.

Table 1. Physical-mechanical characteristics of liners (sample n. 1).

Operation time, hours	Thickness, mm		Resistance, MPa		Tensibility, %		Hardness, Sh A	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
New	2.00	0.11	10.9	1.32	448	22.8	54.9	0.71
300 h	2.18	0.12	9.8	1.21	428	59.3	54.5	0.41
600 h	1.74	0.11	12.1	1.75	416	41.0	53.9	1.56
900 h	2.14	0.14	9.3	0.62	432	17.9	45.9	1.18
1 200 h	2.18	0.12	10.4	1.34	480	28.3	49.7	2.36

Table 2. Physical-mechanical characteristics of liners (sample n. 2).

Operation time, hours	Thickness, mm		Resistance, MPa		Tensibility, %		Hardness, Sh A	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
New	2.18	0.06	12.3	1.67	456	8.9	47.7	1.63
300 h	1.98	0.12	15.0	1.15	408	11.0	54.8	1.01
600 h	2.49	0.08	11.7	0.26	448	11.0	44.9	1.82
900 h	2.12	0.09	13.7	0.56	420	24.7	43.1	1.57
1 200 h	2.49	0.08	12.3	0.87	476	21.9	45.1	0.86

Alike by the sample number 2 we registered the statistically significant by differences in hardness, where the highest hardness was found out after 300 hours and the differences were significant opposite, the other variants of sample number 2 (a new rubber, after 600 hours, after 900 hours and a rubber after 1 200 hours of function).

Our results show, that the hardness of researched samples the liners increased during the operating time untill 300 - 600 hours, then decreases, what is in certain contradiction with cited author (Prikryl, 1988). According to samples of liners and their operating time the average value of hardness was in the scale 43.1 - 54.9 Sh A.

By the calculation of correlative relationships between operating time and hardness we found out the significant and statistically certified correlative coeficient. Because of the high correlative coefficient by samples number 1 and 2 (r = -0.751; r = -0.5643) we realized the calculation of regressive analysis by the multi-nominal function of third class.

Following the regressive analysis the indipendent variable (operating time) influaces the dependent variable (hardness) by the expression of used regressive function on 83.55 % resp. 85.38 %.

Evaluation of microphotographs by method of sqare grid we discovered, that the cracks ratio by liners after 600 hours usage is 9.4 %, by liners after 900 hours usage is 13.4 % (accumulation 42.6 %). The results is that the cracks are growing on all directions with operational time.

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