COMPARATIVE STUDY OF RUBBER HOUSEHOLD GLOVES STANDARD

Kajian Perbandingan Standar Sarung Tangan Karet untuk Rumah Tangga

Yani Kartika Pertiwi, Teguh Martianto, Ageng Priatni

Center for Leather, Rubber, and Plastic
JL. Sokonandi No. 9 Yogyakarta 55166, Indonesia
e-mail: yanipertiwi@gmail.com

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Abstract

Rubber gloves are widely used for hand protection in medical, food industries, and household purposes. The Indonesian national standard (SNI) that regulates quality specifications of these products is SNI 06-1301-1989, while for international standard is ISO 20057:2017. This study aimed to assess whether or not the SNI 06-1301-1989 needs to be updated referred to ISO 20057:2017 using comparative analysis. Eight samples of rubber household gloves have tested using ISO 20057:2017 as guidance. The result treated using descriptive analysis method then SNI 06-1301-1989 and ISO 20057:2017 were being compared. The result showed that only 4 samples namely G1, G2, G3, and G8 fulfilled requirements. Based on the result, several update were recommended for SNI 06-1301-1989 following ISO 20057:2017. Specifications such as letter and number size code and whether the gloves are ambidextrous or hand specific should be on the package. A uniform finish, free from discoloration appearance also width, length and thickness dimension and pH test needs to follows ISO 20057:2017 since latex allergen is can be found. Physic test i.e. tensile strength and elongation at break at standard laboratory temperatures and humidity and tensile strength after ageing should be kept as well as liquid for immersion test while tear strength and permanent set at 200% was unnecessary.

Keywords: comparative study, ISO, SNI, rubber household gloves

Abstrak

Sarung tangan karet digunakan untuk melindungi tangan di bidang medis, industri kimia dan industri makanan serta untuk kegiatan rumah tangga. Standar Nasional Indonesia (SNI) yang mengatur spesifikasi mutu produk ini adalah SNI 06-1301–1989, sedangkan untuk standar internasional yaitu ISO 20057:2017. Penelitian ini bertujuan untuk mengetahui apakah SNI 06-1301–1989 perlu diperbarui dengan mengacu pada ISO 20057:2017 menggunakan analisa perbandingan. Delapan buah sampel sarung tangan karet untuk rumah tangga diuji dengan ISO 20057:2017 sebagai pedoman. Hasil uji dianalisis secara deskriptif, selanjutnya SNI 06-1301–1989 dibandingkan dengan ISO 20057:2017. Hasil uji menunjukkan bahwa hanya sampel G1,G2,G3 dan G8 yang memenuhi persyaratan ISO 20057:2017. Berdasarkan hasil penelitian, beberapa pembaruan disarankan untuk SNI 06-1301–1989 menyesuaikan dengan ISO 20057:2017. Spesifikasi seperti pencantuman kode ukuran dalam huruf dan angka serta apakah sarung tangan karet tersebut disamakan atau dibedakan untuk tangan kanan dan kiri harus ada di kemasan. Tampilan yang seragam dan tidak ada perubahan warna serta dimensi lebar, panjang dan ketebalan mengikuti ISO 20057:2017 sedangkan pengujian pH sangat penting dilakukan karena alergi terhadap lateks masih ditemui. Uji fisik seperti kuat tarik dan perpanjangan putus pada suhu dan kelembaban ruang serta setelah pengusangan sebaiknya tetap dipertahankan sebagaimana cairan yang digunakan untuk uji perendaman. Uji fisik lain yaitu ketahanan sobek, perpanjangan tetap 200% serta pengembangan (swelling) bisa dihilangkan.

Kata kunci: *kajian perbandingan, ISO, sarung tangan karet, SNI*

1. INTRODUCTION

Indonesia is the second largest rubber producer in the world. Thailand and Malaysia are Indonesian competitors for rubber agribusiness products. The market share of those three countries is more than 70 percent of total world natural rubber production (Permana & Izzaty, 2010).

Rubber can be used as a raw material for tire manufacturing, gloves, footwear, and other products. Around half of the natural rubber which is absorbed domestically used by the tire manufacturing industry, followed by rubber gloves, yarn rubber, footwear, retread tires, gloves medical and other tools (Harahap & Segoro, 2018).

The biggest problem faced by rubber industry players is the presence of nitrosamines and allergen proteins found in natural rubber

products. Allergen proteins are dangerous because they can cause allergies, especially for rubber tools which are often used on the human body and medical devices (Prihatin, Utama, & Andriyanti, 2014).

There is no pH value measurement in SNI 06-1301-1989 while ISO 20057:2017 states that pH value must between 5-9. Several researches have mentioned that allergies to rubber household gloves are rare to found since special inner cotton flocks on surface presumably reduce skin contact to latex allergens and rubber chemicals. In addition, household gloves are loose fitting which reduces skin contact, allows ventilation and water evaporation. It is used for a short time per day thus release a lower amount of thiurams and carbamates than surgical gloves. However, the prevalence of latex allergy has increased due to the increased regular use of natural rubber latex gloves (Risenga, 2010).

The era of free trade allows goods and or services into a country with or without trade barriers thus guarantees are needed to avoid harm for consumers. Certification or standard label is information on quality assurance of goods (Sukesi, Suminto, Resnia, Mahatama, Nur, & Wicaksena, 2013). One of the main objectives of the Indonesian National Standard (SNI) is to protect local markets from foreign products that are not in accordance with security and safety standard, hence it can potentially harm domestic consumers. The advantage of SNI also to improve the competitiveness of domestic products from imported products since it motivates the manufacturer to produce goods with quality that in accordance with standards (Kemendag, 2015).

Adjustment of SNI referring to ISO is a form of SNI development to protect domestic products in order to compete with products from outside (Emaputra, 2015). The main obstacle faced by producers in the application of SNI are limited human resources, difficulty to calibrate laboratory and production equipment, sub-standard product distortion in the market, the certification fees are relatively expensive, and consumer care for standards are still lacking (Herjanto, 2011).

Based on the description above, quality standards are very necessary both for export products to accelerate exports and imported products to protect consumers. Rejection of export products and increased imports due to lack of competing for quality standards indicate a gap between domestic and other country products. Therefore, it is very important to assess the suitability of the Indonesian National Standards (SNI) with international standards.

Rubber gloves for households use SNI 06-1301–1989 as a domestic standard, whereas for international standards is ISO 20057:2017. This ISO is a reference for the export quality of household rubber gloves. The analytical method used descriptive analysis, which is a comparative analysis to see the basic components needed by a product to meet certain standards. The needs of this standard will be compared between SNI and ISO. This study aimed to assess whether or not the SNI 06-1301-1989 needs to be updated referred to ISO 20057:2017 using comparative analysis. This method is expected to produce solutions to achieve optimal quality requirements for rubber household gloves standard.

2. LITERATURE REVIEW

2.1 Rubber household gloves

Latex products are the largest sub-sectors in the rubber products industry that contributed 79% of the total export value of finished rubber goods, Most of it comes from product exports such as gloves, condoms, catheters and thread rubber (Syarifa, 2011).

Based on SNI 06-1301–1989, rubber gloves are hand protective equipment made from latex with a certain shape and size, processed through the dip and used for general purposes, except for medical and chemical industries (Badan Standardisasi Nasional, 1989). Rubber household gloves are gloves made from rubber used to protect hands while doing household chores such as cleaning, dishwashing, and gardening.

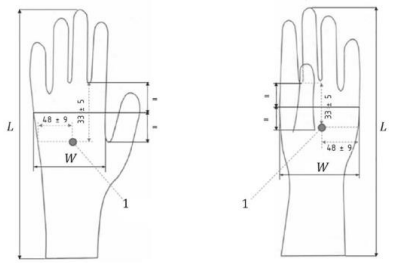
2.2 Standard of rubber household gloves

The rubber gloves industries can survive and develop well in terms of production and export capabilities. This is seen from the ability of Indonesian rubber glove products to penetrate the export market, where more than 90 percent are exported to various countries in America and Europe. However, so far 80 percent of Indonesia's primary natural rubber products are exported and only 20 percent is consumed domestically (Kemenperin, 2017).

Product standardization and quality aim to support economic activities, consumer protection, safety and health. In addition, standardization also plays a role in facilitating trade activities for domestic, regional and international levels. However, although the main purpose of the application of SNI is to protect the domestic market, it does not rule out the possibility that the application of SNI in the

country also a potential for export since several parameters listed in the SNI refer to international standards. Hence, the entrepreneur that have applied SNI will easily adjust to international standards that applied in destination countries (Kemendag, 2015).

ISO 20057:2017 as the international standard of requirements and test methods for rubber household gloves has set a specification appearance and relevant test methods. It covers for gloves made of natural rubber latex or synthetic rubber latex or blends of natural rubber and synthetic rubber lattices intended for household use. ISO 20057:2017 has normative references *i.e.* ISO 37, ISO 188, ISO 2859-1, ISO 3071, and ISO 23529 (International Standard Organization, 2017). Figure 1 shows measurement points for length, width and thickness based on ISO 20057:2017. There is a different specification for ambidextrous gloves and hand-specific gloves.



a. ambidextrous gloves b.Hand-specific gloves

Figure 1 Measurement points for length, width and thickness from ISO 20057:2017.

Key:

L length (mm);

W width (mm);

1 measurement point for thickness (palm)

Note: The distance (48 ± 9) mm is the approximate center of the palm for different gloves size.

The Indonesian National Standard (SNI) 06-1301-1989 for rubber gloves is covering gloves made from latex for general purpose except for medical and chemical industries. This document has the Indonesian Industrial Standard (SII) 1655-85 as normative reference (Badan Standardisasi Nasional, 1989). However, there is no specific standard for rubber household gloves. Hence, SNI 06-1301-1989 can be used as a standard of rubber household gloves. Based on SNI 06-1301-1989, there is no difference in measurement points for ambidextrous gloves or hand specific gloves. Figure 2 shows the shape and section size of rubber gloves based on SNI 06-1301-1989.

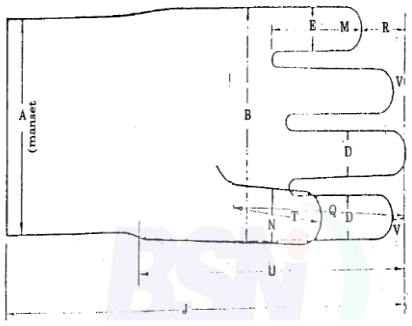


Figure 2 Shape and section size of rubber gloves from SNI 06-1301-198.

3. METHODS

Materials used in this research were eight samples of rubber gloves that have different brands, different size that purchased from abroad and local, deionized water, n-Lauryl benzene sulfonic acid sodium salt, hydrochloric acid. Apparatus that used were measurement tools for length, wide and thickness, pH meter, water bath, apparatus for tensile strength measurement. The procedure for test methods was fit with ISO 20057:2017 while the data analyzed using descriptive analysis and comparative analysis methods. The samples were tested at the laboratory of Center for Leather, Rubber and Plastic. This laboratory has been accredited by the Committee of the National Accreditation (KAN) since 2016. The data explored through detailed reviews of standard documents then SNI 06-1301-1989 as a domestic standard and ISO 20057:2017 as international standards are being compared.

4. RESULTS AND DISCUSSION

4.1 Test result of samples based on ISO 20057:2017

Eight samples of rubber household gloves were tested in the laboratory using ISO 20057:2017 as standard. The result was showed in *Table 1.* Based on the result, it can be seen that sample G1, G2, G3 and G8 fulfilled the standard requirements. Meanwhile, G4 sample test results meet the standard except for tensile strength after immersion in hydrochloric acid 2% volume fraction at 23 ± 2 °C for 4 ± 0.25 hours. As for the G5 sample, test results for all tensile strength parameters do not meet the standards except after immersion in water at 50 ± 2 °C for 4 ± 0.25 hours.Test results of G5 sample for elongation at break parameters after immersion in water at 50 ± 2 °C for 4 ± 0.25 hours and after immersion in hydrochloric acid 2% volume fraction at 23 ± 2 °C for 4 ± 0.25

hours also does not meet the standard. The value of the G6 sample test results for tensile strength without pretreatment (measured at standard laboratory temperature and humidity) and after immersion in water at a temperature of 50 ± 2 °C for 4 ± 0.25 hours does not meet the standards, also for all elongation at break parameters do not meet the standards except without pretreatment. The values of the G7 sample test results for width dimension parameters, tensile strength without pretreatment and elongation at break without pretreatment do not meet the standard.

Table 1 Dimension and Tensile Strength test result of eight samples.

Sample	Test Repetition	Test Parameter													
		Dimension (mm)			Tensile strength (MPa)					Elongation at break (%)					pH value
		Length	Width	Thickness	a	b	c	d	e	f	g	h	i	j	
G1	**1**	305	105	0.72	26.43	21.83	17.30	19.66	14.56	800	850	850	850	800	6.92
(Size: L/B)	**2**	304	105	0.73	27.78	20.07	18.12	24.20	15.94	800	850	850	850	800	6.98
	3	306	104	0.70	26.96	22.53	16.57	17.98	16.25	800	850	850	850	800	6.97
Final		**305**	**105**	**0.72**	**26.96**	**21.83**	**17.30**	**19.66**	**15.94**	**800**	**850**	**850**	**850**	**800**	**6.97**
G2	**1**	332	110	0.66	42	15.57	22.69	17.92	20	950	1000	1000	950	1000	7.01
(Size: L/B)	**2**	332	109	0.66	40.92	15.88	19.91	19.03	22.73	950	1000	1000	1000	1000	7.02
	3	332	109	0.68	43.10	14.83	19.90	17.59	19.51	950	1000	1000	950	1000	7.09
Final		**332**	**109**	**0.66**	**42**	**15.57**	**19.91**	**17.92**	**20**	**950**	**1000**	**1000**	**950**	**1000**	**7.02**
G3	**1**	352	105	0.76	45.34	21.16	23.28	18.80	18.48	800	800	800	750	800	7.12
(Size: 8.5/B)	**2**	355	105	0.74	44.58	20.33	24.12	18.88	19.57	800	800	800	800	800	7.11
	3	354	105	0.75	47.32	22.02	23.26	20.12	18.56	800	800	800	800	800	7.09
Final		**354**	**105**	**0.75**	**45.34**	**21.16**	**23.28**	**18.88**	**18.56**	**800**	**800**	**800**	**800**	**800**	**7.11**
G4	**1**	330	110	0.32	52.01	21.14	19.06	20	11.70	700	700	650	700	750	7.18
(Size: L/B)	**2**	330	110	0.32	62.33	22.82	21.45	19.45	10.62	700	750	700	700	700	7.25
	3	330	110	0.32	54.24	20.37	20.38	18.87	11.30	700	750	700	700	700	7.10
Final		**330**	**110**	**0.32**	**54.24**	**21.14**	**20.38**	**19.45**	**11.30**	**700**	**750**	**700**	**700**	**700**	**7.18**
G5	**1**	310	109	0.42	7.68	5.90	8.43	5.81	5.92	500	450	500	450	500	7.57
(Size: L/-)	**2**	307	110	0.40	7.88	6.08	8.52	7.08	6.31	500	450	500	500	500	7.51
	3	310	108	0.41	6.98	6.12	8.70	5.66	6.52	500	450	500	450	450	7.59
Final		**310**	**109**	**0.41**	**7.68**	**6.08**	**8.52**	**5.81**	**6.31**	**500**	**450**	**500**	**450**	**500**	**7.57**
G6	**1**	292	110	0.26	9.74	8.39	7.77	8.52	8.41	500	550	550	500	500	7.39
(Size: L/B)	**2**	302	110	0.26	10.25	8.66	7.88	10.27	9.07	500	550	550	550	500	7.36
	3	298	110	0.25	9.95	8.40	7.79	7.78	8.50	500	550	500	450	450	7.33
Final		**298**	**110**	**0.26**	**9.95**	**8.40**	**7.79**	**8.52**	**8.50**	**500**	**550**	**550**	**500**	**500**	**7.36**
G7	**1**	325	104	0.43	12.60	12.96	14.88	14.09	15.50	550	650	600	600	700	7.30
(Size: L/-)	**2**	325	104	0.45	12.80	14.02	11.85	12.59	16.02	550	600	600	600	700	7.39
	3	324	104	0.44	12.73	13.75	13.42	12.82	17.08	550	650	550	600	700	7.35
Final		**325**	**104**	**0.44**	**12.73**	**13.75**	**13.42**	**12.82**	**16.02**	**550**	**650**	**600**	**600**	**700**	**7.35**
G8	**1**	383	104	0.59	22.06	18.06	21.38	20.49	20.01	800	750	750	750	800	7.44
(Size: M/-)	**2**	384	104	0.57	21.74	17.86	20.60	20.10	22.27	750	750	750	750	850	7.35
	3	380	104	0.57	22.49	18.83	20.70	20.22	21.75	750	750	750	750	800	7.37
Final		**383**	**104**	**0.57**	**22.06**	**18.06**	**20.70**	**20.22**	**21.75**	**750**	**750**	**750**	**750**	**800**	**7.37**

Notes:

a. Tensile strength test of rubber glove samples at standard laboratory temperature and humidity
b. Tensile strength test of rubber glove samples after aging at 70 ± 2 °C for 168 ± 2 hours
c. Tensile strength after immersion in deionized water at 50 ± 2 °C for 4 ± 0.25 hours
d. Tensile strength after immersion in n-lauryl benzene sulfonic acid sodium salt 2 % mass fraction at 50 ± 2 °C for 4 ± 0.25 hours
e. Tensile strength after immersion in hydrochloric acid 2 % volume fraction at 23 ± 2 °C for 4 ± 0.25 hours
f. Elongation at break at standard laboratory temperatures and humidity
g. Elongation at break after aging at 70 ± 2 °C for 168 ± 2 hours
h. Elongation at break after immersion in deionized water at 50 ± 2 °C for 4 ± 0.25 hours
i. Elongation at break after immersion in n-lauryl benzene sulfonic acid sodium salt 2 % mass fraction at 50 ± 2 °C for 4 ± 0.25 hours
j. Elongation at break after immersion in hydrochloric acid volume fraction at 23 ± 2 °C for 4 ± 0.25 hours

4.2 Comparative analysis of SNI 06-1301-1989 and ISO 20057:2017.

Comparisons of both standards were classified as (1) comparison of dimension and tolerance and (2) comparison of the quality specification. Table 2 shows the comparison of dimension and tolerance (coded by letter and number) for rubber gloves based on SNI 06-1301-1989 and ISO 20057:2017.

Table 2 Dimension and tolerance comparison of SNI 06-1301-1989 and ISO 20057:2017.

Code (letter & number)	Width (mm)		Minimum length (mm)		Thickness (mm)	
	SNI 06-1301-1989[a)]	ISO 20057:2017	SNI 06-1301-1989	ISO 20057:2017	SNI 06-1301-1989	ISO 20057:2017
***Extra-small* (XS)**	-	< 80	-	260	-	Min. 0.20
***Small* (S)**	193 – 207	90 ± 10	254	260	0.75 ± 0.25	Min. 0.20
***Medium* (M)**	210.8 – 226.1	100 ± 10	254	260	0.75 ± 0.25	Min. 0.20
***Large* (L)**	236.2 - 254	110 ± 10	254	260	0.75 ± 0.25	Min. 0.20
***Extra-large* (XL)**	261.6 – 271.8	> 120	254	260	0.75 ± 0.25	Min. 0.20
6	-	86 ± 10	-	260	-	Min. 0.20
6,5	193	93 ± 10	254	260	0.75 ± 0.25	Min. 0.20
7	207	99 ± 10	254	260	0.75 ± 0.25	Min. 0.20
7,5	210,8	105 ± 10	254	260	0.75 ± 0.25	Min. 0.20
8	218.4	112 ± 10	254	260	0.75 ± 0.25	Min. 0.20
8,5	226.1	118 ± 10	254	260	0.75 ± 0.25	Min. 0.20
9	236.2	124 ± 10	254	260	0.75 ± 0.25	Min. 0.20
9,5	243.8	131 ± 10	254	260	0.75 ± 0.25	Min. 0.20
10	254	-	254	-	0.75 ± 0.25	-
10,5	261.6	-	254	-	0.75 ± 0.25	-
11	271.8	-	254	-	0.75 ± 0.25	-

Based on Table 2, it can be seen that ISO 20057:2017 has letter code XS as the smallest size while SNI 06-1301-1989 has S as the smallest size. However, both SNI 06-1301-1989 and ISO 20057:2017 provide the letter and number code. As for user convenience, it will be better if both letter and number code are mentioned on the package. In addition, it will be easier for the consumer if the package is labeled whether the gloves are ambidextrous or hand specific.

The width coverage of SNI 06-1301-1989 is from 193 mm to 271.8 mm. In accordance with letter code, the range of width coverage of ISO 20057:2017 are from less than 160 mm to 282 mm. In terms of width dimension, ISO 20057:2017 has more benefit since the range is larger than SNI 06-1301-1989. Manufacturers of rubber household gloves are more flexible to arrange their production costs due to this requirement.

As for minimum length, ISO 20057:2017 has 260 mm while SNI 06-1301-1989 is 254 mm. ISO 20057:2017 with minimum length of 260 mm is safer because it optimally covers the wrist. SNI 06-1301-1989 requires 0.5-1 mm for thickness while ISO 20057:2017 just states minimum thickness is 0.2 mm. Regulations of thickness from ISO 20057:2017 have no limitation for maximum thickness, hence it has benefited as a hand protector.

Table 3 Quality comparison of SNI 06-1301-1989 and ISO 20057:2017.

No.	Test Parameter	Quality Specification	
		SNI 06-1301-1989	ISO 20057:2017
1	**Organoleptic test**	The gloves appearance must be good, no patches, free from holes, blisters, foreign objects, and foreign defects	The gloves shall have a uniform finish and free from discoloration, thin spots, air bubbles, embedded particles, tackiness and other blemishes to affect serviceability (visual inspection).
2	**Physic test**		
2.1	Length (mm)	See Table 1	See Table 1
2.2	Width (mm)	See Table 1	See Table 1
2.3	Thickness (mm)	See Table 1	See Table 1
2.4	Tensile strength		
2.4.1	Tensile strength at standard laboratory temperatures and humidity (MPa)	> 17	• Class 1: > 15 • Class 2: 10 – 15
2.4.2	Tensile strength after ageing at 70 ± 2 °C for 168 ± 2 hours (MPa)	> 11	• Class 1: > 12 • Class 2: 8 – 12
2.4.3	Tensile strength after immersion in deionized water at 50 ± 2 °C for 4 ± 0.25 hours (MPa)	-	• Class A: > 12 • Class B: 8 – 12
2.4.4	Tensile strength after immersion in n-lauryl benzene sulfonic acid sodium salt 2 % mass fraction at 50 ± 2 °C for 4 ± 0.25 hours (MPa)	-	• Class A: > 12 • Class B: 8 – 12
2.4.5	Tensile strength after immersion in hydrochloric acid 2 % volume fraction at 23 ± 2 °C for 4 ± 0.25 hours (MPa)	-	• Class A: > 12 • Class B: 8 – 12
2.4.6	Tensile strength after immersion in NaOH 10 % at 23 ± 2 °C for 72 hours (MPa)	> 16	-
2.4.7	Tensile strength after immersion in HCl 10 % at 23 ± 2 °C for 72 hours (MPa)	> 16	-
2.5	**Elongation at break**		
2.5.1	Elongation at break at standard laboratory temperatures and humidity (%)	> 650	• Class 1: > 550 • Class 2: 450 – 550
2.5.2	Elongation at break after ageing at 70 ± 2 °C for 168 ± 2 hours (%)	> 500	• Class 1: > 450 • Class 2: 450 – 550
2.5.3	Elongation at break after immersion in deionized water at 50 ± 2 °C for 4 ± 0.25 hours (%)	-	• Class A: > 450 • Class B: 350 – 450
2.5.4	Elongation at break after immersion in n-lauryl benzene sulfonic acid sodium salt 2 % mass fraction at 50 ± 2 °C for 4 ± 0.25 hours (%)	-	• Class A: > 450 • Class B: 350 – 450
2.5.5	Elongation at break after immersion in hydrochloric acid 2% volume fraction at 23 ± 2 °C for 4 ± 0.25 hours (%)	-	• Class A: > 450 • Class B: 350 – 450
2.5.6	Elongation at break after immersion in NaOH 10 % at 23 ± 2 °C for 72 hours (%)	> 600	-
2.5.7	Elongation at break after immersion in HCl 10 % at 23 ± 2 °C for 72 hours (%)	> 600	-
2.6	Tear Strength (N/mm)	> 4	-
2.7	Permanent set at 200 % (N/mm^2)	> 2,5	-
2.8	Swelling		
2.8.1	Change in length after immersion in *Fuel* B (70 % iso-octane and 30 % toluene) at 23 ± 2 °C for 24 hours (%)	< 60	-
2.8.2	Change in width after immersion in *Fuel* B (70 % iso-octane and 30 % toluene) at 23 ± 2 °C for 24 hours (%)	< 60	-
3	**Chemical test**		
3.1	pH value	-	5 – 9

Table 3 describes comparison of quality specification based on SNI 06-1301-1989 and ISO 20057:2017. In ISO 20057:2017, rubber household glove was classified into class A or B or 1 or 2 based on the appearance before and after ageing tensile properties such as tensile strength and elongation at break and tensile properties after immersion in general household

liquids, including water, diluted surfactant and diluted acid solutions (Wirasate, Pinprayoon, Sunintaboon, & Nimsuwan, 2019).

However, those classifications are unclear although it is based on the appearance before and after ageing. Thermal aging occurs when rubber components are exposed to high temperatures for a long time, causing a decrease in the elastic properties of the vulcanize (Scully, 2013). Further explanation is needed for what kind of rubber household glove was classified into class A or B or 1 or 2.

4.3. Organoleptic test

Based on *Tabel 3.*, it showed that the organoleptic test of both standards is more or less the same. However, ISO 20057:2017 is more specified. The most noticeable difference is ISO 20057:2017 states that the gloves shall have a uniform finish and free from discoloration. It is necessary for rubber household gloves to be free from discoloration. It will be unsafe for user if the gloves color contaminates their hand or other household object.

4.4. Physic test

Measurement of tensile properties before and after ageing in SNI 06-1301-1989 take the average value of three times test as final result. Meanwhile in ISO 20057:2017, if one piece per glove is used, individual value is final result. If there are two test pieces then average value is reported as final result. If three test pieces per glove are used, median value is reported as final result. Hence, for ISO 20057:2017 one piece per glove is acceptable for measurement. It can be concluded that ISO 20057:2017 is applicable for limited number of sample.

Tensile strength at standard laboratory temperatures and humidity is minimum 17 N/mm^2 in SNI 06-1301-1989 while in ISO 20057:2017 is higher than 15 N/mm^2 for Class 1 and between 10 – 15 N/mm^2 for Class 2. Elongation at break for SNI 06-1301-1989 requires minimum 650%, while in ISO 20057:2017 states minimum value 550% for Class 1 and 450-550% for Class 2. As stated before, further explanation is needed for those classifications. Thus, following SNI 06-1301-1989 requirements for tensile strength and elongation at break value at standard laboratory temperatures and humidity is easier. It can be applied also for tensile strength and elongation at break value after immersion in the test liquid.

Tensile strength is the magnitude of the load required to stretch the test piece of the rubber vulcanized to break in kg per cm^2 of the cross-sectional area before stretching. Through this test, it can be determined the optimum vulcanization time and effects of depletion. Elongation at break is an increase in the length of the rubber vulcanized test piece when stretched until the break is expressed as a percent (%) of the length of the test piece before stretching (Suharman & Harun, 2017).

There are differences in the terms of liquid used to immersion test between SNI 06-1301-1989 and ISO 20057:2017. In SNI 06-1301-1989, NaOH10 % used for basic condition and HCl 10 % for the acid condition. Meanwhile in ISO 20057:2017 used deionized water, n-lauryl benzene sulfonic acid sodium salt, and hydrochloric acid 2%. Test liquids in SNI 06-1301-1989 are more concentrated than in ISO 20057:2017. Therefore it better to used as test liquid since in manufacture used the concentrated one.

The other physic test of SNI 06-1301-1989 i.e. tear strength and permanent set at 200% are less necessary since tensile strength and elongation at break have represented enough as physic parameter. The swelling parameter after immersion in the mixture of 70% iso-octane and 30% toluene as required in SNI 06-1301-1989 is also advised to be removed because in SNI 06-1301-1989 already prepares HCl 10 % and NaOH 10% as test liquid for immersion. One of the critical points of an elastomer is its ability to swell (swelling) in a liquid. When a polymer such as rubber comes into contact with a certain liquid it will result in a mass transfer and a change in volume (Scully, 2013).

4.5. Chemical Test

It can be seen from Table 3 that there is no pH value measurement in SNI 06-1301-1989 while ISO 20057:2017 states that pH value must between 5-9. Finished rubber goods made from raw latex have poor physical properties. In order natural latex can be used as material for rubber goods aside for increase physical properties, it must be vulcanized first (Marsongko, 2013). The additives for the manufacturing process and rubber stabilization may initiate an allergic sensitization and allergic contact dermatitis (Shah & Chowdhury , 2011). Rubber products such as rubber household gloves from natural latex contain a small number of proteins which can induce allergic symptoms. Latex allergy is still present in subjects who got sensitized before the implementation of countermeasures (Rueff, 2014). Hence, it is very essential to do pH test and put pH value as one of quality specification in rubber household gloves standard.

5. CONCLUSIONS

The test result of eight rubber household gloves samples based on ISO 20057:2017 that only 4 samples namely G1, G2, G3, and G8 fulfilled requirements. Based on the comparative analysis above and looked back at the eight samples test result, SNI 06-1301-1989 needs to be updated with ISO 20057:2017 as the benchmark specially pH test is very important to do since latex allergy still occurred. Several addition specifications such as letter and number code are labelled on the package and note if the gloves are ambidextrous or hand specific. The width, length and thickness dimension needs to be revised follows ISO 20057:2017. As for organoleptic test, the gloves shall have a uniform finish and free from discoloration like ISO 20057:2017 requirements. Physic test i.e. tensile strength and elongation at break at standard laboratory temperatures and humidity and tensile strength after ageing should be stuck as well as liquid for immersion test. The other physic test such as tear strength and permanent set at 200%, and swelling parameter are less necessary.

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