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Effects of Different Splicing Methods on Conveyor Belt Strength

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ABSTRACT

Belt conveyors are at the forefront of the systems that minimize the need for people in the transportation of materials. With the continuous development of today's technology, it develops in the improvements in belt conveyor systems. Owing to the innovations and improvements in the conveyor belts, it becomes possible to minimize the maintenance, repair, and undesired stoppages of the facilities. In this study, specimens were extracted from a conveyor belt with a width of 800 mm, with a tensile strength of 45 N/mm^2, 4 layers of polyester-polyamide blend cord fabric, 6 mm rubber bottom coating thickness, and 3 mm rubber top coating thickness were used. The specimens were taken in three different ways (from the unspliced belt, from the mechanically spliced belt, and the vulcanized belt). The specimens were subjected to the tensile test. The strength values of the belt specimens, from high to low, are in the form of unan spliced belts vulcanized belts, and mechanically spliced belts. It is found that there is a 28.2% decrease in tensile strength compared to the unspliced belt in the vulcanized belt, and a 49.8% decrease in the tensile strength compared to the unspliced belt in the mechanical spliced belt.

1. INTRODUCTION

With the development of technology, the factories and facilities being established have become more modern. The development of technology has led to an increase in production capacities in parallel with this situation. The use of raw materials and materials has increased in almost all production facilities, especially in iron and steel plants, and the need for them to be transported more easily, quickly, and reliably has arisen. Because of this need, transportation and transportation technology have also improved.

Today, one of the parameters affecting the operating costs in industrial facilities is material transportation. Belt conveyors are the first transport equipment that comes to mind in facilities such as iron and steel plants where raw material transport is of great importance. Belt conveyors are transmission mechanisms that are used to transport materials of various sizes and sizes to desired distances, and they are one of the most preferred transportation techniques for the continuous transportation of materials. High carrying capacities and the ability to transport to desired distances have made it inevitable to prefer belt conveyors. Moreover, features such as simple belt conveyor designs, light construction, and safe operation were also important factors in this choice. With belt conveyors, wet or dry materials are transported in general, as well as coarse-grained materials in whole or in pieces. In short, belt conveyor systems are the cheapest, most effective, and most efficient systems for transporting bulk materials today [1, 2]. These high-efficiency belt conveyors have become important equipment applied in industries such as power generation, iron, and steel production, manufacturing, metallurgy, mining [3].

Belt conveyors are frequently used especially in integrated iron and steel production facilities. In the industry, belt conveyors are mostly preferred for the transportation of bulk goods, but they are frequently used especially in integrated iron and steel production facilities. Along with the studies on conveyor belts in the world, innovative solutions are produced regarding the resistance of belts against burning, pressure, and tensile. In addition to all these, it is important to determine the splicing methods, which will ensure the belt serves for the maximum time. Repair of conveyor belts with hot vulcanization and mechanical splicing methods continues to be researched and developed today as in the past. Splicing points on belt conveyors are considered the weakest part of the conveyor belt and approximately 93.75% of belt failures occur at these points [1-5].

Hardygora et al. tried to explain the decrease in strength at the splice of conveyor belts with various test methods. They stated that systematic testing of conveyor belts and their splices is needed to achieve the high standards of safety and operational reliability required by belt conveyors. The strength of the conveyor belt splices determines the strength of the entire belt loop on a conveyor. They stated that the strength loss in a properly made splice can vary between 30% and 45% depending on the number of layers. The strongest splices are made between belts with the same strength characteristics and without damaging the ply fabric. Factors causing strength reduction at the belt splice are shown as construction defects in the splices, surface roughness between the layers, cutting of the layers, and improper vulcanization method. As the layer surface roughness damages the structure of the layers, it causes a decrease in strength. It has been found that this defect usually occurs during the cleaning phase between the belt layers. It has been stated that incorrectly applied vulcanization failure is usually caused by insufficient or inappropriate vulcanization pressure and temperature [6].

Chuen-Shii et al. investigated the optimum conditions for vulcanizing a conveyor belt with better adhesion strength and less wear. They tried to achieve optimum conditions for the on-site curing of the conveyor belt and specified these conditions as a curing time of 25 minutes, a curing pressure of9 kg/cm^2, a stripping temperature of 30 °C, and an air cooling method. They then sought to determine the optimum conditions for on-site curing of a conveyor belt with less wear and specified these as a curing time of 15 minutes, a curing pressure of 9 kg/cm^2, a stripping temperature of 60 °C, and a water-cooling method. Accordingly, it takes a longer time to vulcanize the belt with better adhesion strength than vulcanizing the belt with less wear with a constant curing pressure. The percent contribution of each controllable factor within the current research range was also determined by the Taguchi method's analysis of variance ANOVA. Interestingly, among the four controllable factors, the curing time was found to be the most influential factor on both the bond strength of the bonded area (38.61%) and the wear of the patched and spliced areas (61.22%) [7].

Şahbaz discussed the cold vulcanized splicing method in his study. In the first stage of the study, the effects of factors such as time, temperature, and pressure in the application of cold vulcanized adhesives used in the market were determined and experimental working parameters were established. In the second stage of the study, experimental studies on the production of a new cold curing adhesive were carried out on a laboratory scale. During production, the effects of solvents, fillers, resins, metal oxides, and accelerators were investigated. As a result of the thesis study, A new product has been obtained that exhibits better adhesion than industrial products used in the market and shortens the application time [8].

Çankır applied the method of combining steel cord conveyor belts with the vulcanization method and examined the results. In this study, he investigated the methods and techniques that should be applied to add at least the breaking strength values of the belt and compiled the results obtained by applying them [9].

In his study, Soyubel explained the concept of elastomer and rubber by talking about the history of rubber, classified, and introduced important rubbers. He gave information about the components that make up the elastomer mixture and their effect on the properties of the elastomer. He gave information about the vulcanization temperature and time, which are the vulcanizing parameters of elastomers, and it was shown that curing at 140 ºC in 20 minutes is ideal [10].

Öztürk gave information about rubber and vulcanization in his study. He compared EPDM (Ethylene Propylene Diene Monomer) and NR (Natural Rubber) natural rubbers. In experiments, it was found that different accelerators not only shorten the curing time but also affect many physical properties. It has been concluded that changing the amount of accelerator affects the physical properties as well as the speed [11].

Vahapoğlu, on the other hand, mentioned in his study that the vulcanization temperature of rubber and rubber is generally applied between 140 °C and 180 °C, and quite good results are obtained in this temperature range [12].

2. EXPERIMENTAL STUDIES

2.1. Preparation of Specimens

In the hot vulcanized splicing method, TS EN ISO 283 Textile conveyor belts total belt tensile test standard is used. In the mechanical splicing method, the TS EN ISO 1120 standard for determining the strength of the mechanical connections of the conveyor belts is used. The belt was first cut in the form of a bow tie using the type B template selected according to the TS EN ISO 14890 standard, as it came from the manufacturer, without applying any splicing method. The conveyor belt combined with vulcanization was also cut to the same standard. Belt specimens are cut according to ISO 37 using the bow tie apparatus, which is shown in Figure 1 [13].

Figure 1. Image of bow tie specimen apparatus according to ISO 37 Standard [13]

The test specimens were kept at room temperature for 24 hours before being tested and were tested after this waiting period [14, 15].

2.1.1. Preparation of Hot Vulcanization Specimens

Before starting the belt splicing p, all the impurities and oils on the belt are cleaned. For the belt splicing process to be healthy and not be affected by adverse weather conditions (rain, wind, dust, etc.), the belt splicing process was carried out in a closed workshop environment. As a splicing technique, splicing by cutting perpendicular to the axis of the belt is not preferred, since there is a risk of opening the splice as a result of bending during the passage of the belt through the drums [16]. The two ends of the splice are connected at an angle to each other in the form of a right or left cross by the cross-cutting technique. In the studies, as shown in Figure 2, cross-cutting was applied by giving an angle of 0.3 x Belt width. This value corresponds to approximately 16.7º.

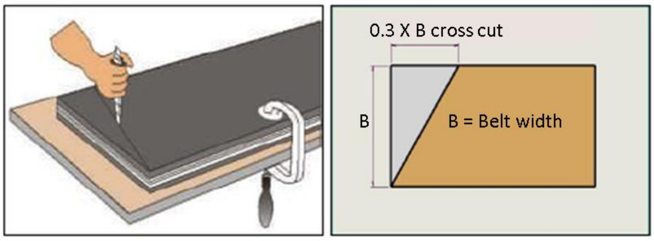

Figure 2. Belt angle cutting technique

Since the belt used in specimen preparation is a 600mm wide 4-layer belt, the number of layers was applied as 3 (Figure 3.a). In the site application, the belt splice determination is made according to the rotation (working) direction of the belt (Figure 3.b), the most important point to be considered is the prevention of damage that may occur due to the scraper. Since this study is experimental, the determination of the splice site is not important.

While L_v is the recommended total length of the splice, the required length for the curing length is shown in Figure 3.b.

$$L = L_v + L_a \tag{1}$$

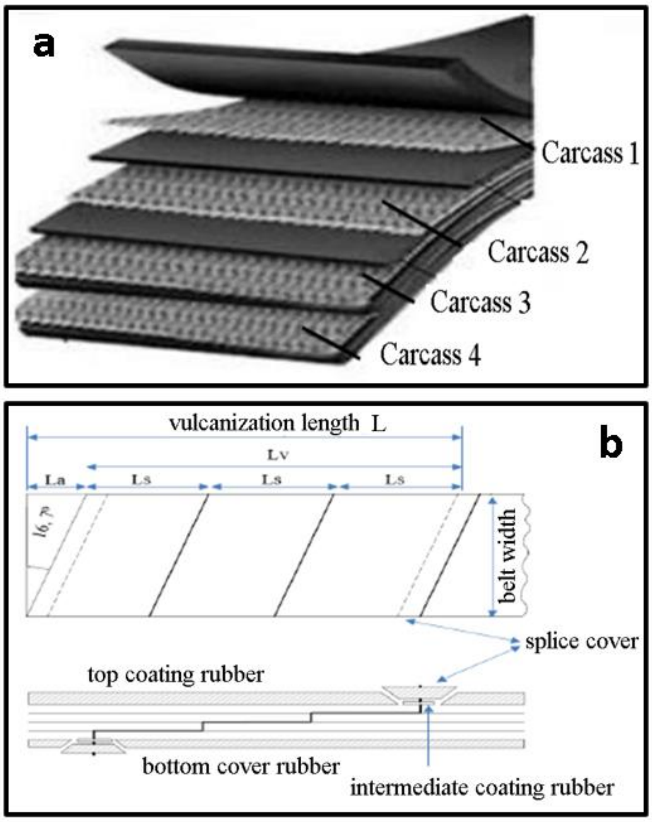

Figure 3. Schematic representation of four-layer carcass belt (a) and belt splice (b) [8, 17]

According to the fabric strength and the number of layers, the layer length value (Ls) and the additional length value (L_v) were chosen as 200mm and 600mm, respectively [8]. The distance La=0.3xB from the intersection of the reference line (LR) to the edge of the belt along the belt edge line was measured and marked. A line is drawn from the marked length La between the point where the reference point cuts the opposite edge. This line is called the coating cut line (LCO). The straight edge was used to draw this line and the square shape was adjusted and marked with a colored marker. This process was done at the end of the other belt in the same way. After the marking process, cross cuts were made (Figure 4) After the cross-cutting of the belt ends were completed, the upper splice rubber cover was peeled off with the belt scraper knife. Care should be taken that the blade does not injure the textile tissue while cutting the rubber cover of the upper splice. The end of the splice is vertical, the head (splice cheek) is cut with a 45° inclination. The cutting process was done up to the first court fabric. After the upper splice rubber cover was cut, the upper coating rubber of the belt was stripped. After the layers were opened and stripped on the belt, cleaning was carried out with a cleaning solvent to remove unwanted elements such as oil and pollution and to make an efficient addition.

All surfaces to be spliced were scraped. The scraping process was applied, including the rubber edges on all four sides of the joints and the beveled cut edges of the rubber cover. Textile tissue should not be damaged during scraping. In addition, during the scraping process, the angle grinder should not be pressed excessively on the belt, and the process should be done intermittently so that the temperature of the region does not increase more than 80°C and damage the belt.

Figure 4. Images of belt splice preparation stages

The lower and upper belt ends must be matched by taking into account their steps and axis adjustment. It is adhered to by mounting 15 to 20 mm wide edge rubber along with the belt splice. In the process of overlapping the belt ends, the bonding process should be done by pressing, starting from any direction, so that there is no gap and air at the splice. By controlling the centerline of the belt, the belt ends are fixed. The important thing in this process is that the axial adjustment of the belts is done well. The top cover closure rubber was cut at the upper splice of the belt and the filling and bonding process was applied (Figure 5).

Figure 5. Images of the bonding process

Figure 6 shows the vulcanizing machine and equipment. The vulcanization system in general; traverses, hydraulic pistons, vulcanized press tables (heat plates), hydraulic hand pump, hydraulic hoses, energy panel, resistances, and thermometer components.

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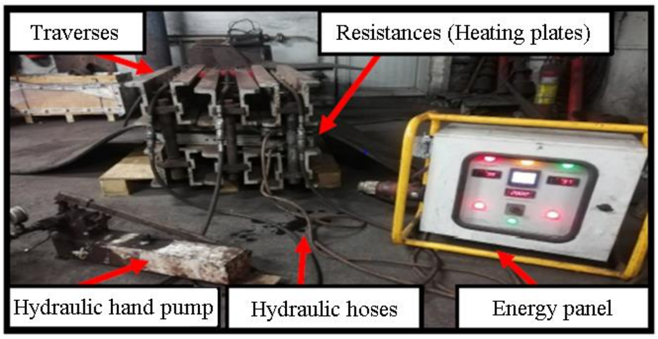

Figure 6. Vulcanization system equipment

When starting the loading process of the vulcanizing press machine, the important points are the heating time, temperature, and pressure. Generally, 50 bar pressure is applied at 0 °C when the system is idle. After this application, when the heater reaches 50 °C in the energy panel, it is increased to 100 bar pressure. When it reaches 100 °C, 150 bar should be applied. In an average of 20-25 minutes, the temperature reaches 145 °C, and cooking is continued by applying 150 bar pressure from 145 °C until the process ends. In this study, since the total belt thickness is 14 mm, it was left to bake for about 24 minutes after being seen from the energy panel at 145 °C. Parallel to this, the pressure is adjusted as 150 bar on the hydraulic piston manometer screen. After the vulcanization process is finished, the system should be left to cool. The vulcanizing press machine is left to cool until the temperature drops to 60-80 °C. After this process, the excess remaining on the splice surface and edges were trimmed and cleaned.

The test specimens were marked as 3 pieces in the longitudinal direction of the belt, and a minimum distance of 50 mm from the edges of the conveyor belt was cut from the inside (Figure 7).

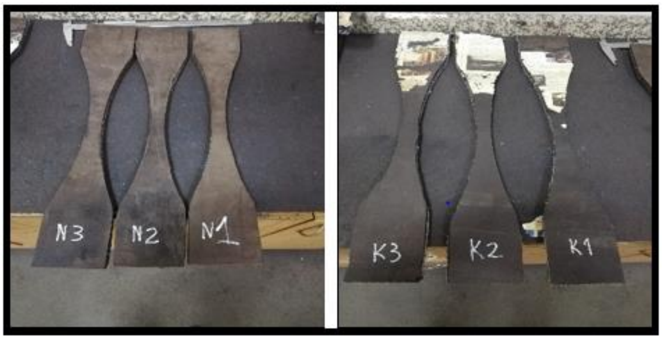

Figure 7. Bowtie-shaped specimens: Original unspliced (N coded) and vulcanized (K coded) belt specimens.

2.1.2. Preparation of Mechanical Splicing Specimens

The hole diameters of the fasteners used are 8 mm and the distance between the holes in the fasteners is 55 mm. The distance between the hole axes between the two fasteners is 40 mm, and it is applied by templating. 26 fasteners are used for the 1000 mm wide belt, 21 fasteners are used for the 800 mm wide belt, and 17 fasteners are used for the 650 mm wide belt according to the template. The number of fasteners to be used on the belt to be mechanically spliced is shown in Table 1 and recommended [19].

For the splicing to be made in the facility, firstly, the belt is fixed by tightening it with angle profiles from both ends and brought to the end with pullers. It is arranged by adjusting both ends with miter and gauge. In the mechanical splicing application, two different splicing methods are applied, which are performed in the form of angled (leveled) and straight splicing. One can be made as an angled cut and the other as a straight cut at 90º perpendicular to the movement direction of the belt. In this study, straight cut, which is mostly used in the facility, was preferred perpendicular to the movement direction of the belt (90º).

Table 1. Quantity of mechanical splicing fasteners [18]

Belt Width [mm]	Fasteners Qty.
300	8
400	10
500	13
650	17
800	21
1000	26
1200	31
1400	37
1600	42
1800	47
2000	53

To drill the fastener holes of the belt, the template supplied from the manufacturer was placed on the belt by using a gauge and a meter, and the hole centers were marked with a pencil (Figure 8). Likewise, the same procedure was applied to the opposite end. The 90º splice template facilitates the repair by allowing the holes to be drilled in the right places mutually. Since the diameter of the fasteners used is 8 mm, the holes were drilled with a 9, mm punch, and the application was made in the same way with the other belt end. After the drilling process on the belt was completed, the nuts and covers of the fasteners were removed and mounted on one side of the holes one by one. Rubber is placed between the fasteners to prevent dust spills in parallel. To ensure the alignment of the belt from the middle to the sides, the assembly of the upper fastener was started from the middle of the belt. After all the fasteners were mounted in the holes, the nuts were placed. Then tightening was done with the help of a nut tightening machine. The nut tightening process was carried out until the belt aligned with the upper surface of the upper coating rubber. After the tightening process was completed, the long bolt ends were broken with the help of a pipe and straightened. Finally, the protrusions on the bolt were removed with help of an angle grinder, to minimize the possible damage that the belt splice may cause while passing through the drums, scrapers, and belt carrier rollers, and the process was completed.

Figure 8. Images of the mechanical splicing application

Mechanically spliced conveyor belt specimens were cut in 3 pieces, parallel to the conveyor belt axis and at a distance of at least 50 mm from the belt edge, according to the TS EN ISO 1120 standard (Figure 9). The test specimens consist of a full-length longitudinal piece of a conveyor belt. The test specimen was taken with mechanical fasteners and the belt specimen was taken with a splicing width of at least 100 mm.

Figure 9. Image of belt specimens with mechanical splicing

2.2. Tensile Tests

A test piece cut from the full thickness of the conveyor belt is elongated under certain conditions using a tensile testing machine until rupture occurs. In the test, a test device that can apply a continuous and smooth tensile force is used. The testing speed of the device should be 100 mm/min [14, 20]. Experiments were carried out in the Mechanical Physics and Test Laboratory of Kardemir A.Ş, Quality Metallurgy and Laboratories Directorate, on a 200-ton SP1200 Zwick brand extensometer tensile testing device (Figure 10).

Figure 10. Image of the tensile tester

The extensometer tensile tester must have a measuring length of at least 100 mm and an accuracy of 0.1 mm or better, and be capable of measuring the elongation of the gauge length marked on the test pieces. It is also preferable to use a device that creates a graphical diagram throughout the test. Holders are required to prevent the test piece from slipping during the tensile test. It is recommended to use transverse serrated jaws as in Figure 11 [20]. To hold the test piece, the jaws to be attached to the device must be movable without slipping and causing excessive friction.

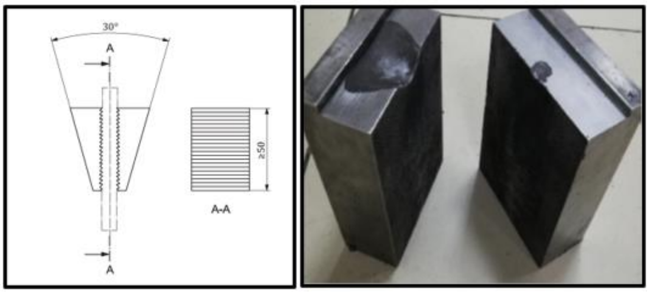

Figure 11. Technical drawing and image of the holding jaws

Conveyor belts spliced in the vulcanization splicing method were subjected to a full-thickness tensile strength test according to TS EN ISO 283 standard. The TS ISO 283 standard applied in the experiment explains how to perform the full-thickness tensile strength test of textile conveyor belts. A test piece cut from the full thickness of the conveyor belt is elongated under certain conditions using a tensile testing machine until rupture occurs. The force at the break of the test specimens gives the maximum value. In the experiment, a test device that can apply a continuous and uniform tension was used. The tensile strength is obtained by dividing the greatest force measured during the tensile test by the width of the test piece. It is expressed in N/mm or kg/cm. The test specimens are placed symmetrically between the serrated jaws of the testing device. Thus, the longitudinal axis of the test specimen, the centerline of the jaws, and the line of action of the tensile force are adjusted. At the beginning of the test, the distance between the inner surfaces of the jaws is applied as 415 ± 10 mm for type B test pieces.

Conveyor belts spliced by the mechanical method are subjected to a strength test according to the TS EN ISO 1120 standard and a static test method is provided according to this standard to determine the mechanical strength of the conveyor belt according to the operating conditions in the facility. The mechanical splice connection of a conveyor belt can be fixed or movable. Fixed fastener-type mechanical attachments were used in this study. The extensometer is tested by applying an increasing tensile force to the test device until the mechanical splice or piece of belt breaks, and the sample is divided into two parts. The ends of the test specimen body are fixed to the jaws of the tensile testing machine. The prepared test specimens were placed symmetrically between the jaws of the tensile test device. In Figures 12 and 13, the tensile test images of the unspliced specimen and mechanically attached specimens are given, respectively. The distance between the inner surfaces of the jaws is set as 415±10 mm for the type B template according to the standard. The width and thickness of the bow tie sample were measured from the narrowest part with the help of a caliper. The bow tie is placed on the device to cover the jaws. The tensile device was activated and the test specimen was extended steadily and uninterruptedly until it ruptured at a rate of 100±10 mm/min. The test was continued until the test piece broke, and when the belt specimen broke, the tensile device stopped. The maximum force F (tensile force N or kg) recorded for each test specimen was read.

Figure 12. Tensile test image of the unspliced belt

Figure 13. Tensile test images of the belt joined by mechanical splicing method

3. EXPERIMENTAL RESULTS AND DISCUSSION

The maximum force recorded during testing for each test specimen is divided by the width of the test piece and its value is recorded in N/mm or kg/cm. The tensile strength value in N/mm^2 is calculated using the belt thickness value. These processes were repeated as 3 samples for each, as the normal unspliced belt, the vulcanized belt, and the mechanical jointed belt, and the arithmetic average of the obtained values was taken. The results of the unspliced belt samples are given graphically in Figure 14 and as values in Table 2.

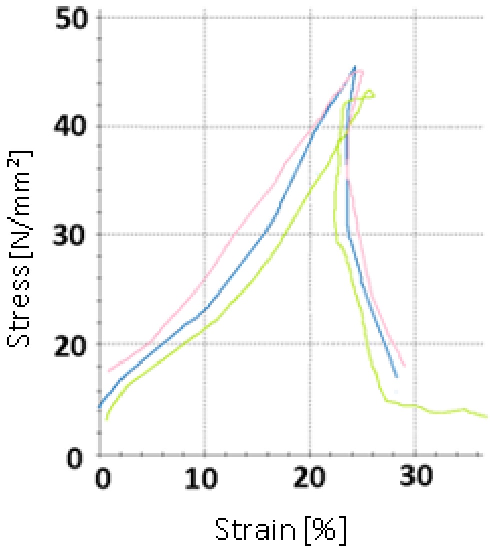

Figure 14. Tensile testing graph of unspliced belt specimens

Table 2. Tensile strength test results of unspliced belt samples

Specimen No	Thickness [mm]	Section [mm]	Sectional Area [mm^2]	Fmax - Tensile Force [kg]	Tensile Strength [N/mm^2]	Average Tensile Strength [N/mm^2]
1	14	25.5	357	1650	46.219	
2	14	25.8	361.2	1678	46.456	46.312 ±0.127
3	14	25.4	355.6	1645	46.260	

It has been observed that the normal belt specimen is above the minimum tensile strength of 630 N/mm (45 N/mm^2) specified in the standard and required to be provided.

The results of the belt specimens spliced by using the vulcanization method are given graphically in Figure 15 and values in Table 3, and the tag of the method is given in Table 4.

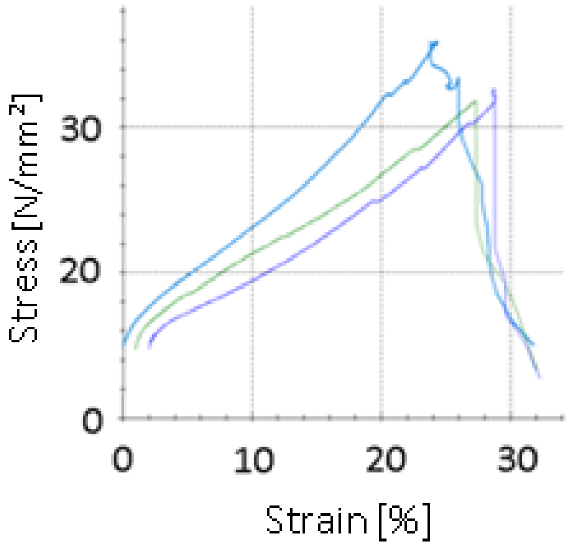

Figure 15. Tensile testing graphs of vulcanized bonded belt specimens

Table 3. Tensile test results of vulcanized belt specimens

Specimen No	Thickness [mm]	Section [mm]	Sectional Area [mm^2]	Fmax - Tensile Force [kg]	Tensile Strength [N/mm^2]	Average Tensile Strength [N/mm^2]
1	14	25.8	361.2	1205	33.361	
2	14	25.6	358.4	1190	33.203	33.268 ±0.082
3	14	26.0	364	1210	33.241	

Table 4. Identification table of the vulcanized splicing method

Features	Value
Width[mm]	800
Fabric quantity	4
Top coating thickness [mm]	6
Bottom coating thickness [mm]	3
Total thickness [mm]	14
Average tensile strength [N/mm^2]	33.268 ±0.082
Strength value compared to unspliced belt [%]	71.8

It has been revealed that the conveyor belt. which is spliced according to the vulcanized hot splicing method. has lost 28.2% of strength compared to the unspliced belt.

The results of the belt specimens spliced by the mechanical splicing method are given graphically in Figure 16 and as values in Table 5. and the tag of the method is given in Table 6.

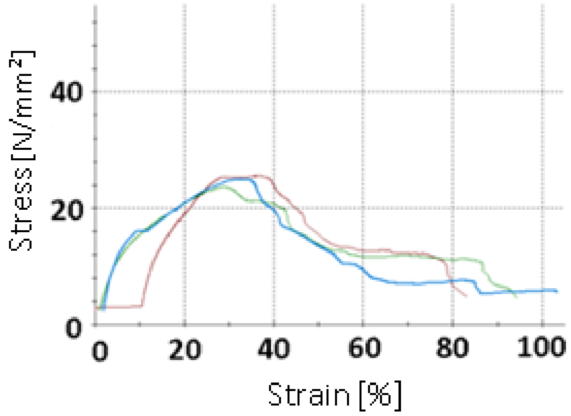

Figure 16. Tensile testing graphs of mechanically spliced belt specimens

Table 5. Tensile test results of mechanically spliced belt specimens

Specimen No	Thickness [mm]	Section [mm]	Sectional Area [mm²]	Fmax - Tensile Force [kg]	Tensile Strength [N/mm²]	Average Tensile Strength [N/mm²]
1	14	106.4	1489.6	3450	23.161	
2	14	105.5	1477.0	3410	23.087	23.241 ±0.206
3	14	107.1	1499.4	3520	23.467	

Table 6. Identification table of the Mechanical splicing method

Özellik	Değerler
Width[mm]	800
Fabric quantity	4
Top coating thickness [mm]	6
Bottom coating thickness [mm]	3
Total thickness [mm]	14
Average tensile strength [N/mm²]	23.241 ±0.206
Strength value compared to unspliced belt [%]	50.2

It has been revealed that the conveyor belt. which is spliced by using mechanical fasteners. has a 49.8% strength loss compared to the unspliced belt.

The strength values of unspliced. vulcanized and mechanically spliced belts are given in Table 7 as a table and in Figure 17 graphically. In Table 8. the advantages of splicing applications over each other are given as a table.

Table 7. Belt splicing methods strength and standard deviation values

Splicing Method	Specimen 1	Specimen 2	Specimen 3	Strength Values [N/mm²]
Unspliced	46.219	46.456	46.260	46.312 ±0.127
Vulcanized	33.361	33.203	33.241	33.268 ±0.082
Mechanical	23.161	23.087	23.476	23.241 ±0.206

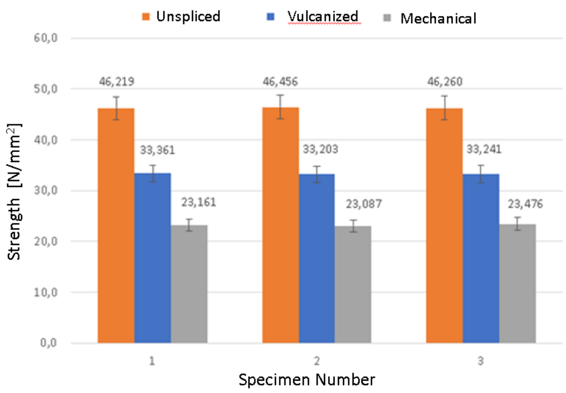

Figure 17. Comparison of strength of belt splicing methods

Table 8. Splicing methods comparison chart

	Mechanical Splicing	Vulcanized Splicing
Strength	Low	High
Being affected by humidity and humidity	Yes	No
Loss of Transported Material (Spill from Joint)	Yes	No
Potential to Damage Other System Equipment	Yes	No
Application time	Short	Long
Applicability	Easy	Difficult
Control and Inspection Status	Easy	Difficult
Experience Requirement	Less	More
The Need for Special and Expensive Equipment	No	Yes

4. CONCLUSIONS AND RECOMMENDATIONS

In this study. a belt with a tensile strength of 630 N/mm and a 4-layer polyester polyamide blend cord fabric. which is used as a conveyor belt in industrial facilities. was used. Splices were formed on the band in question by using mechanical splicing and vulcanization methods. and the strengths of the joints were investigated experimentally. The results obtained from this study are summarized below.

• Specimens extracted from conveyor belts with spliced joints were subjected to the tensile test. and according to the tensile test results. the tensile strength of the unspliced belt was found to be 46.312 N/mm² (648.36 N/mm). The fact that this result was above the minimum tensile strength value of 45 N/mm² (630 N/mm) confirmed the suitability of the result.

• The tensile strength of the belt spliced by using the vulcanization method was found to be 33.268 N/mm² (465.76 N/mm). According to this value. it was concluded that there was a 28.2% decrease in tensile strength compared to an unspliced belt.

• The tensile strength of the mechanically spliced belt was found to be 23.24 N/mm² (325.38 N/mm). According to this value. it was concluded that there was a 49.8% decrease in tensile strength compared to a unsanlicedriods belt. In the light of these results. it has been observed that the belts spliced by using the vulcanization method are 21.6% more durable than the mechanical splicing method. although there is a decrease in strength of approximately 28.2%.

• In addition to these results. considering the duration of the belt splicing applications. it is concluded that the mechanical splicing application. which can be performed in the range of 1 to 2 hours. significantly reduces the downtime of the plant compared to the hot vulcanization application. which can be performed in the range of 6 to 8 hours.

In addition to the above-mentioned results. the findings that emerged as a result of the studies and site observations are given below.

• It has been observed that mechanical fasteners provide a splice that is easy to control and inspect. and can be easily applied by existing plant maintenance personnel.

• The low cost of mechanical attachments and the ability to be stored for long pe make the mechanical splicing method advantageous.

• The vulcanization method is a more comprehensive and costly process and can be performed by professionally trained personnel.

• Belts move through scrapers. relays and drums for continuous transmission. The fasteners used in the mechanical joining method move by rubbing and hitting the conveyor belt elements. As a result. it has been observed that the same situation. which can cause damage to mechanical splicing elements and conveyor equipment over time. is not encountered in the vulcanization method because it does not require any mechanical element.

If a general evaluation is made. as a result of the obtained strength values and other observations. it has been understood that the vulcanization method is more advantageous than the mechanical splicing method.

In the continuation of this study. studies can be carried out to determine the effects of the application parameters used in the hot vulcanization method. which turned out to be more advantageous than the mechanical splicing method. on the strength of the spliced belt. and to optimize the parameters.

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BIOGRAPHIES

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