Evaluation of Material Properties of Acetylated Medium Density Fiberboard (MDF)

Jong Shin LEE²,† · Soung Joon KIM³

ABSTRACT

This study examined the material properties of MDF manufactured using acetylated pinus radiata fibers against moisture and compared the properties with the fiberboard quality standards of KS F 3200. Since acetylated MDF shows very low moisture content, water absorption and thickness swelling than the quality standards, it is expected to have an excellent dimensional stability. The bending strength in wetting condition of the acetylated MDF reached approximately 70% of the bending strength in dry condition, making it suitable for the quality standards. The internal bond of the acetylated MDF in the wetting condition was higher than the minimum internal bond of the quality standards in the dry condition, showing a good water resistance. Since the water droplet contact angle of the acetylated MDF is larger than that of untreated MDF, it is determined that it contributes in improving the water resistance due to the low wettability.

Keywords: medium density fiberboard, acetylation, moisture content, water absorption, dimensional stability

1. INTRODUCTION

The dimensional changes caused by the shrinkage and swelling of the wood tissue is a major obstacle in the use of wood processing. As it is well known, the phenomenon of dimensional changes (swelling and shrinkage) in wood is caused by changes in spacing between micelles following the changes in the quantity of bound water at the moisture content region below the fiber saturation point, which leads to increase or decrease of the cell wall volume to (Lee et al., 1981). As number of studies have been conducted on the heat treatment of wood as a technique for improving the defects of wood and allowing the dimensional stability (Priadi et al., 2019; Lee and Lee, 2018), its effectiveness has been proven, and heat-treated wood for outdoor decking is being produced.

While fiber boards or particle boards having a wide surface are used for various purposes such as for furniture and interior materials, their components are wood fiber or particles. Thus, dimensional changes take place due to moisture, and the degree of the changes is more severe than in wood materials, imposing much restrictions on their uses. In particular, severe dimensional changes occur in the thickness direction. The causes for the dimensional changes include the wood’s inherent characteristics of swelling and shrinkage, as well as the spring-back phenomenon in which compressed de-
formation temporarily fixed during the manufacturing process of the boards recovers and swells following moisture absorption (Korai, 2012). In order to develop and expand their various usage such as wood-based boards for exterior materials, it is important to fix the defects and improve the performance of these boards, especially to provide dimensional stability in the thickness direction (Arima, 2000; Kawai, 1997). In the wood-based boards, a large swelling stress takes place locally due to the compaction of wood raw materials in the manufacturing process. What suppresses this swelling stress is the bonding force between the adhesive and the wood raw material. Boards are surface-adhesive, and unlike plywood, where binding strength is expressed on the adhesive side, they are point-adhesive and binding strength is expressed at the adhesive points (Sekino, 2006). Thus, the boards tend to have an easy deterioration of mechanical properties compared to plywood, and the swelling rate in the thickness direction is significantly increased due to the spring-back phenomenon which occurs as the adhesive points collapse (Sekino and Okuma, 1986, Saito, 1972). For dimensional stability of boards, it is important to suppress the above two causes of dimensional changes and spring-back phenomenon (Korai, 2012). Sekino et al. (1996) classified technologies for the dimensional stability in thickness direction into five types, and Korai (2012) presented acetylation and formalization treatments as the main technology to suppress the dimensional changes among the five technologies.

It’s been known that there are two methods of chemical dimensional stabilization treatment of wood: an acetylation treatment in which a hydrophobic group (acetyl group (-CH$_3$CO)) is introduced into a wooden cell wall, and a formalization (acetalization) that forms a crosslink between hydroxyl radicals (-OH), a hydrophilic group in the wooden cell wall. In particular, as high dimensional stability of the acetylated wood has been recognized, many studies have been conducted on achieving high dimensional stability by using acetylated wood as a raw material for manufacturing boards (Kiguchi et al., 1985, Rowell et al., 1986, 1989, 1991, 1995; Yoshida et al., 1986; Subiyanto et al., 1989). In Korea, Chung et al. (2011) evaluated the properties of bio-composites manufactured with acetylated Kenaf fibers. The effects of drying temperature and acetylation treatment on the residual amount of PEG were studied on the pine wood treated with acetylation of bamboo instruments by Kang et al. (1996) and polyethylene glycol (PEG) by Lee et al. (2015).

It is confirmed that a smaller size of the board raw material is more suitable for the acetylation treatment when manufacturing an acetylation-treated board (Imamura, 1989), and wood fiber has the optimal conditions. Currently, acetylated medium density fiberboards (MDF) are produced and distributed by company T in the Netherlands, and the product is imported and sold by company Y in Korea. While the manufacturer is posting the product performance on their websites, including material properties against moisture such as product absorbency and thickness swelling, these performances are the results of investigation according to the American Society for Testing and Materials (ASTM) D1037 method. The ASTM method is different from KS F 3200 (fiberboard) test method of Korea. Therefore, this study examined the quality performance of the acetylated MDF distributed in Korea according to the test method of KS F 3200, the domestic quality test standards.

2. MATERIALS and METHODS

2.1. Test materials

The acetylated MDF was received from company Y in Incheon and used to investigate the material performance on moisture. The received acetylated MDF (14 mm thick) is a board in which the *Pinus radiata*
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The acetylated MDF fiber had been acetylated using a technology developed by company T in the Netherlands, and then bonded with a non-formaldehyde-based adhesive. This product is imported and distributed by the company Y in Korea. The average density and moisture content of the material were 0.71 g/cm³ and 2.9%, respectively. The density was within the density range (0.35 g/cm³ or more, and 0.85 g/cm³ or less) of the medium density fiberboard specified in KS F 3200 (fiberboard). In the case of moisture content, it was much lower than 5%, the minimum KS quality standard for moisture content of medium density fiberboards.

2.2. Test Methods

2.2.1. Physical properties

After collecting specimens of a predetermined size from the acetylated MDF according to the method specified in KS F 3200 (fiberboard), the moisture absorption and the absorption thickness swelling were investigated, and each test was performed 5 times repeatedly.

2.2.2. Mechanical properties

After collecting test specimens according to the method specified in KS F 3200 (fiberboard), bending strength, internal bond, condition on screw holding were examined and wettability test was performed (Table 1).

In the case of the bending strength during wetting, in the KS F 3200 fiberboard quality category, the type M (urea/melamine co-condensation resin system, equivalent or above), according to the type of adhesive used when manufacturing the fiberboard, was subjected to bending strength test A during wetting (bending strength test after soaking for 2 hours in hot water at 70 ± 3 °C and soaking again for 1 hour in room temperature water. This is referred to as wet treatment A.) and type P (phenolic resin, equivalent or above) to bending strength test B during wetting (bending strength after soaking for 2 hours in boiling water and soaking again for 1 hour in room temperature water. This is referred to as wet treatment B.). Since this study aims to evaluate the effect of improving the water resistance by the acetylation treatment of MDF, bending strength tests during wetting both A and B were applied. For the cases of internal bond and screw holding as well, the material performance in dry condition as well as the performance after the wet treatment tests of A and B methods were investigated. The internal bond at the time of wetting was measured after conducting the wet treatment on the specimen bonded to the aluminum block for the internal bond measurement. The screw holding was measured on both the specimen’s plane and sides, and wet treatment was conducted after driving in the screw into the specimen. All tests were repeated 5 times.

2.2.3 Contact angles

In order to identify the difference in wettability between ordinary MDF without acetylation treatment and MDF with acetylation treatment, the contact angle of

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<sup>a)</sup> Soaking for 2 hours in hot water at 70±3°C, followed by 1 hour in cold water  
<sup>b)</sup> Soaking for 2 hours in boiling water, followed by 1 hour in cold water.
the water droplets falling on each board surface was measured and compared. After dropping 0.1 ml of water droplets on the surface of the specimen at a height of 1 cm according to a predetermined method, the contact angles formed on the left and right sides of the water droplets were measured immediately after the splashing caused by the drop was disappeared. For the measurement, company SEO's contact angle meter (Phoenix 150, Contact angle: 0 ~ 180 ± 0.1°, Frame: 70 frame/sec, CCD camera resolution: 640 × 480 pixels) was used (Fig. 1).

3. RESULTS and DISCUSSION

3.1 Physical properties of acetylated MDF

After steeping the MDF specimen in water for 24 hours according to the test method of KS F 3200, the absorption rate and thickness swelling rate were investigated by using the changes in the weight and thickness, as shown in Fig. 2. First, the average absorption rate was 5.9%, which is significantly lower than the absorption rate standards of KS F 3200 for reinforced high-density fiberboards (20% or less). For reference, there is no standard for absorption rate in the KS quality standards for medium density fiberboards. The average thickness (swelling) after absorption was 1.5% (average thickness swelling of 0.21mm), which is significantly lower than 10%, the lowest standard of KS F 3200. Thus, a high dimensional stability of the acetylated MDF on the thickness direction was confirmed.

3.2 Mechanical properties of acetylated MDF

Shown in Fig. 3 are the dry condition and bending strength during wetting. The average bending strength of the acetylated MDF in dry condition was 32.9 MPa, and according to the classification of medium density fiberboards based on the bending strength specified in KS F 3200, it was equivalent to type 30.
After steeping in hot water for 2 hours at temperature of $70 \pm 3 \, ^\circ\text{C}$, and then soaking in room temperature water for 1 hour, the average bending strength (A test) during wetting was measured to be 27.2 MPa. In addition, the average bending strength in test B (testing the bending strength in wetting after soaking for 2 hours in boiling water and then steeping in room temperature water for 1 hour) under the harshest conditions was 23.1 MPa, which was equivalent to maintaining approximately 70% of the bending strength in dry condition. KS F 3200 specifies the quality standards of bending strength during wetting as at least 1/2 (50%) of the bending strength in dry condition. In addition, the P-type medium-density fiberboards based on the adhesives are presented as suitable not only for furniture but also for architectural elements (floor finish, exterior wall finish, roofing, etc.). Thus, given that the acetylated MDF showed a higher bending strength during wetting than the KS quality standards, it is highly possible to be used as exterior building materials.

Shown in Fig. 4 are the internal bond in dry condition and wetting of the acetylated MDF specimen. First, the average internal bond in dry condition was 0.72 MPa, satisfying the KS’ quality standards (type 30, 0.5 MPa or above). The internal bond at the time of wetting does not belong to the quality items of KS F 3200 fiberboards. However, according to the assessment of water resistance of the acetylated MDF, a high average internal bond of 0.59 MPa was maintained even after the wet treatment test A. This is revealed to be close to 0.6MPa (type 35), the highest internal bond in dry condition provided by the KS’ quality standards, which proves an excellent water resistance property of the acetylated MDF. However, the internal bond after the wet treatment test B, a harsher condition in compared to the test A, could not have been possible to be confirmed due to the deformation of the specimen.

Fig. 5 shows the results of examining the screw holding on the board’s plane and sides. In the dry condition, the average screw holding on the plane surface was 482.2N, which did not meet the quality standards of KS F 3200 (30 type, equal to or above 500N). However, the average screw holding on the sides was 337.7 N, which exceeded the quality standard (30 type, equal to or above 250 N). The average holding force was maintained as 391.2 N on the plane after the wet treatment test A, but there was no screw holding maintained on the sides. After the wet treatment test B, it was impossible to measure the screw holding due to the weakening of the specimen material. Based on these results, it was revealed that the screw holding at the time of wetting process of the acetylated MDF was inferior to the bending strength or internal bond at the time of wetting process.

**Fig. 4.** Internal bond of acetylated MDF in air dry condition and after wet treatment (A-test).

**Fig. 5.** Screw holding to the face and edge of acetylated MDF under air dry and wet (A-test) conditions.
3.3 Wettability of acetylated MDF

As one of the mechanisms through which liquid penetrates into wood, wettability is known as a phenomenon which determines the initial penetration. The availability of wettability in a liquid can be measured with contact angle, and the evaluation showed that the smaller the contact angle of the liquid on the wood surface, the better the wettability and the larger the poorer. In order to compare the water permeability between the non-acetylated MDF and the acetylated MDF, water droplets were dropped on the plane of the MDF according to a predetermined method, and the contact angle of the droplets formed with the surface was measured. Shown in Fig. 6 are the photographs of the shapes of water droplets falling on the planes of the non-acetylated MDF and the acetylated MDF. In can be confirmed from the angle formed by the droplets with the MDF surface, that the contact angle (B in Fig. 6) on the acetylated MDF is larger than that on the non-acetylated MDF (A in Fig. 6). To clarify this, the contact angles were measured against the plane of the MDF on the left and right sides of the droplet, as indicated by Fig. 7. The average angle between the left and right sides was 87.7° on the non-acetylated MDF, and 95.47° on the acetylated MDF, indicating a larger contact angle formed on the acetylated MDF. Using the measurements of the contact angles, Wulf et al. (1997) investigated the wetting characteristics based on the differences between the types of fiber raw materials (spruce and beech) of MDF, the presence or absence of surface polishing, and the presence or absence of water-repellent treatment using paraffin wax. The data on the contact angles formed between the water droplets and the untreated MDF that is not polished or water-repellent, regardless of the type of fiber raw material, show that the contact angles range from 75 ± 7° to 82° ± 3°, indicating the contact angles of below 90°. Although it was an indirect comparison, Fig. 6 showed a larger contact angle on the acetylated MDF than that reported by Wulf et al. The above results indicate that the acetylated MDF has a poor wettability, the initial penetration mechanism of moisture, compared to the non-acetylated MDF, and this seems to have contributed in part to improving the water resistance of the acetylated MDF.

4. CONCLUSION

After investigating the material properties of MDF manufactured using acetylated radiata pine fibers against moisture, in compared to the quality standards of the medium density fiberboards of KS F 3200, the following conclusions were derived.

1. Since the acetylated MDF shows a very low moisture content, water absorption and thickness swelling, compared to the quality standards of MDF specified in KS F 3200, acetylation treat-
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ment is expected to improve the water resistance of the boards.

2. Even during the wetting process, the acetylated MDF maintains a bending strength of approximately 70% or above of the bending strength under the dry condition. Thus, it meets the KS F 3200 standards for bending strength during the wetting process.

3. Even during the wetting process, the acetylated MDF shows a higher quality than the internal bond under the dry condition specified in KS F 3200. Thus, it indicates a high level of water resistance.

4. The maintenance of screw holding of the acetylated MDF in the wet condition is relatively inferior to the bending strength or internal bond.

5. The contact angle of water droplets formed on the acetylated MDF is larger than that on the non-acetylated MDF. This contributes to the expression of low wettability and high water resistance of the acetylated MDF.

ACKNOWLEDGMENT

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REFERENCES


아세틸화 처리 중밀도 섬유판(MDF)의 재질 평가

초록: 아세틸화 처리한 라디에타소나무 섬유를 사용하여 제조한 MDF는 수분에 대한 재질 특성을 조사하고 KS F 3200의 성능 품질기준과 비교하였다. 아세틸화 처리 MDF는 품질 기준보다 매우 낮은 핵수용 및 수분 흡수성 및 두께 팽창율을 보여 우수한 치수안정성을 기대할 수 있다. 아세틸화 처리 MDF의 수분 흡수성은 품질 향상으로 기대할 수 있으며, KS F 3200의 치수안정성은 품질 향상으로 기대할 수 있다.

초론: 목재 조직의 수축과 팽윤에 의해 나타나는 치수변화는 목재 가공 이용에 있어 큰 장애로 작용한다. 목재의 치수변화(팽윤과 수축) 현상은 섬유포화점(fiber saturation point) 이하의 함수율 영역에서 결합수(bound water)의 증감에 따라 미셀(micelle) 상호간의 간격이 변화되고, 이로 인해 세포벽의 용적이 증가하는 결과로 두께 팽창율이 발생한다(Lee et al., 1981). 이러한 치수변화에 기인한 치수안정성의 부족은 신축성에 대한 기술로 목재의 열처리에 관한 연구가 수행된 바 있으며(Priadi et al., 2019; Lee and Lee, 2018), 그 효과가 입증되어 야외 데크용 열처리 목재가 생산되고 있다.

2. 재료 및 방법

2.1. 실험 재료
아세틸화 처리 MDF를 인천 소재 Y사로부터 분양받아 수분에 대한 재질성능 조사에 사용하였다. 분양받은 아세틸화 MDF(두께 14 mm)는 네덜란드의 T사에서 라디에타소나무(Pinus radiata) 섬유를 자체 개발한 기술을 사용하여 아세틸화 처리한 후 비포름알데히드계 접착제로 접착한 것으로 Y사에서 수입하여 국내에 공급하고 있는 제품이다. 재료의 밀도와 함수율은 각각 평균 0.71 g/㎤와 2.9%를 나타냈다. 밀도는 KS F 3200(섬유판)에서 규정한 중밀도 섬유판의 밀도 범위(0.35 g/㎤ 이상, 0.85 g/㎤ 이하) 내에 해당하였으며, 함수율의 경우에는 중밀도 섬유판의 KS 최저 함수율 기준인 5%보다 매우 낮았다.

2.2. 실험 방법
2.2.1 물리적 성질 조사
KS F 3200(섬유판)에서 규정하고 있는 방법에 따라 아세틸화 처리 MDF로부터 소정의 크기의 시험편을 채취한 후 수분 흡수율과 흡수 두께 팽창율을 조사하였으며, 모든 시험은 각각 5반복 실시하였다.

2.2.2 기계적 성질 조사
KS F 3200(섬유판)에서 규정하고 있는 방법에 따라 시험편을 채취하여 휨 강도와 박리강도 및 나사못 유지력에 대한 상태 및 습윤 시험을 실시하였다(Table 1).

3. 결과 및 고찰
3.1. 아세틸화 처리 MDF의 물리적 성질
MDF 시험편을 KS F 3200의 시험방법에 따라 수중에 24시간 수침처리 한 후, 무게와 두께 변화를 가지고 형수율과 두께 팽창율을 조사하여 Fig. 2에 나타냈다. 먼저 형수율을 살펴보면, 평균 5.9%로 KS F 3200의 강화 고밀도 섬유판의 형수율 품질 기준(20% 이하)보다 높은 값을 나타내었다. 참고로 중밀도 섬유판의 KS 품질 기준에는 형수율에 관한 기준은 없다. 형수 후 두께 팽창율은 평균 1.5%(평균 0.21 mm 두께 팽창)로 KS F 3200의 최저 기준인 10% 이하보다 일정하게 낮은 값을 나타내 아세틸화 처리 MDF의 높은 두께방향 지수안정성이 확인되었다.
3.2. 아세틸화 처리 MDF의 기계적 성질

기견 상태 및 습윤 시 휨 강도를 조사하여 3.2. 아세틸화 처리 MDF의 기계적 성질

기견 상태 및 습윤 시 휨 강도를 조사하여 Fig. 3에 나타냈다. 아세틸화 처리 MDF의 상태 휨강도는 평균 32.9 MPa로 KS F 3200의 월등한 인장시험(물등에 2시간 담근 후 젖은 상태에서 휨 강도)에 해당하는 것으로 조사되었다. KS F 3200에서는 습윤 시 휨강도는 평균 27.2 MPa의 강도 값을 보였다. 또한, 기건 상태의 습윤 시 휨강도는 평균 32.9 MPa로

기건 상태 및 습윤 시 휨 강도를 조사하여 Fig. 3에 나타냈다. 아세틸화 처리 MDF의 상태 휨강도는 평균 32.9 MPa로 KS F 3200의 월등한 인장시험(물등에 2시간 담근 후 젖은 상태에서 휨 강도)에 해당하는 것으로 조사되었다. KS F 3200에서는 습윤 시 휨강도는 평균 27.2 MPa의 강도 값을 보였다. 또한, 기건 상태의 습윤 시 휨강도는 평균 32.9 MPa로

온도 70±3℃의 온수 중에 2시간 침수처리한 후에 이어서 상온의 물 속에 1시간 담근 다음 젖은 상태에서 측정한 습윤 시 휨 강도(A시험)를 조사한 결과, 평균 27.2 MPa의 강도 값을 보였다. 또한 접착제에 따른 구분 P형의 월등도 식유판은 가구 이외에도 건축(바루 바탕, 외벽 바탕, 지붕 바탕 등) 용도로 적합한 것으로 제시하고 있다. 따라서 아세틸화 처리 MDF는 KS 품질 기준보다 월등하게 높은 습윤 시 휨강도를 보이는 것으로 판단된다.

아세틸화 처리 MDF 시험체의 기건 상태 및 습윤 시의 박리강도를 조사하여 Fig. 4에 나타냈다. 먼저 기건 상태 박리강도를 살펴보면 평균 0.62 MPa로 KS의 품질 기준(30형, 0.5 MPa 이상)을 충족하였다. 습윤 시 박리강도는 KS F 3200의 월등도 식유판의 품질 항목에 해당하지 않는다. 그러나 아세틸화 처리 MDF의 내수성 평가를 위해 조사한 결과, 습윤처리 A시험 후에도 평균 0.59 MPa의 높은 박리강도를 유지하였다. 이것은 KS의 품질 기준에서 제시하고 있는 최고의 기건 상태 박리강도인 0.6 MPa(35형)에 근접한 값으로 아세틸화 MDF의 우수한 내수성을 확인할 수 있다. 그러나 습윤처리 A시험에 비하여 좀 더 가혹한 습윤처리 B시험 후에는 시험체의 변형으로 측정이 불가능하였다. Fig. 5는 보드의 평면과 측면에서의 나사못 유지력을 조사한 결과이다. 기건 상태에서 평면의 나사못 유지력은 평균 482.2 N으로 KS F 3200의 월등도 식유판의 품질 기준(30형, 500 N 이상)을 충족하지 못하였다. 그러나 측면에서의 나사못 유지력은 평균 337.7 N으로 월등도 식유판(30형, 250 N 이상)의 품질 기준을 상회하는 결과를 나타냈다. 습윤 시 나사못 유지력에서는 습윤처리 A시험 후에 평균 391.2 N의 유지력을 보였고 측면에서의 나사못 유지력은 없는 것으로 나타났다. 습윤처리 B시험 후에는 시험체의 변형으로 나사못 유지력의 측정이 불가능하였다. 이러한 결과로부터 아세틸화 처리 MDF의 습윤 시 나사못 유지력은 습윤 시 휨강도나 박리강도에 비하여 열등한 것으로 평가되었다.

3.3. 아세틸화 처리 MDF의 습윤성

목재 내부로 액체가 침투해 들어가는 기작 중의 하나로 습윤성이 있으며, 초기침투를 결정하는 현상으로 알려져 있다. 액체의 습윤성의 양부는 접촉각을 측정하여 평가할 수 있으며, 목재 표면에서의 액체의 접촉각이 작을수록 습윤성이 양호하고 크면 클수록 불량한 것으로 평가된다. 비아세틸화 처리 MDF와 아세틸화 처리 MDF의 수분 침투성의 차이를 비교하기 위하여 MDF의 평면 위에 물방울을 떨어트린 후 면과 이루는 물방울의 접촉각을 측정하였다. Fig. 6은 비아세틸화 처리 MDF와 아세틸화 처리 MDF의 평면에 낙하시킨 물방울의 형상을 촬영한 모습이다. 물방울이 MDF의 표면과 이루는 각도를 살펴보면 비아세틸화 처리 MDF에서는 좌우 평균 87.7°, 아세틸화 처리 MDF에서는 좌우 평균 95.47°의 접촉각을 나타내 아세틸화 처리 MDF에서의 접촉각이 큰 것을 알 수 있다. Wulf 등(1997)은 접촉각 측정을 통해 MDF의 심유 원료 수종(spruce와 beech), 표면 연마가공 유무, 피라핀 왁스를 이용한 발수처리 유무 등의 차이에 따른 습윤 특성을 조사하였다. 이들 연구결과에 중에 연마 표면에 발수처리 하지 않은 무처리 MDF의 물방울과는 접촉각의 차를 살아보면 심유 원료 수종에 관계없이 접촉각은 최저 75±7°에서 최고 82±3°의 범위를 나타내 90° 이하의 접촉각을 보이고 있다. 긴밀한 비교가 있지만 아세틸화 처리 MDF는 Fig. 6에 보이는데 같이 Wulf 등의 연구 결과에 비하여 큰 접촉각을 나타내었다. 이는 결과로부터 아세틸화 처리 MDF는 비아세틸화 처리 MDF에 비하여 수분의 초기 침투기작의 습윤성이 높다는 것을 알 수 있으며, 이것은 아세틸화 처리 MDF의 내수성 향상에 일정 부분 기여한 것으로 판단할 수 있다.

4. 결론

아세틸화 처리 MDF는 KS F 3200에서 규정하고 있는 MDF의 품질 기준에 비하여 매우 낮은 함유율과 수분 흡수성 및 두께 경축성을 보이며 아세틸화 처리에 의한 보드의 내수성 향상 효과를 기대할 수 있다.
2. 아세틸화 처리 MDF는 습윤 시에도 기건 상태의 약 70% 이상에 달하는 휨 강도를 유지하여 KS F 3200에서 요구하는 습윤 시 휨강도 기준에 부합한다.
3. 아세틸화 처리 MDF는 습윤 상태에서도 KS F 3200에서 규정하고 있는 기건 상태에서의 박리강도 이상의 품질을 보여 높은 수준의 내수성이 인정된다.
4. 습윤 상태에서 아세틸화 처리 MDF의 나사못 유지력은 휨강도나 박리강도에 비하여 비교적 열등하다.
5. 아세틸화 처리 MDF에서는 비아세틸화 처리 MDF에 비하여 물방울 접촉각이 크게 형성되며, 이것은 아세틸화 처리 MDF의 낮은 습윤성과 높은 내수성 발현에 기여한다.