

Study for the Expression for Various Models of Furniture and Wooden Trifling Article Made of Layered Plywood

Sung Hee Cha¹, Jae Young Lee², Byung Ho Park² and Ki Choi^{†2}

ABSTRACT

We suggest layered sculpture method and color painting method with new materials for the preparation of various expressions for aesthetic model of the furniture and interior articles made of river birch. Through the analysis of the layered sculpture method and preference, we try to set a new direction for the enhancement of the decoration for the furniture or article design made of birch plywood. Also, we study the fittest manufacturing process after selecting color painting materials different from the existing painting method and goes well with the furniture or article made of river birch.

Color painting which systemic application of the layered plywood from birch and new paints such as Oriental dye is one of the best schemes to realize various possibility of the furniture and wooden article made of the layered plywood, and this research result has affected positive effect on the development fields such as wooden furniture and interior articles.

Key words: Birch plywood, color painting, furniture, interior article.

INTRODUCTION

Purpose

What is used for making the human being's life more convenient and comfortable is wood as the materials of furniture (Cho 2002). As access factor for wooden furniture is good and more available than metal or fiber in case of process method, it is just judged that it retains the attraction factor for the differentiated customers and urges them to buy it.

However, random cut-off causes serious matter against the environment and this phenomenon increases the cost of wood and decreases the access factor. According to the minister of Indonesia Forestry, his explanation, forestry damage due to illegal cut-off came up to 430 million hectare and this damage brings worse damage than terror against the human life (<http://www.globalwindow.org>). Hence, for the utility rate of wood materials, artificial wood such as plywood, particle board or MDF has increased more than material lumber and the change of such preference became a moment which the necessity of study for the new manufacturing method and way of model expression is suggested.

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We analyze the physical and modeled characteristic of plywood used recently as the materials of wooden furniture and suggest various methods of model expression from plywood with a base of layer and color painting method from the analysis result and example study. As plywood layer has the possibility of model, we suggest a method to apply the development of natural friendly emotion stirring factor of artificial wood to furniture and article design. Also, to test the color expressed materials of plywood with painting and analyze any result relies on developing some design method of color expression with furniture and articles made of plywood.

Layer application method of plywood has been researched but we consider there is still some design developing methods. Especially, in case of river birch that is used a lot the designing education field, more methods should exist. Also, the original color of the surface of birch plywood (Mick Allen 2007) has the fittest condition to test various colored materials. Through the analysis of various examples for the model expression of birch plywood in this study, We want to classify and examine the model expression with layer sculpture method and the model expression method with colored birch plywood to open certain possibility to apply them to new design development.

Study Method and Its Scope

To retain the objectivity and universality of this study, we analyze the model characteristics of wooden furniture and articles where the recently demonstrated Birch plywood was used. Especially, we research simple preference degree for the design examples where layered sculpture method was used. Also, we look into the examples that color painting method was used to furniture and trifling articles.

For the examples where birch plywood was used, we collected and then examined the furniture design schemes that the graduation works of the students at Design Department from Hong-Ik University, Sang-Ji University and Kangwon University and the regular exhibition of whole national ranged design association. For wooden articles, we study the products that have been sold at the small & medium workshops, the works that the winner acquired prizes from Korean Industry Exhibition and the works that the students of Design Department in Chung-Ang University. Also, with the artists, designers and students majoring the relating departments, we perform a simple research to estimate the possibility for the model value of color painting method.

Finally, we describe layer sculpturing method, color painting process and model characteristics, and suggest certain alternative to find the application method of new wooden furniture and article design.

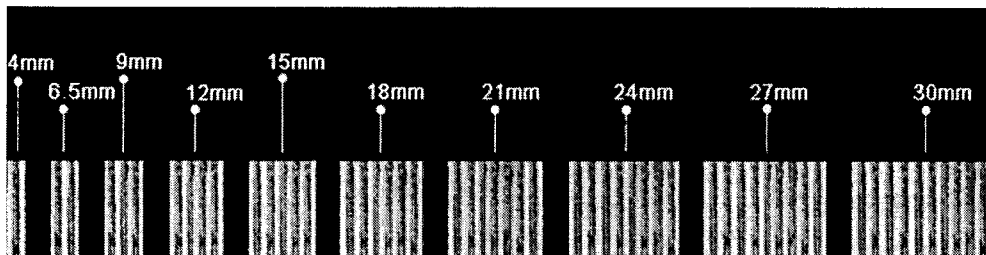
THEORETICAL BACKGROUND

Types and Characteristics of birch plywood

River birch which is broadleaf tree and has close tissue shall be created as the interior decoration finish-up such as birch plywood which doesn't any damage the nature and give friendly and comfortable feeling after it is manufactured through the capital and technology of Finland. As birch plywood has outstanding and bright color, considerably same tone, natural beauty can be alive as possible as it can with lacquer finish-up and various colors can be expressed with clean paints made from vegetable oil, it has been used for the interior decoration finish-up and material for furniture. Especially, for the birch plywood imported from Finnforest Co. Ltd in Finland, as the emission amount of formaldehyde is 0.1mg/L, which is lower than 0.5mg/L from the highest quality of domestic plywood, it is an environment friendly material satisfying the Interior Air Quality Control Law which was set on April in 2004. Also, it has been valuated as the material satisfying at the same time the esthetic and functional factors which unique layer formation has.

Table 1. Specification and retail cost of river birch plywood (<http://www.birchplywood.co.kr>)

Thickness (mm)	4	6.5	9	12	15	18	21	24	30
The number of veneer layers	3	5	7	9	11	13	15	17	21
Max. thickness	4.1	6.9	9.5	12.5	15.3	18.1	20.9	23.7	29.9
Min. thickness	3.5	6.1	8.8	11.5	14.3	17.1	20.0	22.9	28.1
Weight (kg/m ²)	2.7	4.4	6.1	8.2	10.2	12.2	14.3	16.3	20.4
Price (Won)	33,000	50,000	62,000	77,000	92,400	110,000	132,000	147,000	199,000
Produced Area	Russia	Finland	Finland	Finland	Finland	Finland	Finland	Finland	Finland

Fig.1. The number and shape of birch plywood by the thickness of birch plywood (<http://www.birchplywood.co.kr>).

In case of Finland's birch for the size of birch plywood, it is 1220 × 2440 mm (4' × 8') and is formed as Short Grain. In case of Russia's birch for the size of birch plywood, it is 2440 × 1220 mm (8' × 4') and is formed as Long Grain. For the constitution of the plywood, plywood is rotary-cut to 1.4mm, is laid to be odd numeric pattern, all the part of the inner veneer is filed with river birch (<http://www.birchplywood.co.kr>)

Table 1 shows the sizes and retail cost of the birch plywood from Finland. Picture 1 shows the number and shape of birch plywood by the thickness of birch plywood.

The amount of birch plywood has increased recently as the material for interior decoration and furniture and the size of its application has been extended from interior articles and artifacts to tourism souvenir due to its artificial beauty that even gap of the layered structure gives and its model characteristic that the natural beauty of its grain gives.

OPTIMUM STUDY

Example study of layer sculpture method and color painting method of river birch plywood

The layer of birch plywood has model characteristic on the sectional surface where stripe pattern presents dominantly. In case the plywood is sculptured from the plain direction, this kind of pattern presents similar pattern with the annual ring of the trees in the nature. Picture 2 shows the example of furniture and interior trifling articles made by the method of the layer sculpture method from river birch (<http://www.birchplywood.co.kr>).

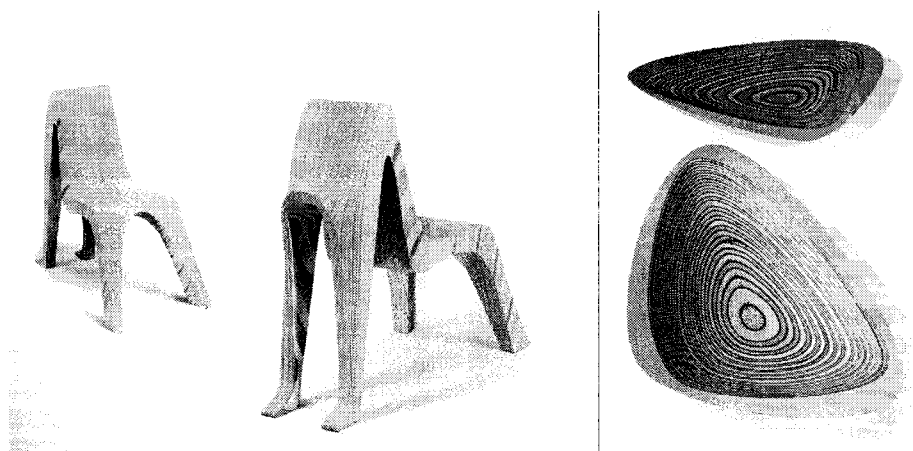


Fig.2. The design example of the furniture (Left) (Kwon and Park 2005) and trifling articles (Right) (Park 2006) in the kitchen made by the layer sculpture method.

The pattern on the sectional surface looks similar to the straight grain of the trees in the nature and has the similar pattern with the grain of the trees in the nature for the grain on the horizontal surface.

In case of common plywood, they are used commercially as furniture material. However, as they have artificial image, it's rare to be manufactured as furniture only with plywood. Commonly, they are framed with plywood for furniture, the patterned wood or growth rings of wood printed film are attached on the surface and then showed as if they look like the furniture made of the tree in the nature. This process is concerned with the contraction/metamorphosis characteristic or economic feasibility of the tree in the nature. However, from the aesthetic aspect, as the customers feel beautiful and friendly for the furniture in natural state more than that of the furniture made of plywood, it seems to be used a lot. Therefore, river birch plywood is considered as one of the fittest materials that the aesthetic and physical & economical disadvantage can be covered mutually.

For various models for the layer sculpture method of birch plywood can be expressed according to the shape of sculptured surface, this method is used throughout for furniture and articles design. The same number of grains occur like layered veneer plate. In case you express the outer lines such as oval, flower pattern, circle, square and random curved surface according to the outer shape of the sculptured surface, grain remains according to the regular space and shows recursive concentricity according to the angle and depth of the sculpture. This kind of utility for the layer sculpture pattern is accepted as an affirmative way to enhance the aesthetic value of the furniture and trifling articles made of plywood.

You can find the examples of color painting method for river birch plywood from the plywood furniture manufactured and sold recently. For example, ELSSI Co.,Ltd (<http://www.elssi.co.kr>), a domestic company, which has 'environment-friendly' as the moment of its products, is the case. In case of overseas company, UNTO THIS LAST Co.,Ltd (<http://www.untothislust.co.uk>), an England company, produces and sells the mixed method of birch plywood and color painting applied furniture.

Especially, UNTO THIS LAST Co.,Ltd put a considerable weigh on design as it was established by some designers With UV typed or polyurethane contained paint as painting material, environment-friendly paint for wood has been used recently (<http://www.untothislust.co.uk>). What we have to consider from color painting method is that the color painting of birch plywood shows

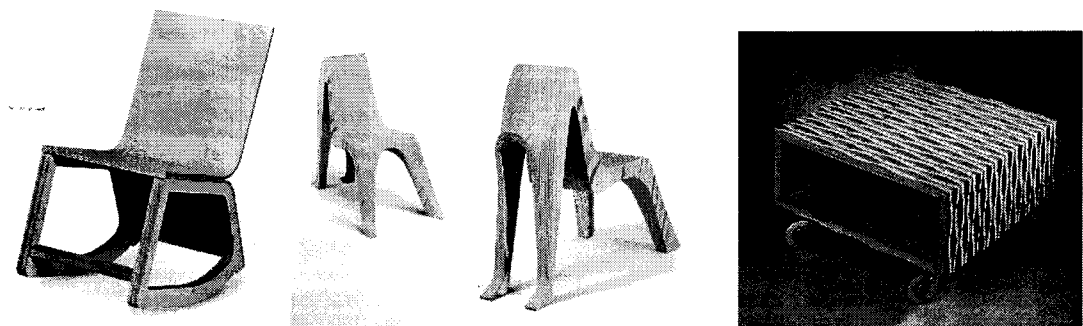
clear differentiation from the painting method for the furniture made of common plywood and MDF in design aspect. We will research this gap in the concrete at 'The research of the kinds of color painting methods and its process'.

Analysis of the effect for model expression of layer sculpture method on birch plywood

Most of all, we set the scheme that the decoration and aesthetic effect of layer sculpture method influences affirmatively on the promotion for the aesthetic value of furniture and articles. We try to testify this thesis through the research and interview for the furniture designers and students whose major are related to furniture and general customers. We classify the existing furniture and trifling articles made of plywood into 3 types of model expressing methods, analyzing them.

First case is for the products that birch plywood was used as its original shape. Second case is for the sectional surface of birch plywood was processed through 3D process. Third case is for the birch plywood that engraving or embossed carving design is applied to. In analyzing the result of research, in case of the furniture made of birch plywood, they answered its model beauty was excellent, compared to the common plywood and MDF applied to. Also, in case of the furniture that was sculptured along with the plain direction for its model expression, they said that the case of sculpturing along the plain direction for its model expression was more gorgeous and aesthetic than that along the sectional direction. Picture 3 shows the design scheme optional questions are given and their content means to ask "Among the stripes expressed along with the structures of the layers of the below birch plywood, what samples can you feel more gorgeous and aesthetic than any others?" The rate of response is shown as below.

The choice rate for the above cases was shown like next; the choice rate of example 1 was 15%, the choice rate of example 2 was 25% and the choice rate of example 3 was 60%. According to the result of research, the model expression by the layer sculpture method shows people feel so positive aesthetic effect. Of course, trifling differences exist according to each person but the fact that the amount of its utility has increased is evidence supporting this point.



1. In case it is used as it is 2. In case of sectional direction

3. In case of plain direction

Fig.3. Examples of the layer sculpturing method for birch plywood furniture.

The fact that various patterns and grains from the sectional/sculptured surface of birch plywood were testified for the greatest aesthetic advantage of birch plywood from the preceded studied content. Recently, birch plywood that its aesthetic factor is retained has enhanced certain diversity more and more. From the practice course of furniture design department in a university, various kinds of color painting has been educated along with oily lacquer paint or polyurethane

paint. Also, in taking a look at ELSSI' furniture and articles, you can find easily the products such as various color painted furniture made of birch plywood. Color painting used commonly for birch plywood furniture and trifling articles are classified into polyurethane, UV and high-glossy painting and became the mainstream at the recent furniture market. Picture 4 shows some kinds of examples applied to the design of birch plywood furniture and trifling articles.

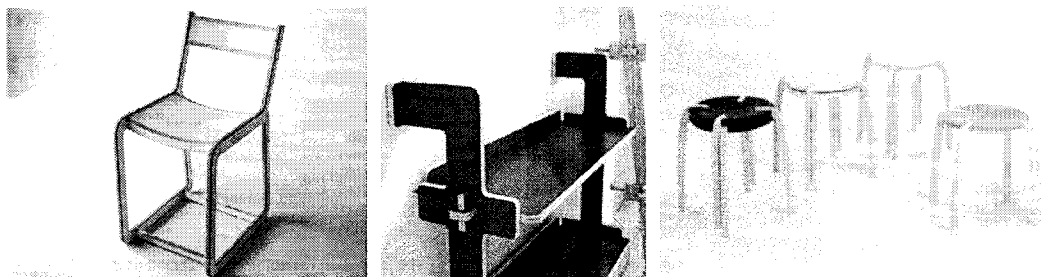


Fig.4. An application of birch plywood to furniture design by using color coating technique (<http://www.untothislust.co.uk>).

The in-depth speculation of the examples above enables us to find common characteristics in the color- painting method for birch plywood furniture and its articles. In general, all the surface of furniture exposed is being coated, however, in case of the furniture made of the birch plywood, painting is made except where the cutting area in plywood is not applied. This is probably because the natural cutting face of the wood could be better explicitly expressed for aesthetic sympathy touching to viewers due to its stripe patterns and colors. Fig. 4 shows the generally applicable coating methods (poly-urethane coating, UV-coating, high-glossy coating (Jung and Kim 2001)) found in birch-plywood furniture. This study aims at providing new methodological ways for refined conceptual painting through an experiment.

The first relates to anti-fungi environment-friendly acrylic painting method, the second to picturesque coloration using watercolors for Oriental painting, and the last to acid dyes used for silk dyeing. Each of those methods was put into practice through experiment, accordingly bearing the results as follows in Fig. 5.

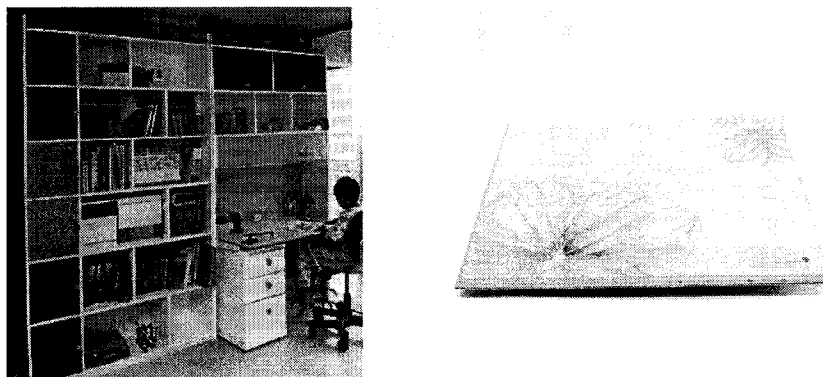


Fig.5. experimental results conducive for new technical coloration -based on environment- friendly and anti-fungi painting technique (left) and Oriental picture dyes-based painting technique (right).


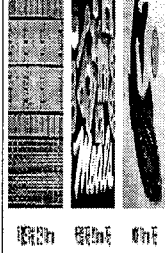
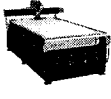
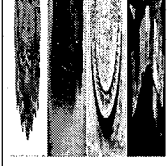
The last technique mentioned above represents quite similar tint of watercolors used in

painting Oriental pictures in which the finishing process is being studied in detail. The acrylic painting method is deemed a differentiated representation laying much weight on 'environment-friendly' function, while the painting method based on watercolors is developed to adopt its uniqueness not affordable by constructional paints to furniture in order to open up the possibility for new dimensional art expression focused on 'plastic art + furniture.' Nowadays there appears a trend in home electronic appliances pursuing aesthetic representation that can be interpreted as 'decoration through picturesque images.'

Proposed ways and results for wide applications to designing

The main objective through the current study is to not only get closer into how the cumulative layers in birch plywood are usefully applicable for upgrading aesthetic valuation in furniture and small article designing, but incorporate the experimental results seeking for better color painting methods to designs using birch plywood in a differentiated manner. The cumulative fragments are considered a best tool to demonstrate the aesthetic properties in birch plywood, as shown in the research before. But given the facts of difficult handicraft and the need of long-term period for production, there produces a fatal weakness in the aspect of economical design activity.

Table 2. Analysis of specifications and features in fragmenting machine (<http://www.finecnc.co.kr>)

Name of machine	OS software	Model	Image	Fragment tolerance	Features	Examples of fabrication
Laser fragment M/C	CorelDRAW Program	FL1000		1400×750mm	able to do acrylic processing and embossed sculpture in wooden patterning	
CNC fragment M/C	TYPE2.5D CAM Program	FX1325		1300×2500×10mm	able to use wood as well as acrylic, aluminum, etc. for representing 3D sculpture	

In this context, the study is suggesting, as a means of getting over this weak point, what is called cumulative fragment technique by using up-to-the-date fragmenting machine, which leads to remarkable time-saving and reduction of labor cost as already implemented in reality by many educational institutions and designers.

Such advanced techniques are applied to birch plywood in an attempt to develop a refreshed cumulative layer technique. In case of embossed sculpture as a sculptured shape, laser fragment machine or CAD-program based CNC fragment machine is adopted, and in case of 3-D shape of sculpture, 3D-MAX program based CNC fragment machine is adopted. Fig. 9 describes in detail the characteristics in cumulative fragmenting method for birch plywood using high-tech machines. Herein, the color painting method focuses on the representation of picturesque style using Oriental picture dyes as mentioned above whose detailed results from the experiment are to be introduced by stage.

Fig. 6 accounts for the color painting method using Oriental picture dyes by stage of the experiment.

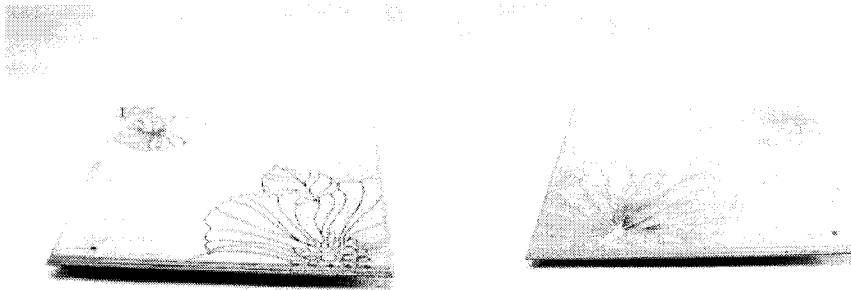


Fig.6. Coloring process based on a laser knife and oriental pigments.

Products, colored by oriental pigments, attracted viewers' positive reactions at the exhibition and also they were directly sold to consumers and with success. Acrylic paint-based coloring was focused on bookcases and desks for children who are fond of 'environment-friendly' and as a result they were successively sold. 'Fig. 5' shows those products.

CONCLUSION

To sum up, the reasons why white birch veneers have been remarkably used in recent times are concluded as in the following.

First, a white birch veneer has the functional merits of veneers as well as the functional merits of natural trees and therefore it has high economical efficiency.

Second, the laminar structure of a white birch has can be variously designed by sculptural art.

Lastly, the product, produced by combining a white birch veneer with coloring technique, incites consumers to purchase it.

Various designs should be methodologically tested in order that white birch veneers may maximally exhibit its value. It is because the variety of design should be secured, the same as the increase of output, so that it can be advanced in the market economy. In white birch veneers, laminar sculpture is likely to vary depending upon sculpturing machine, sculptured outline. Likewise, coloring techniques vary depending upon such things.

Cases of laminar sculptures, presented in this study, are judged to be suitable to show off the fanciness of furniture or articles. Also, those sculptures may be varied through concrete and multilateral studies. It is confirmed that various experiments, performed during this study, proved the possibility that furniture and interior decorations can be differentiated from normal things by combining white birch veneers with new pigments. Furthermore, the related study should be more precisely performed so as to introduce coloring techniques, based on Oriental pigments or environment-friendly paints, into real production.

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