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A Comparative Study of Indigo Dyes and Dyeing in 19th Century Korea and England

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Abstract

This paper is a comparative analysis of the 19th century practice of indigo dyes and dyeing in Korea and England. From over hundreds species of indigo plants in the world, it was dyer's knotweed and woad that were cultivated in Korea; however, the only indigo plant grown in England was woad. Indigo dye was produced in the form of damp indigo sediment (jeon) in Korea; however, imported indigo (as a main dye) and couched woad (as an additional dye) were indigo dyes used in England. There existed three kinds of indigo vats, the ice vat, ash-water vat, and indigo sediment (jeon) vat, in Korea. The fresh leaves of indigo were used for both the ice vat and ash-water vat. The ice vat was very convenient for preparation, but had a weakness in the inability to produce a very deep shade of blue. The ash-water vat and indigo sediment (jeon) vat were in use for producing a very deep shade of blue. The indigo sediment (jeon) vat was employed presumably only by professional dyers. The indigo vat practiced in England was categorized into two types; one was woad-indigo vat, and the other was an indigo powder vat prepared by using imported indigo rock. There was a tendency to adopt different kinds of indigo vats according to the material to be dyed. The woad-indigo vat was employed for the dyeing of wool. A few of chemical vats with imported indigo were adopted, especially for the dyeing of cotton. Indigo dyers in 19th century Korea were differentiated from the rest of the dyers. They managed the growing of indigo plants as well as the production of indigo sediment (jeon). Woad dyers in 19th century England handled woolen cloth as well as worsted and woolen yarn in general. However, they sometimes dyed silk skein as well. They produced several colors such as black, blue, slates, grays, by using both woad and imported indigo.

Key words: Indigo, Dyes and dyeing, Dyer's knotweed, Woad, Indigo dyer

I. Introduction

Indigo is the only plant to be dyed into fast blue in human history. Many countries have an indigenous indigo dyeing tradition and Korea also shares the long history of indigo dyeing. Especially in Joseon Korea (1392-1910), indigo was one of the most important dye plants, and the blue obtained from the plant was valued by people of all classes. In England, woad was an important plant that produced a blue color. Woad is believed to have been the source of the dye which the ancient Celts used to paint themselves to strengthen their fighting spirit as well as to frighten their enemy in battle (Carr, 2005).

Recent researches on indigo dyes and dyeing have been widely conducted by specialists in the field of archeology, anthropology, agriculture, chemistry, biology, and textiles. However, historical approaches are still in their early stage both in Korea and in England. Some studies have been conducted through the use of historical sources (Balfour-Paul, 2006; Betty, 1978; Carr, 2005; Cho, 2007; Diadick Casselman, 2009; Edmonds, 1998, 2002; Fairlie, 1965; Kim, 2008; Lee,

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1983; Mellor & Cardwell, 1963; Peacock, 2006; Wills, 1979). However, comparative studies of different cultural areas are limited. A comparison can be a useful tool to understand the regional dyeing tradition in the geography of the world; though it may be premature to compare different cultural areas at a specific point where sufficient outcomes in the history of dyes and dyeing have not yet been accumulated in each nation.

The purpose of this study is to improve a mutual understanding of the history of indigo dyes and dyeing in Korea and England. The paper focused on the indigo dyeing culture located within 19th century workshop system. The 19th century was the last era when natural indigo dyes were in popular use in both countries and the current revival of indigo dyeing is based on a 19th century workshop tradition. In some cases, the present practice was also investigated in order to see the changes in the tradition. This study starts with questions on what kinds of indigo plants grew and how they were cultivated in Korea and in England. Then the paper compares the method of how the indigo plants were produced into dyes and what indigo vats were used in each country. Finally, it examines who were the indigo dyers and how they managed their works.

This study was conducted through a literature review and field research. For Korean resources, three agricultural documentations, including 『Haedong Nongseo (海東農書)』 (Seo, 1798-99/1981), 『Yimwon Geongjeji (林園經濟志)』 (Seo, 1842-45/1983), 『Hanguk Toji Nongsan Josa Bogo (韓國土地農產調査報告)』 (Nongsangmuseong, 1906), and two practical encyclopedic publications, each titled 『Gyuhap Chongseo (閨閤叢書)』 (Yi, 1809/1975) and 『Oju Yeonmun Jangjeon Sango (五洲衍文長箋散稿)』 (Yi, 1800-63/1959), were mainly examined. For English resources, two agricultural reports, written by Young (1799/1970) and Marshall (1809/1969), and four practical treatises on dyeing, written by Packer (1816), Tucker (1817), Love (1854), and Hummel (1885), were investigated. Some workshops, including 'Indigonara' in Gwacheon, 'Woad Centre' in Norfolk, and 'Vauxhall City Farm' in London, were visited to understand current practices on the growing of indigo plant and dyeing.

II. Indigo Plants and Cultivation

1. Indigo Plants

Of the over hundreds species of indigo-producing plants all over the world, this paper explores dyer's knotweed (Polygonum tinctorium L.) and woad (Isatis tinctoria L.), because these two species were cultivated in Korea, and especially woad was the only indigo plant grown in England.

According to 『Haedong Nongseo』 (Seo, 1798-99/1981), the leaves of dyer's knotweed (yoram: 蓼藍), similar to those of a water pepper, were used for dyeing light blue, and the leaves of woad (sungram: 崧藍 or cheongdae: 靑黛), similar to those of a lettuce, were used for preparing indigo sediment (jeon: 靛). The accounts in 『Gyuhap Chongseo』 (Yi, 1809/1975) show that there existed two variations within the dyer's knotweed species. One was the superior, whose leaves were rounder and thicker; the other was the inferior, whose leaves were pointed and thinner. <Fig. 1>-<Fig. 2> show both variations of the dyer's knotweed. Dyer's knotweed is easily found in dyers' farms; however, woad is hardly found in modern South Korea. For the past few years, this author has tried to find Korean woad seeds and was able to acquire some seeds from the Korean National Seed Bank. The Korean woad is in the process of experimental cultivation (Fig. 3).

Since ancient times, woad was the main plant in England to provide a dye that produced a blue color. However, the role of woad as a dyestuff dramatically changed with the arrival of Indian, Javan, and American indigo. The value of the imported indigo was known to dyers at least in the first half of the 16th century. The use of it was partly permitted during the second half of the 16th and the first half of the 17th century. The use of imported indigo was officially permitted in the late 17th century. Consequently, imported indigo surpassed the role of woad (Balfour-Paul, 2006).

Although woad changed from a main coloring material to an assistant one in the indigo vat, it was believed to be an indispensable article for English dyers. Therefore it was persistently cultivated by woad

Fig. 1. Dyer's knotweed with the oval-shaped leaves, cultivated in Indigonara, Gwacheon.
Photographed by author (Aug. 1, 2008)

Fig. 2. Dyer's knotweed with the pointed leaves, cultivated in Indigonara, Gwacheon.
Photographed by author (Aug. 1, 2008)

Fig. 3. Korean woad in the first year, cultivated in Indigonara, Gwacheon.
Photographed by author (Jan. 23, 2010)

growers. Woad was grown near Bedfordshire, Somerset, and around the Fens in the late 17th to 19th century (Fiennes, 1694/1995; Marshall, 1809/1969; Wills, 1979; Young, 1799/1970). English woad is now commercially being cultivated by Mr. Howard in Norfolk (Fig. 4). A small amount of English woad is also grown in a dyers' garden in London (Fig. 5).

Fig. 4. English woad in the first year, cultivated in Woad Centre, Norfolk.
Photographed by author (Nov. 23, 2008)

Fig. 5. English woad in the second year, cultivated in Vauxhall City Farm, London.
Photographed by author (Mar. 28, 2009)

2. Cultivation Process

The cultivation process of dyer's knotweed (yoram) and Korean woad (sungram) was outlined in agricultural documentations published during the late 18th and the 19th century (Table 1).

In the case of dyer's knotweed, the main process was as follows: sowing in April, pricking out in June, cropping the leaves in August, and collecting the seeds in September. Dyer's knotweed is now being cultivated in several provinces, including Gyeonggi-do (the west center of Korea), Jeolla-do (the south west of Korea) and Gyeongsang-do (the south east of Korea). Two of the growers in Jeolla-do were officially designated by the Korean government as 'an intangible national cultural heritage specialized in dyeing'. The present process of growing dyer's knotweed is quite similar to the original process. However, if the grower wants to crop the leaves twice during the summer, it is recommended that each pro-

Table 1. The cultivation process of dyer's knotweed and woad in Korea

Species / Season	Dyer's knotweed (yoram)	Korean woad (sungram)
April	· Sowing, harrowing, covering the soil with reed mat · Watering every morning · Getting rid of the mat after germination	· Sowing and harrowing · Providing the soil with the ash and manure after sowing · Pricking out when it grows 2chi (about 6cm)
June	· Pricking out with an interval of 5 chi (about 15cm) between holes when it grows 4 or 5 chi (about 12~15cm) · Watering and providing the soil with manure after pricking out	· Cropping the first leaves, cutting them at the point of 2~3chi (about 6~9cm) from the ground after waiting for the leaves thickening · Making the first indigo sediment (dujeon)
August	· Cropping the leaves	· Providing the plant with manure
September	· Collecting the seeds	· Cropping the second leaves and making the second indigo sediment (yijeon) · Possible to make the third indigo sediment after making yijeon
Sources	Yu (1766/2003), Seo (1798-99/1981)	Yu (1766/2003), Seo (1842-45/1983)

Chi means Korean inch (1chi= about 3.03cm).

cess of sowing and pricking out should be conducted about one month earlier (Kim, 2008).

As with dyer's knotweed, Korean woad was sown in April. But the first leaves of woad were already ready to be gathered and were prepared for the making of the first indigo sediment (dujeon: 頭靛) in June. Whereas dyer's knotweed was cropped once, woad was cropped twice or three times in a year. The leaves of woad, which belongs to a biennial herb, grow quicker and last longer than those of dyer's knotweed.

The cultivation process of English woad during the late 18th and the early 19th century was written in the reports by Young (1799/1970) and Marshall (1809/1969) (Table 2). Though each process was slightly different depending on the location, the outline of the process was summarized as follows: plowing during winter, sowing from March to June, weeding and

Table 2. The cultivation process of woad in England

Region / Season	Near Boston, Lincolnshire	Keynsham, North Sommerset
February	· Plowing	· The first plowing in winter · The second plowing and forming the ridges in the spring
March	· Sowing and harrowing from the middle March to the middle May in order to vary the time of cropping	
April		· The third plowing
May	· Starting weeding, twice before the first cropping and once after	· The last plowing just before sowing in May or June, sorrowing after each plowing · Germination in 14 days · Hoeing in 2~3 weeks in order to weed and thin to the distance of 6 inches at least
July	· Cropping the first leaves when they grow about 8 inches (but three weeks sooner in the centre of the Kingdom owing to the land being warmer)	· Cropping when the first change of color was found at the end of the leaves · Possible to crop 3 or 4 times, but the first and second one is the best
August	· Cropping the second leaves six weeks after the first	· Leaving some plants after the first or second crop for seeding if needed
Sources	Young (1799/1970)	Marshall (1809/1969)

thinning before and after the first crop, cropping the first leaves in June, cropping the second leaves in August, and leaving some plants after the first or second crop for seeding. The major process of the cultivation (especially the method practiced in Lincolnshire) was similar to one conducted by Mr. Howard, a woad grower/dyer in Norfolk. The difference is that Mr. Howard uses herbicides instead of the hand-weeding. In addition, he sows once in April and crops twice in late August and in October (an interview with Mr. Howard at the Woad Centre in Nov. 22, 2008). Each process of his growing seems to proceed one month later than the method of late 18th century Lincolnshire.

Pricking out was not practiced in England compared to woad growing in Korea. Instead, hoeing and thinning were conducted to space the plants far enough from each other. In addition, Korean woad was sown once in April, which seems similar to the current method of Mr. Howard in Norfolk. English woad used to be sown from March to June. This successive sowing was conducted to vary the time of cropping. In England, the cultivation of woad was practiced for producing the dye and for breaking in grasslands so as to make them later suitable for main crops, such as oat, cole, wheat, and beans (Marshall, 1809/1969; Young, 1799/1970). Probably, English woad growers could afford to use the wide area of grass lands as arable land. Therefore, they would have partitioned the land into several quarters and sowed the seeds in a successive method.

III. Indigo Dye and Indigo Vat

1. Indigo Dye

For all species of indigo plants, the first step is to extract the 'coloring ingredient' from the plant if it is to be used as a dye. <Fig. 6> illustrates the transformation from dye-plant to dye and its application to the dye vat. Both dye-plant and dye were adopted for the indigo vat in Korea (process A, B, C). But only dyes were employed in England (process D, E). Looking at the form of indigo dyes, the Korean type was indigo sediment (jeon) and English type was woad ball (or couched woad) and indigo rock (or powder) imported from the tropical regions of India, Java, and the Americas.

According to 『Haedong Nongseo』 (Seo, 1798-99/1981) and 『Ymwon Geongjaeji』 (Seo, 1842-45/1983), the making of indigo sediment (jeon) was summarized as follows. The leaves and the stems of woad are dipped into a pot. The slaked lime (haphoi: 蛤灰) made from clam shells is added to the pot. They are left to soak for one day. When the liquid turns yellow, the stems are taken off. The liquid is stirred with a wood rake. When the color of the liquid changes from pale blue (buncheong-saek: 粉青色) to deep reddish blue (jahwa-saek: 紫花色), the water is poured out and the indigo sediment (jeon) remains.

The slaked lime made from seashells is called paebun (貝粉) today. It is still produced in Jeolla-do province. Although limestone was another source for the

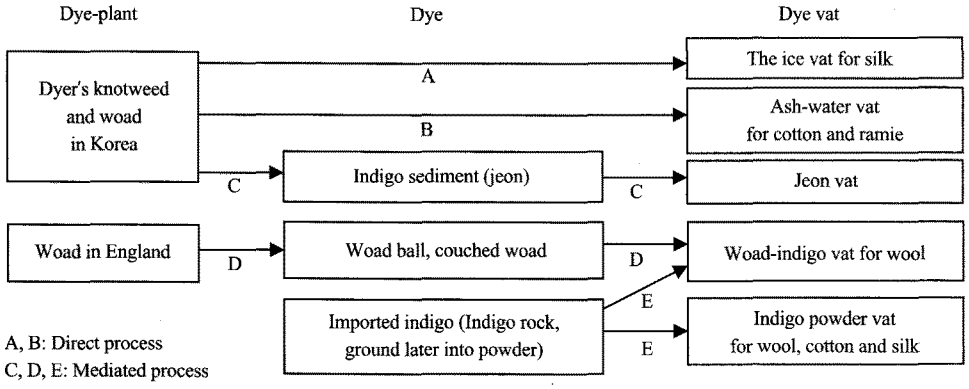

Fig. 6. The transformation from dye-plant to dye and its application to the dye vat.

slaked lime prior the second half of the 18th century (Kim, 2008), nobody uses it anymore. The geography of the Korea peninsula is abundant in both limestone and seashells. However, shells would have been easily obtained rather than limestone that needs access to mineral rights and capital for investment in mining facilities. Indigo sediment shown in <Fig. 7> was obtained from the addition of the slaked lime made from seashells.

There existed two kinds of indigo dyes in 19th century England: one was the imported indigo as the main dye and the other was woad ball (or couched woad) as an assistant colorant. A treatise authored by Partridge (1823/1973) introduced the making of woad dye as practiced by a master English dyer. According to the method of Mr. Parish, woad was carried to the mill when gathered; it was then ground and cut into the small leaves that were thrown into heaps to ferment and develop an adhesive consistence. The heaps were then formed into balls as compact as possible and placed on hurdles in a shed. After the balls were dry they were so hard and compact that a mallet was needed to break them and then put into a heap again that was watered to a due degree. When the couch had attained its due point, it was opened, spread, and turned, until regularly cooled so that it could be considered in condition for sale.

The process of the making of woad ball and couched woad as shown above, was similarly illustrated in the reports by Young (1799/1970) and Marshall (1809/1969). Sometimes, not couched woad, but dried woad balls were sold to dyers (Marshall, 1809/1969). Some dyers would have been experts in dye manufacturing as well as dyeing because in this case, the couching process needed to be performed by dyers. The present practice in England does not seem to use the form of woad ball any more and only a few of dyers make a woad ball for research purposes (Fig. 8). The majority of dyers use fresh woad leaves or indigo pigment extracted from woad (Fig. 9).

Dyer's knotweed and woad are the species that contain less coloring matter in comparison to tropical indigofera species. It is very hard to get a pure status of coloring matter only by air oxidization. Therefore, the coloring matter was obtained as the form of indigo sediment with slaked lime in Korea and as the form of a woad ball in England. While indigo sediment is still being used in Korea, the woad ball is scarcely used for an indigo vat in England. Instead of a woad ball, indigo pigment extracted from woad is produced in England. Because of its purity, the powder

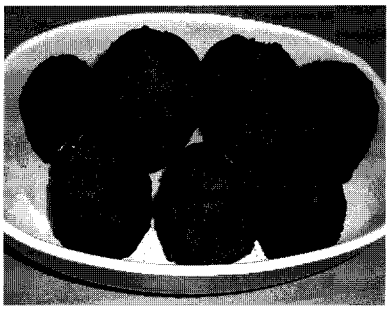

Fig. 8. Dried woad ball, made by Howard, I. in Woad Centre, Norfolk.
Photographed by author (Nov. 23, 2008)

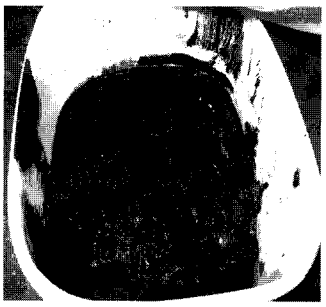

Fig. 7. Damp indigo sediment (jeon), produced by Kim, S. D. in Indigonara, Gwacheon.
Photographed by author (Aug. 1, 2008)

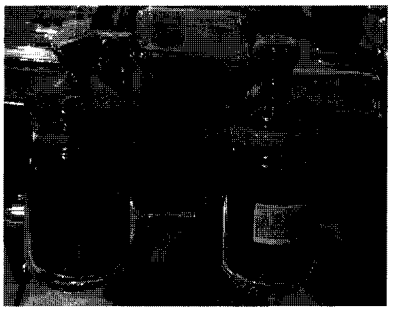

Fig. 9. Indigo pigment extracted from woad, produced by Howard, I. in Woad Centre, Norfolk.
Photographed by author (Nov. 23, 2008)

form can be a practical product for application in a wide range of uses. The powder form of indigo would have been familiar to English dyers because the imported indigo (traded in the form of a rock or cake) had to be ground into powder before it was added to an indigo vat.

2. Indigo Vat

In 19th century Korea, there existed three kinds of indigo vats, the ice vat, ash-water vat, and indigo sediment (jeon) vat. All of these vats are still in practice by some dyers in Korea. The pictures shown in <Fig. 10>–<Fig. 11> are an ice vat and an indigo sediment (jeon) vat, used by Mr. Kim in Indigonara, Gwacheon.

The ice vat is characterized by the use of the fresh leaves and ice water. Therefore, this vat was adopted during a specific season (normally summer) when dyers could crop the fresh leaves of indigo. Ice was an essential material to keep the vat cool and it was possible for people to obtain ice in the summer from ice storage facilities (dongbing-go: 東氷庫 and seobing-go: 西氷庫) managed by the government (Seo & Sim, 1808/1971). The ice vat was one of the most preferred indigo vats because of its simplicity. But it was employed only for the dyeing of very light blue (oksaek: 玉色), light blue (yeonnam: 軟藍), and deep blue (jinnam: 眞藍) on silk material. Light blue was obtained from the diluted indigo vat through the use of a large amount of ice water. Deep blue could be obtained from the undiluted indigo vat and the subsequent rinsing in ice water. Very light blue could be obtained at the end status of the dyeing process (Yi, 1809/1975). Ice would have been a catalyst for dissolving oxygen in the vat and the creation of a more vivid blue color (Cho, 2007).

Fig. 10. The ice vat practiced by Kim, S. D. in Indigonara, Gwacheon.
Photographed by author (Aug. 1, 2008)

Fig. 11. Cold indigo sediment (jeon) vat managed by Kim, S. D. in Indigonara, Gwacheon.
Photographed by author (Aug. 1, 2008)

The ash-water vat was also popular for the dyeing of cotton and ramie. The blue color obtained from the ash-water vat was known as banmul. Very deep blue (acheong: 鴉青 or yacheong), almost like black, could be obtained after eight times of dipping in this vat. The ash-water vat was prepared as follows. The fresh leaves are put into the pot with water. Some indigo stems are added to the product and a stone is laid on the surface to keep the mixture submerged. The liquid is drained off one to three days later. Ash water made from wild spinach (myeongaju) or wormwood (ssuk) is added. The liquid is stirred for around three days until a 'bubble flower' appears (Yi, 1809/1975; Seo, 1842-45/1983).

The rationale for all the various methods used for dyeing with natural indigo is the same: to work with soluble forms of dye. This can be done either by dyeing with 'indoxyl' before it oxidizes into indigo or by reducing the insoluble indigo to soluble 'leuco-indigo' in an alkaline medium (Cardon, 2007). The ice vat uses the reaction of indoxyl and the ash-water vat uses the reaction of leuco-indigo.

In regards to the indigo sediment (jeon) vat, the fermentation technique was described as follows. To dye with jeon, the jeon flower floats on the surface at first and it precipitates to the bottom of a pot. Then, in the case of one big pot, a cup of unpasteurized dis-

tilled rice liquor (soju: 燒酒) is added. The jeon appears when the pot is tilted with the help of an assistant. Good honey is also used if soju is unavailable. Soju or honey can be replaced by high density unrefined rice wine (takju: 濁酒) or refined rice wine (cheongju: 淸酒). Cover the surface with wheat powder and wait for the results. The fermentation and 'rising up' of the liquid is due to the effort to avoid 'cold' and 'illness' (Yi, 1800-63/1959).

The details of the fermentation process did not follow the right order, as this account was not written by a dyer, but only an observer. It seems like a mixed description of jeon dye manufacturing and jeon vat preparation. While the fermenting agents, such as rice wine or honey, were added to the jeon vat, there was no mention on the fermenting agents for an ash-water vat. It must have been more difficult to ferment a jeon vat than an ash-water vat. The dyeing process in a jeon vat was not written in detail. It contrasts with the fact that the making of jeon was illustrated in such fine detail that it continued to be mentioned in several agricultural books published in Korea during the 17th to 19th centuries (Kim, 2008). It might have been unnecessary to mention the dyeing process in the jeon vat, because the principle was the same as that of the ash-water vat. Otherwise, the jeon vat might have been employed only by professional dyers that considered the dyeing technique has a sort of 'trade secret'.

As regards the indigo vat practiced in 19th century England, several recipes were found (Hummel, 1885; Love, 1854; Packer, 1816; Tucker, 1817). Imported indigo had been used as the main colorant for indigo vat since 17th century England and there remained no 'pure woad vats' in 19th century England. Woad played the part of a dyeing assistant for an indigo vat for wool. The English Indigo vat was categorized into two types; one was a woad-indigo vat and the other was an indigo powder vat. The imported indigo was also put to good use as the form of 'indigo extract' (Saxon blue, chemic blue, and indigo carmine) for the dyeing of wool and silk or 'solution of indigo' for penciling printed cotton (Hummel, 1885; Packer, 1816). However, these forms of indigo were excluded from the investigation of this study as they followed a different principle in dyeing and had nothing to do with woad.

It is found that there was a tendency to adopt a different kind of indigo vat according to the materials to be dyed (Table 3).

For the dyeing of wool, the woad-indigo vat was popularly employed as it was believed that potash could injure the quality of the wool (Partridge, 1834). Couched woad, ground indigo powder, slaked lime,

Table 3. Indigo vats employed in 19th century England

Indigo vat / Fabric	Indigo vat in the early to the mid 19th century	Indigo vat in the late 19th century
Wool	· Woad-indigo vat: woad, prepared indigo (potash, madder, bran, indigo ground, lixivium of lime), slaked lime, madder, bran · Potash vat: indigo, potash (or pearl ash), madder, bran · Urine vat: indigo, urine, alum, tartar	· Woad-indigo vat: woad, indigo, slaked lime, madder, bran · Potash vat: indigo, carbonate of potash, madder, bran · Soda vat (German vat): indigo, carbonate of soda crystals, slaked lime, bran · Urine vat: indigo, stale urine, common salt, madder · Hydrosulphite vat: indigo, milk of lime, neutral hyposulphite
Silk	· Pearl ash vat: indigo, pearl ash, madder, bran	· Not use lime in the vat for silk · Soda or potash vat · Hydrosulphite vat · Zinc powder and ammonia vat
Cotton and linen	· Cold indigo vat: indigo, lime, potash (or soda, or pearl ash), copperas, bran · Another cold blue vat for linen and cotton: indigo, lime, copperas	· Ferrous sulphate vat (lime and copperas vat): indigo, milk of lime, ferrous sulphate · Zinc powder vat: indigo, slaked lime, zinc powder · Hydrosulphite vat: same as for wool, but in cold condition
Sources	Packer (1816), Tucker (1817), Love (1854)	Hummel (1885)

madder, and bran were the main ingredients for the woad-indigo vat. In some cases, the potash (or pearl ash or soda) vat normally employed in the vat for silk was also used for wool. Only indigo powder played the part of a dye in the potash vat and potash (or pearl ash or soda) acted as an alkali instead of the slaked lime in this vat. A urine vat was also used for wool. The urine vat consisted of indigo powder, stale urine, and alum. Stale urine was known to be a natural weak alkaline liquid which had an abundant of nutrients indispensible for natural fermentation. Besides these three kinds of vats for wool, a hydrosulphite vat was applied for the dyeing of wool in the 1880s. The hydrosulphite vat was the only chemical vat applied for wool. The chemical vat refers to the vat in which chemicals such as hydrosulphite, zinc, or ferrous sulphate are added as a reducing agent.

For the dyeing of silk, a potash (or pearl ash or soda) vat was employed. It was important not to use lime in the vat for silk, as lime makes the silk harsh and brittle (Hummel, 1885). Chemical vats such as the hyrosulphite vat and zinc powder-ammonia vat were also used for the dyeing of silk in the late 19th century.

For the dyeing of cotton, there existed three kinds of chemical vats. Since the 18th century, European scientists had sought a quicker and more controllable condition in the process of reducing indigo through the use of chemical reactions. At first, various chemical vat processes were adopted by cotton dyers and calico printers (Cardon, 2007). A ferrous sulphate vat was one of the most commonly employed methods for the dyeing of cotton in 19th century England (Hummel, 1885). It was also called the 'cold indigo vat' or 'lime and copperas vat'. The vat was comprised of indigo powder, lime, potash (or soda or pearl ash), and copperas. Copperas is a compound substance containing iron in a state of black oxide and oil of vitriol in which the iron was dissolved (Partridge, 1834). Sulphate of iron was vulgarly called copperas (Packer, 1816). Bran was sometimes added in the vat to facilitate reducing process.

In the late 19th century, the zinc powder vat was also frequently employed for the dyeing of cotton (Hummel, 1885). This vat consisted of indigo powder, slaked lime, and zinc powder. The hydrosulphite vat, invented in 1870 and still most commonly used for both synthetic and natural indigo vats (Cardon, 2007), consisted of indigo powder, milk of lime, and neutral hydrosulphite.

Unlike the vats for the dyeing of wool or silk, the chemical vats for cotton were not heated and called cold indigo vats. Pearl ash vat for silk was kept in a degree of hand heat (Tucker, 1817) and the woad-indigo vat for wool was handled at around 50°C (Hummel, 1885; Partridge, 1823/1973). Today, one woad vat consists of woad pigment, calcium hydroxide, and sodium hydrosulphite, and it is kept at 80°C for wool (an interview with Mr. Howard, in Nov. 23, 2008). The picture shown in <Fig. 12> is a warm woad vat managed by Mr. Howard in Woad Centre, Norfolk. The other consists of fresh woad leaves, household ammonia, and sodium hydrosulphite, and is kept at 50°C (a recipe practiced by Walsh, P. in Vauxhall City Farm).

Dyeing methods are inevitably related to the properties of the material to be dyed. Koreans commonly used cotton and silk material for their clothes, while English people used wool. Compared to wool, cotton and silk are less damaged by alkaline liquid and easily dyed in cool conditions. Wool is susceptible to alkalinity treatments and needs a higher temperature because of the waterproof properties. This is why English dyers adopted a warm vat or urine vat for wool.

Since the late 18th century, dyeing in England was forced to keep pace with the textile industry, especially in the cotton industry. It would have been inev-

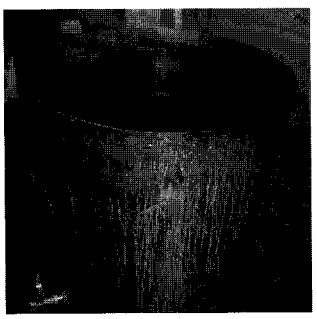

Fig. 12. Warm woad vat managed by Howard, I. in Woad Centre, Norfolk.
Photographed by author (Nov. 23, 2008)

itable to use chemicals in the dye vat to shorten the process of fermentation. The hydrosulphite vat (one of 19th century chemical vats) is still in general use for indigo dyeing in England and it seems to have become a traditional English method of indigo dyeing. Unlike England the chemical vat was not used in Korea. Though synthetic dyes and various kinds of chemicals produced in Europe were imported in large amounts and were in popular use in late 19th century Korea, there was no sign of adopting chemicals for the indigo vat. Indigo dyers maintained a conventional style of indigo vat at least until the 1900s (Nongsangmuseong, 1906).

IV. Indigo Dyer

As with weaving and sewing, general dyeing in Korea had been conducted by housewives of all classes for the purpose of self-sufficiency and as an odd job. However, large amounts of materials have been usually dyed by professional dyers. They were male and female artisans who belonged to the middle class (yangin: 良人) of society (Kim, 2010). Their customers were (in most cases) government officials and merchants. They received the money or dyestuffs in advance from their customers and produced the products. Normally dyers purchased the needed dyestuffs themselves. However, they were sometimes provided with dyestuffs when the order was related to the color red or purple, because the dyestuffs, safflower (honghwa: 紅花) and gromwell (gicho: 芝草) were very expensive compared to other dyestuffs (Archives on accounts of cotton and silk merchants held in Gyeongdo University, 1881-94; Takjibu, 1876-79). Not only did they dye the raw materials, such as skein, cotton, leather, paper, textiles, they also re-dyed old clothing. Sometimes they washed the clothes as well, especially when they re-dyed them (Takjibu, 1876-79).

It is not clear how many dyeing branches were in 19th century Korea. But there had existed special branches, such as dyers handling red (hongyeom-jang: 紅染匠), dyers handling blue (cheongyeom-jang: 靑染匠) and dyers handling the rest of dyestuffs (choyeom-jang: 草染匠), in the earlier period of Joseon Korea (King Seongjong, 1485/1985). Dyers specialized in indigo dyeing (yeomnam-jang: 染藍匠) still remained until the end of 19th century (Kim, 2010). Indigo dyeing is differentiated from other types of dyeing, in terms of vat preparation. This is probably why indigo dyeing specialists were needed. Indigo dyers printed their hand prints with indigo flowers (jeonhwa: 靛花, the scum appeared on the surface of indigo vat) on the wall of their workshop, in order to signify their branches (Yu, 1830/1956). Indigo dyers managed the growing of indigo plants as well as the production of indigo sediment (Kim, 2010).

Indigo sediment (jeon) produced by indigo dyers were traded in the markets. The products produced in Seoul, Buyeo, Haeju, and Pyeongyang, were evaluated high in quality (Yi, 1800-63/1959). There were also two kinds of imported indigo sediment, called dried indigo sediment (geonram: 乾藍) and damp indigo sediment (suram: 水藍), in 1880s (Joseonguk Haegwan Semok: 朝鮮國海關稅目, 1883). Both of these were imported from Japan. Japanese sukumo and synthetic indigo were also traded in 1900s Korea (Gwanbo: 官報, 1908-09).

There were special traders called hwapi-jeon (樺皮廛) in 19th century Korea. Hwapi-jeon dealt with various coloring materials. Hwapi (樺皮) refers to the bark of a white birch. The naming of hwapi-jeon originated from the use of hwapi for the purpose of wrapping coloring materials. They had belonged to a group of official merchants (sijeon: 市廛) who acquired a privilege from the government to operate a monopoly. But they were no longer exclusive merchants in the 19th century, because free commercial trading had commenced in the 18th century. Miscellaneous goods merchants (sang-jeon: 床廛) and medicine traders (yakguk: 藥局) were the main competitors of hwapi-jeon merchants. Dyers purchased varying types of dyestuffs and mordant from those merchants in the 19th century (Kim, 2010).

In preindustrial England, dyeing had been conducted under the strict control of a master dyer and under the supervision of a guild organization. But during the 18th century, small-scale dyeing in workshops began to undergo notable changes. There was an attempt to centralize the skills of the craftsmen in

particular settings (Nieto-Galan, 2001). The process of change was complicated. Resistance to the standard unified model of a centralized factory was common in the textile industry (including dyeing) (Nieto-Galan, 2001). Domestic dyeing activity existed especially in woolen dyeing (Diadick Casselman, 2009).

It is found that several branches of dyeing were distinguished from each other in the first half of the 19th century. Depending on the materials and dyestuffs, the branches were divided into: woolen dyers, worsted and woolen yarn dyers, woad dyers, silk skein dyers, rag dyers (garment dyers), black silk hose dyers, black hat dyers, and so on <Table 4>. Few dyers remained occupied one branch and each of them tended to merge (Packer, 1816). Woad dyers handled woolen cloth and worsted and woolen yarn in general. They sometimes dealt silk skein as well. They produced several colors such as black, blue, slates, and grays, through the use of woad and imported indigo powder.

A few of dyers in London worked only for the shop. They presumably received the orders from the shop and provided their products exclusively. They handled all of woolen, silk, cotton materials, and produced all sorts of colors. These kinds of dyers seem to have enlarged their business during the first half of the 19th century. There were master dyers in London who employed more than twenty men and women in drapers' work only (Love, 1854).

Garment dyers handled new pieces of silk and woolens, and many new goods such as shawls, gauzes, and crapes, which were unsalable due to many causes, including mildew, fading in the drapers' windows, and damage in shipwrecks and fires (Love, 1854). The new pieces of woolen goods to be shrunk came also to the garment dyers (Love, 1854). Garment dyers received work from the warehousemen and drapers who paid a pittance to the dyers. Yet some dyers could keep their carts, and every morning and evening called for orders and brought the work home (Love, 1854).

It was a dry-salter who supplied dyestuff to dyers in 18th century England. English dry-salters traded with indigo, cochineal, madder, alum, ashes, soap,

Table 4. Dyeing branches in 19th century England

Branches (Materials)	Branches (Dyestuffs)	Colors	Notes
Woolen cloth	· Cochineal, indigo · Woad, indigo	· Scarlet, crimson, orange, buff, purple, royal purple · Black, blue · Browns, drabs, stone colors	· Particularly in country
Worsted and woolen yarn	· Cochineal, indigo · Woad, indigo	· Black, blue, slates, grays	
Silk skein	· Cochineal · Woad, indigo	· Black, blue, slates, grays	
Cotton	Adrianople (Turkey red)		
Calico & muslin		· Black / browns, drabs, stone colors	
Garments & furniture			· Rag dyer (or garment dyer), keep shops
Woolen, silk, cotton		· Black / all colors	· In metropolis, to dye only for the shops
Silk hose		· Black	
Bombasines		· Black	
Hats		· Black / fancy colors	
Others			· Fur / chip & straw / feathers / leather / kid leather for shoes and gloves
Sources	Packer (1816), Love (1854)		

copperas, vitriol, lime, bran, urine, cow dung, and vinegar that were presumably bought locally by dyers (Fairlie, 1965). A dry-salter played an important part in the establishment of specialized firms for the making and selling of chemicals for dyeing and printing (Nieto-Galan, 2001).

Compared to Korean dyers, English dyers were elaborately divided into distinct branches in the 19th century. These branches must have been related to the enlargement of the factory system in the textile industry in 19th century England. In spite of the few divisions of dyeing, the existence of indigo dyers in Korea reflects the unique properties of indigo dyeing and implies the large amount of circulation of indigo dyed materials in Korea.

V. Conclusions

This paper compared the 19th century practice for indigo dyes and dyeing in Korea and England. Dyer's knotweed and woad were indigo plants cultivated in Korea and woad was the only indigo plant grown in England. It was common that dyer's knotweed was cropped once and woad was gathered twice or three times during the cropping season. English woad was sown throughout a wider range of the season and less cropped compared to Korean woad. It probably resulted from the different way of the use of arable land and the different condition of climate.

Indigo dye was produced in the form of damp indigo sediment (jeon) in Korea. However, imported indigo rock (ground into powder just before the use) was the main dyestuff for indigo vat in 19th century England. English woad ball (or couched woad) acted as an additional dye for the vat.

There existed three kinds of indigo vats, the ice vat, ash-water vat, and indigo sediment (jeon) vat in Korea. Fresh leaves of indigo were used for both the ice vat and ash-water vat. So these vats were handled only during the season when dyers could crop the fresh leaves of indigo. The ice vat was very convenient in preparation, but had a weakness that it was impossible to obtain a very deep shade of blue. In addition, it could only be employed for the dyeing of silk. The ash-water vat was also confined to the cropping season. However, it was a multipurpose form of vat compared to the ice vat, because it was used for the dyeing of cotton and ramie as well as silk, and it was possible to get very deep shade of blue through repetitive dipping. The indigo sediment (jeon) vat was probably used by professional dyers who needed to operate dyeing business throughout a year.

The indigo vat technique practiced in 19th century England was categorized into two types; one was a woad-indigo vat and the other was indigo powder vat. There was a tendency to adopt different kinds of indigo vats according to the material to be dyed. A woad-indigo vat was employed for the dyeing of wool. Chemical vats with imported indigo were in popular use especially for the dyeing of cotton. Of them, the hydrosulphite vat was to be used for the dyeing of wool and silk as well as for the dyeing of cotton in the late 19th century.

Indigo dyers in 19th century Korea were differentiated from the rest of dyers. They printed their hand prints through the use of indigo flowers on the wall of their workshop, to signify their branches. Indigo dyers managed the growing of indigo plants as well as the production of indigo sediment (jeon). Woad dyers in 19th century England handled woolen cloth and worsted and woolen yarn in general. They sometimes dyed silk skein as well. They produced several colors such as black, blue, slates, and grays, by using both woad and imported indigo.

The historical techniques for natural indigo dyes and dyeing that had been in decline were revitalized as valuable sources of cultural heritage in both Korea and in England. Indigo has become a type of sustainable crop for both dyes and medication. Indigo dyeing has become a recreational activity or educational program as well as an occupation in both countries. A close look at these customs show that with inevitable yet minimal changes and transformations to the tradition, each practice was revived within the local historical context. Korean dyers succeeded the cultivation of dyer's knotweed and chose the commercializing of the indigo sediment (jeon, also called niram today) products. English dyers revived the cultivation of English woad, and adopted the commercializing of indigo pigment made from woad. Indigo dyes

and dyeing in the future would be embodied by adding the established historical reality to their present globalized value.

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