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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

División de Nuevas Creaciones

E. S. D.

**REF: Expediente:
Patente de Invención:**

07-056926

**"METODO PARA TRATAR
FIBRAS CELULOSAS"**

Titular:

AKZO NOBEL N.V.

PRESENTACION PODER

HUMBERTO RUBIO CAMACHO, mayor de edad, identificado con la cédula de ciudadanía No. 17'192.062 de Bogotá, Abogado en ejercicio portador de la Tarjeta Profesional No. 50.007 del Consejo Superior de la Judicatura, actuando en carácter de apoderado de la sociedad **AKZO NOBEL N.V.**, domiciliada en Arnhem, Países Bajos; conforme al poder que para todos los asuntos de Propiedad Industrial me ha conferido la citada sociedad y cuya copia auténtica se encuentra anexa al Expediente No. **05-098.940**, en forma respetuosa manifiesto y solicito a su Despacho:

- 1.- Que sea reconocido como apoderado de la sociedad **AKZO NOBEL N.V.**, dentro del proceso citado en la referencia; conforme al poder otorgado a mi favor el cual se encuentra extendido en forma legal, junto con el certificado notarial que acredita la existencia y representación legal de la sociedad peticionaria, legalizados por el sistema de Apostille, con traducción oficial del idioma Inglés al Español, avalado por el Ministerio de Relaciones Exteriores de Colombia.
- 2.- Como consecuencia de lo anterior y una vez me sea reconocida la personería respectiva, en forma respetuosa solicito a su Despacho, que al momento de proferir cualquier decisión sea notificada al suscrito.

Anexo fotocopia simple de los documentos mencionados al inicio del presente respetuoso memorial, fotocopia autenticada reposa en el Expediente No. **05-098.940**

Atentamente,

HUMBERTO RUBIO CAMACHO
C.C. 17'192.062 de Bogotá
T.P. 50.007 Consejo Superior
de la Judicatura
COD 4134

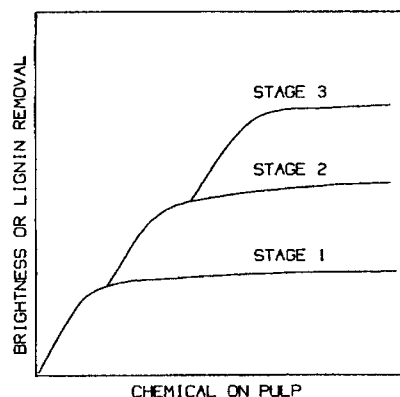


Fig. 5-3. Hypothetical increased brightness vs. chemical usage for three stages of bleaching.

cupriethylenediamine solution and measuring the viscosity of the solution (TAPPI Standards T 254 and T 230). See Section 6.3 for more detail.

Full chemical pulp bleaching

Chemical pulp bleaching is accomplished with various compounds containing chlorine or oxygen and alkali extractions in several stages. Fig. 5-3 indicates why several stages with different compounds are used. The use of three to seven stages increases the efficiency of bleaching by reducing the amount of chemical required. This is due to the complex nature of lignin; each bleaching chemical is going to react differently with lignin. Since lignin is a complex molecule with different types of linkages, the use of different chemicals will break various types of bonds. For example, a large increase in brightness is achieved by using relatively small amounts of ClO_2 in a later stage that could only be achieved using massive amounts of chlorine in stage 1; use of large amounts of chlorine in stage 1 would also cause much carbohydrate degradation. Plate 20 shows handsheets made from pulp at various stages of the bleaching process. Plate 21 shows several washers of a four stage bleach plant.

Since chemical pulps are dark to begin with, bleaching increases brightness up to 70% with a maximum brightness of about 92%. Unlike

bleached mechanical pulps, the high brightness is stable since the lignin is removed. Bleached chemical pulps are insensitive to color reversion, but high temperatures may induce some color reversion. Lignin removal is accompanied by significant losses of pulp yield and strength of the individual fibers. However, the strength of fiber-fiber bonding increases after bleaching.

Bleaching of chemical pulps involves the use of chemicals which are more specific to lignin removal than to carbohydrate degradation compared with the chemicals used in pulping. If this were not true, one could simply continue the pulping process in order to remove more lignin. On the other hand, bleaching is much more expensive than pulping for a given amount of lignin removal. Within the range of useable bleaching chemicals, some are very specific to lignin removal while others are much less specific and cause appreciable carbohydrate degradation and diminished yield. For example, oxygen and chlorine are relatively inexpensive, but not particularly selective for lignin removal. These chemicals are used in the early stages of bleaching to remove most of the lignin. Residual lignin is removed in later stages with expensive, but highly selective bleaching agents like chlorine dioxide, hypochlorite, and hydrogen peroxide.

Table 5-1 is a summary of conditions used in various bleaching stages. Bleaching letters are explained below. Typical sequences are CEH to a brightness of 84-86% or CEHD or CEHHD to a brightness of 92%. Fig. 5-4 shows the layout of a CEHDP sequence. Each stage consists of a pump to mix the chemical with the pulp, a retention tower to provide time for the bleaching chemical to react with the pulp (Plate 22), and a washer (Fig. 5-5) to remove the bleaching chemicals and solubilized pulp components. Diffusion washers may also be used (but are much less common) and are similar to those discussed in Chapter 3 in regards to pulp washing.

C stage, Chlorine (Greek *chloros*, greenish yellow)

Normally, chlorine is the first bleaching stage, where unbleached pulp is treated with elemental chlorine, Cl_2 , that is either gaseous or in solution, at a pH of 0.5-1.5. Bleaching is carried out with a pulp consistency of 3-4%, ambient

Table 5-1. Summary of conditions used in various bleaching stages of chemical pulps.

General conditions ↓	C stage	E ₁ stage	H stage	D stage	P stage	O stage
Chemical addition (on pulp)	3-8%	2-3%	2% (as Cl_2)	0.4-0.8%	1-2% Na_2O_2 , Mg^{2+} , silicate	2-3% 0.4-0.8 MPa 60-120 psi Mg^{2+}
Pulp consistency	3-4%	10-18%	4-18%	10-12%	10%	20-30% 10-12%
pH	0.5-1.5	11-12	8-10	3.5-6	8-10	10-12
Temp. °C	20-30°	50-95°	35-45°	60-80°	60-70°	90-110°
Time, hours	0.3-1.5	0.75-1.5	1-5	3-5	2-4	0.3-1.0

temperature since the reaction is quick, and a retention time of 0.3-1.0 hour. Pressurized, upflow reactors are used since the solubility of chlorine in water is low (4 g/L at STP). Chlorine application is 6-8% on softwood kraft pulps or 3-4% on sulfite or hardwood kraft pulps.

Elemental chlorine was the first agent used to chemically bleach cellulose fibers (cotton, not wood) and has been used since shortly after its discovery in 1774 by Scheele. Its large-scale use

commercially for pulp bleaching had to wait until stainless steel was available in the 1930s.

Chlorine is manufactured concomitantly with sodium hydroxide by electrolysis of sodium chloride; since these two chemicals are produced together, one often speaks of the chlor-alkali industry. One method of producing these chemicals is shown in Fig. 5-6. The production of chlorine is summarized as follows:

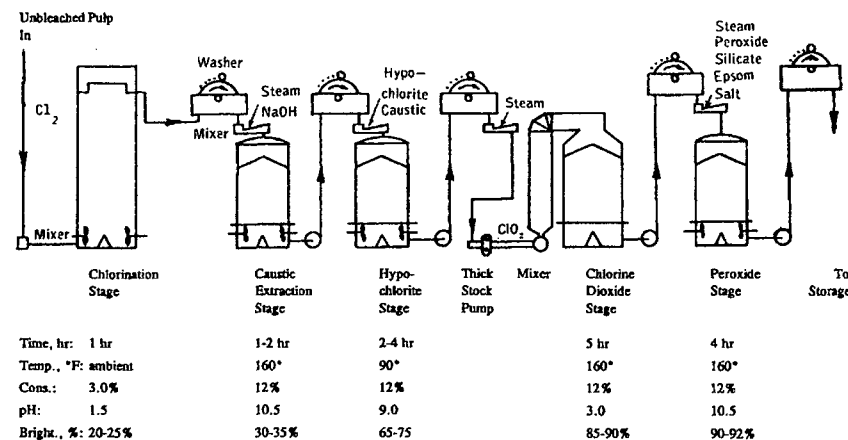


Fig. 5-4. CEHDP sequence used to bleach pulp to 90-92% brightness. Reprinted from *Making Pulp and Paper*, ©1967 Crown Zellerbach Corp., with permission.

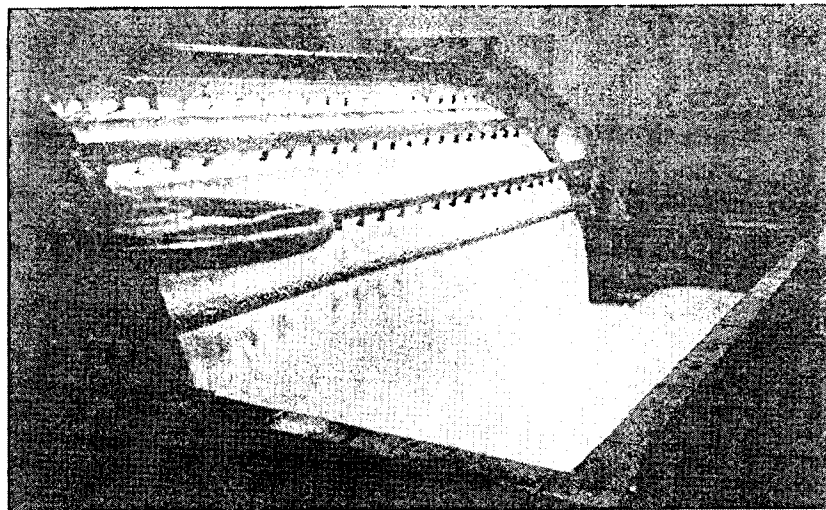


Fig. 5-5. An open, bleach washer of the vacuum drum type. Modern washers are enclosed.

Chlorine is not overly specific to lignin, and much carbohydrate degradation occurs through its use. The chlorine reacts with lignin by *substitution* of hydrogen atoms for chlorine atoms (particularly on the aromatic ring), *oxidation* of lignin moieties to carboxylic acid groups, and, to a small extent, *addition* of chlorine across carbon-carbon double bonds (Fig. 5-7). The substitution reactions (Fig. 5-8) are probably the most important in the ultimate lignin removal.

It has been known for a long time that chlorine is first rapidly depleted by the pulp and then

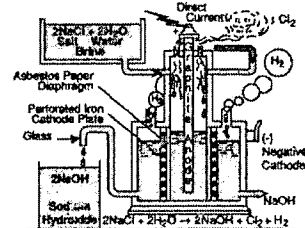


Fig. 5-6. A method of NaOH and Cl₂ manufacture. Redrawn from J. Ainsworth, *Papermaking*, ©1957 Thilmany Paper Co., with permission.

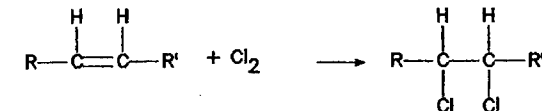
is depleted much more slowly. This indicates several types of reactions are occurring. Fig. 5-9 shows how chlorine reacts with pulp as a function of time. The substitution and addition reactions are much faster than the oxidation reactions and do not leave Cl⁻ in solution, whereas oxidation reactions do. This is the basis for determining the type of reaction occurring.

Oxidation includes reactions with both lignin and carbohydrates. Oxidation of the carbohydrates leads to a decreased cellulose viscosity and decreased pulp strength. The species HClO (Fig. 17.1 shows its formation versus pH) especially contributes to oxidative degradation of the carbohydrates; therefore, chlorination is carried out above pH 0.5 (to avoid acid hydrolysis of cellulose) and below pH 1.5 (to avoid carbohydrate degradation by oxidation). Also sodium hypochlorite bleaching is carried out with excess NaOH to avoid carbohydrate oxidation by HClO. According to Giertz (1951) the actual species causing oxidation may be a complex of hypochlorous acid and hypochlorite ion as the pH of maximum degradation is 6.5 to 7.5 and not 4-5, where hypochlorous is at a maximum (Fig. 17-1).

SUBSTITUTION



ADDITION



OXIDATION

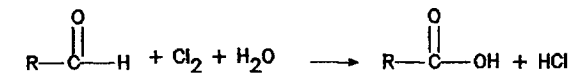


Fig. 5-7. Examples of Cl₂ reactions with lignin. Oxidation reactions occur with both lignin and carbohydrates. In the case of the latter, significant decreases in pulp strength result.

In the past, the amount of chlorine added to pulp was controlled by measuring the residual chlorine after the chlorination stage. In fact it is better to avoid adding excess chlorine, particularly at elevated chlorination temperatures, so that the substitution reactions occur to completion (rapidly), but oxidation reactions are controlled by not allowing residual chlorine to be present. As Fig. 5-9 shows, the oxidation reactions do not increase the amount of lignin removed in the alkali extraction of sulfite pulp; however, this is less true for kraft pulps because of their highly condensed nature (O'Neil, et al, 1962). For the same reason kraft pulps require longer chlorination periods than sulfite pulps, 60-90 minutes versus 15-45 minutes, respectively. The practice of substituting about 10% of Cl₂ with ClO₂ (C₁₀) has been practiced for a long time since it results in a stronger pulp by

avoiding over-chlorination.

Lignin is not removed to a large degree in this stage, and the pulp actually gets darker (with a characteristic orange color). The pulp is diluted to 1% consistency and washed to remove acid which would otherwise consume alkali in the next stage. The lignin removal and brightness increase actually occur in the alkali extraction stage that invariably follows the chlorination stage.

Chlorination produces chlorinated organic materials including a very small amount of dioxin, which has led to the use of other chemicals to replace a part or all of the chlorine use in bleaching (e.g., O and CD bleaching stages). Dioxin and bleaching is discussed in Chapter 11. Many mills have already replaced up to 50% of the Cl₂ with ClO₂. Chlorine-free bleaching sequences are used commercially for sulfite pulps at a few mills.

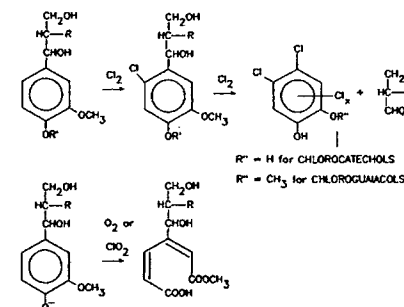


Fig. 5-8. Example reactions of bleaching agents with lignin.

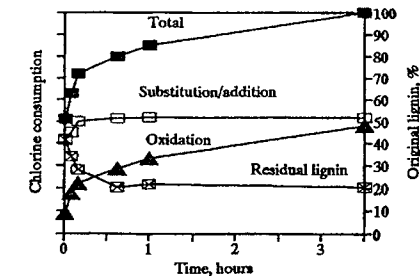


Fig. 5-9. Reaction of excess Cl₂ and sulfite pulp with time. The top 3 curves use the left scale. The bottom curve (right scale) is residual lignin after NaOH extraction. After Giertz (1951).

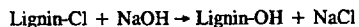
Papers made from these pulps are promoted as "environmentally friendly" or words to that effect. It is difficult to make bright grades of kraft pulps without the use of chlorine, but it is possible if a system is designed specifically for this purpose. The future will bring many changes in this area.

CD stage

The CD or C_D stage is a modification of C stage bleaching, where some of the chlorine is replaced with ClO_2 . ClO_2 acts as a scavenger of chlorine radicals in this stage. Substitution of 10% of the chlorine with chlorine dioxide is used to prevent over chlorination. Substitution of 50% or more of chlorine with chlorine dioxide at many mills is becoming common to reduce production of dioxins and other chlorinated organic chemicals. One problem is that since Cl_2 and NaOH are both derived from electrolysis of NaCl, a slackening in the Cl_2 market will mean much higher NaOH prices. Other industries have taken advantage of excess Cl_2 supplies, such as the polymer industry in the manufacture of polyvinyl chloride and other chlorinated polymers, which has mitigated this effect.

E stage

The E stage is *extraction* of degraded lignin compounds, which would otherwise increase the chemical usage in subsequent bleaching stages, with caustic (NaOH) solution. It follows the C stage and sometimes other stages of bleaching. When it follows the C stage (E_1), it is used at 2-3% on pulp, often with a downflow tower due to the high consistency of pulp (10-18%), with a temperature of 50-95°C (120-200°F), and a reaction time of 0.75 to 1.5 hours. High temperatures and alkali loading up to 5% are used to remove hemicelluloses for dissolving pulps or absorbent pulps. In later E stages, alkali is used at less than 1% on pulp. The alkali displaces chlorine and makes the lignin soluble by reactions such as:



The lignin in the E_1 effluent gives a dark color that is ultimately responsible for much of the color of the final mill effluent. Recently oxygen gas has been incorporated into this stage (0.5% on pulp) at many mills and the term E_0 applies.

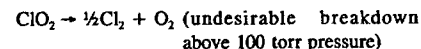
H stage

The H stage consists of bleaching with hypochlorite solution, usually as the sodium salt NaClO; this is the same chemical found in household liquid bleach. This stage is carried out at 4-18% consistency, 35-45°C (95-113°F), 1-5 hours, and pH 10. The process is often controlled by measuring the oxidation-reduction potential. It is important to maintain the pH above 8 because below this pH hypochlorite is in equilibrium with significant amounts of hypochlorous acid (Fig. 17-1), which is a powerful oxidant of carbohydrates, with a E° of 1.63 V. Since the pH is high, lignin is continuously extracted as it is depolymerized. Hypochlorite reacts principally by oxidation. About 1% on wood (based on chlorine) is used. This chemical is more selective than elemental chlorine, but less selective than chlorine dioxide; consequently, the use of hypochlorite has decreased since the advent of chlorine dioxide. Cellulose is oxidized along its chain, forming aldehyde groups and making random cleavage more likely. Calcium hypochlorite was discovered in 1798 by dissolving Cl_2 in an aqueous slurry of calcium hydroxide and was the principal bleaching agent of the industry for a century. Sodium hypochlorite, which is now used since it leads to less scaling, is made from chlorine as follows:



D stage

The D stage involves bleaching with chlorine dioxide. Chlorine dioxide (first studied for pulp bleaching in 1921 by Schmidt and used for commercial pulp bleaching in the mid 1940s) is relatively expensive, but highly selective for lignin. This makes it very useful for the latter bleaching stages where lignin is present in very low concentrations. It is explosive at concentrations above 10 kPa (1.5 psi, or 0.1 atm); hence, it cannot be transported and must be manufactured on site. Its solubility is 6 g/L at 25°C with a partial pressure of 70 mm Hg. It is used at consistencies of 10-12%, 60-80°C (140-176°F), for 3-5 hours at a pH of 3.5-6. It is used at 0.4-0.8% on pulp. Downflow towers are used to decrease the risk of gas accumulation. The D stage is useful for reducing shive contents.



Chlorine dioxide may react in two steps. In the first step ClO_2 is formed; this then reacts under acidic conditions to form $\text{Cl}^\cdot$. Thus, $\text{ClO}_2 \rightarrow \text{ClO}_2^\cdot \rightarrow \text{Cl}^\cdot$. It reacts by oxidation; one reaction is shown in Fig. 5-8.

P stage

Bleaching with hydrogen peroxide, H_2O_2 , is not common for chemical pulps. (But this is changing somewhat as mills look for chlorine-free systems.) It is usually used for brightening mechanical pulps, but when it is used to bleach chemical pulps it appears as the last stage of a sequence such as C-E-H-P or C-E-H-D-P. It is used at 10% consistency, 60-70°C (140-160°F), pH of 8-10, for 2-4 hours. It is an expensive bleaching agent, but may be used more frequently as the use of elemental chlorine decreases. Peroxide oxidizes carbonyl groups of carbohydrates (produced by oxidants such as hypochlorite) to carboxylic acid groups. Its use with chemical pulps is fairly similar to that with mechanical pulps, except for a higher temperature, as described in Section 5.2.

O stage, oxygen pulping and bleaching

Oxygen bleaching or pulping is the delignification of pulp using oxygen under pressure (550-700 kPa or 80-100 psi) and NaOH (3-4% on pulp). Oxygen bleaching has been used commercially since the late 1960s. This is an odorless, relatively pollution-free process used prior to chlorination at high consistencies (20-30%) or medium consistencies (10-15%). Delignification is carried out at 90-130°C (195-266°F) for 20-60 minutes. The key to the use of O_2 delignification was the discovery that small amounts of magnesium ion (0.05-0.1% on pulp) must be present to protect the carbohydrates from extensive degradation. This is the most inexpensive bleaching chemical to use, but also the least specific for lignin removal. A considerable decrease in cellulose viscosity accompanies this process.

Bleaching may be thought of as extended

delignification, that is, an extension of the pulping process. Many mills are considering an oxygen delignification step after pulping but before the traditional chlorination first step of bleaching. Some call it oxygen delignification; others call it oxygen bleaching. Many mills have added oxygen to the first alkali extract step, designated as the E_2 step, because it is not a major change to the process and saves bleaching chemicals in subsequent stages. Oxygen is even less specific at lignin removal than chlorination so it is used to decrease the softwood pulp kappa number from 30-35 after pulping (20-24 for hardwoods) to 14-18 after the oxygen bleaching stage. Bleaching to kappa numbers below this leads to unacceptable losses of the cellulose viscosity.

The effluent of oxygen delignification can be used in the brown stock washers or otherwise ultimately sent to the recovery boiler because there is no chloride ion present that would lead to high dead loads and corrosion in the recovery boiler. Reducing the amount of lignin removed by the chlorination step by half reduces by half the color and BOD from the bleach mill water discharge after secondary treatment. Environmental considerations are the main reason for using oxygen bleaching. The bleach plant produces much of the color of the final mill discharge.

There are two main methods of oxygen bleaching: medium and high consistency. The high consistency process is at 30% consistency and 90-110°C (195-230°F) in a pressurized reactor. In the medium consistency process pulp at 10-15% consistency (the normal consistency as it comes off the drum washers) is used. While high consistency oxygen bleaching is more common, there are some difficulties with it. The gas in the reactor contains high concentrations of oxygen and volatile organic chemicals such as methanol, ethanol, and acetone that are potentially explosive; it is difficult to evenly distribute NaOH and O_2 ; and the pulp is saturated with oxygen which tends to cause foaming on the pulp washers.

Studies indicate that the temperature of oxygen bleaching is important to the selectivity of the process with better selectivity at 100°C (212°F) than 130°C (266°F). Partial pressure of oxygen above 200 kPa (30 psig) leads to little increase in the rate of delignification.

notably phosphate, that form coordinate bonds easily with alum and other materials. Potato starch, with about 0.1% phosphorous, has a slight negative charge due to phosphate groups.

Dry strength additives

Polyacrylamides are used to increase the dry strength of papers by hydrogen bonding. Polyacrylamide of molecular weight of 100,000 to 500,000 is used at about 0.5% on pulp and also acts as a retention aid. It is sometimes used to allow increased use of lower quality pulps such as secondary and hardwood fiber. Cationic (containing some amine functional groups) polyacrylamide is used at 0.2-0.5% on pulp, is suitable for use at pH 4-8.5, and reduces the alum requirement, while anionic (containing some carboxylate functional groups) polyacrylamide is used at a pH of 4.5-4.8 (with alum) to increase strength properties.

Starch is also used to improve strength, drainage, retention, and sizing of paper. Cationic, anionic, and ampholytic (cationic and anionic) starches are available. Guar gum, carboxymethyl cellulose, methyl cellulose, etc. can be used, but tend to be more expensive for a given effect.

Wet strength resins

Wet strength agents are thermosetting resins that are added to stock to impart wet strength to

the paper. Curing of the resin leads to the formation of covalent fiber-fiber bonds. The tensile strength of wet paper is from 0-5% of the dry tensile strength with no wet strength resin to as much as 15-50% of the dry tensile strength of the paper with wet strength resins. Wet strength paper is tested by measuring the resistance to rupture of the paper saturated with water. Papers made with wet strength adhesives are used for produce boxes, paper towels, maps, outdoor posters, food wraps, photographic papers, filter papers, tea bags, and disposable garments and bed sheets (such as for hospital use). Three wet strength resins are used commonly, especially the polyacrylamide resins (Fig. 8-9).

Urea-formaldehyde (UF) is the traditional wet strength resin. It can be used with permanent papers and gives paper repulpable under acidic conditions. UF has largely been replaced by **melamine-formaldehyde (MF)**, which uses melamine in place of urea, largely due to concerns about the health aspects of formaldehyde emission. **Glyoxal-polyacrylamide copolymers**, which can be made cationic, form labile bonds and are not useful for permanent papers such as paperboards. **Epoxidized polyamine-polyamide** resins are also used in permanent papers and result in papers that are not easily repulped. This material is formed in two steps. In the first step a dicarboxylic acid

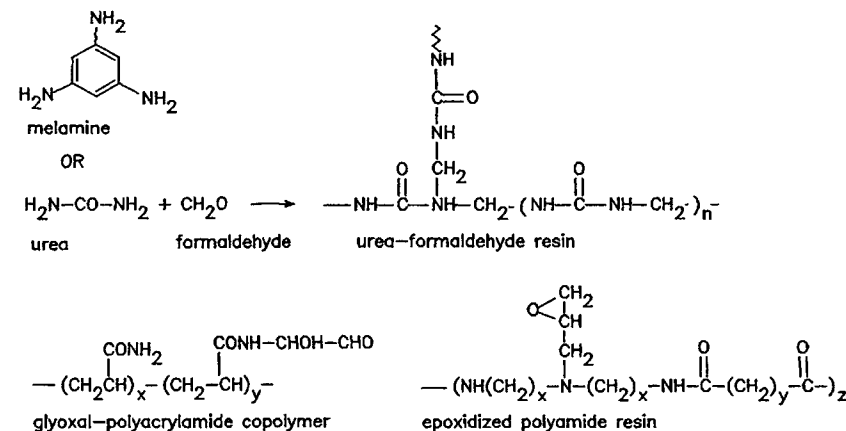


Fig. 8-9. Common wet strength resins.

Table 8-2. The relative surface area of fibers and fiber fragments.

Fiber or fine dimensions (box-shape)	Gross outer surface area, m ² /g	Relative surface area
4000 $\mu\text{m} \times 40 \mu\text{m} \times 40 \mu\text{m}$	0.100	1.00
1000 $\mu\text{m} \times 10 \mu\text{m} \times 10 \mu\text{m}$	0.402	4.02
40 $\mu\text{m} \times 40 \mu\text{m} \times 40 \mu\text{m}$	0.150	1.49
10 $\mu\text{m} \times 10 \mu\text{m} \times 10 \mu\text{m}$	0.600	5.97
100 $\mu\text{m} \times 2 \mu\text{m} \times 2 \mu\text{m}$	2.020	20.10

such as adipic (1,6-hexanedioic) acid is reacted with triethylamine to give a polyamine-amide backbone. In the second step, available amines are then reacted with epichlorohydrin to produce the epoxidized polyamide.

Glyoxal based resins are borrowed from the textile field and are of the form $\text{R}-\text{CO}-\text{CHO}$; at pH above 9, the inactive form predominates by the Cannizzaro reaction to give $\text{R}-\text{CH}(\text{OH})-\text{COO}^-$ which does not crosslink with starch or the fibers. Glyoxal resins require curing time on the warm paper reel for up to 30 minutes.

Specialty chemicals

Some other additives include flame retardants, anti-tarnish chemicals (for example those used in tissue papers to wrap silver, etc.).

8.5 CONTROL ADDITIVES

Retention aids

Retention is a measure of how much material remains on the paper machine wire and is incorporated into the final sheet. Two types of retention are considered in the industry: overall retention and first-pass retention. These are defined below in terms of filler, although the retention of fiber fines, sizing agents, and other materials is also important.

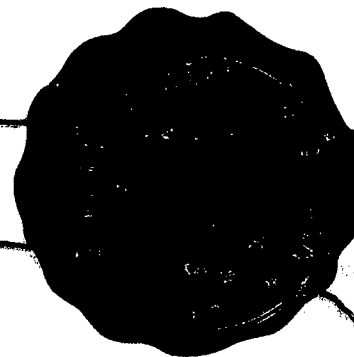
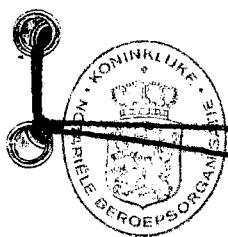
$$\text{overall retention} = \frac{\text{filler in sheet}}{\text{filler added to furnish}} \times 100\%$$

$$\text{first-pass retention} = \frac{\text{filler in sheet}}{\text{filler in headbox}} \times 100\%$$

A high first-pass retention is important for many aspects of wet end chemistry and sheet quality. For example, a high first pass retention of the sizing agents ASA and AKD will limit their hydrolysis. Hydrolysis of these expensive chemicals means they do not contribute to sizing but can cause pitch problems. Overall retention of fillers is important to their economical use. The overall retention really is a measure of first-pass retention and the amount of paper machine excess white water.

Retention occurs by two mechanisms. Particles larger than 200 μm (or the size of the largest openings of the paper machine wire), which are fibers and fiber fines, are primarily retained by **filtration**, particles smaller than 10 μm , which includes all additives, are primarily retained by adsorption onto the fibers via formation of various secondary chemical bonds. The retention aids form bonds with both the fiber surfaces and all of the additives to be retained. The retained additives are preferentially retained onto fiber fines due to their inordinately high surface area as shown in Table 8-2. This should be considered as an advantage because, without a high surface area on the fibers, there may not be enough fiber surface area to achieve adequate retention. Particles of intermediate size (which is generally only the fines) are retained by a combination of both mechanisms. Retention aids function on the small and mid-size materials.

Retention aids are often polymers that are added to improve the retention of fines (small fiber fragments), fillers, internal sizing agents, etc. They may rely on high charge density for the polyamines such as polyethylenimine (PEI) or



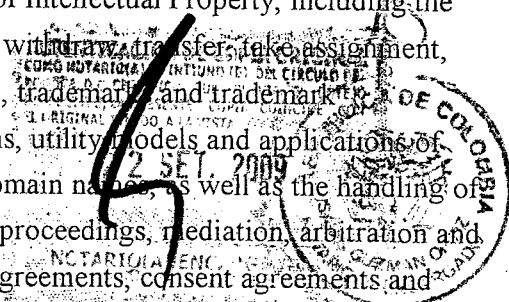
KINGDOM OF THE NETHERLANDS

**TO ALL TO WHOM THESE PRESENTS MAY COME, BE SEEN OR KNOWN
TO WIT:**

I, Karen Astrid Verkerk, civil-law notary, residing at Arnhem, the Netherlands, do hereby certify that:

AKZO Nobel N.V. is a company with public limited liability (*naamloze vennootschap*) incorporated under the laws of the Netherlands, having a place of business at Strawinskylaan 2555, NL-1077 ZZ Amsterdam (P.O. Box: 75730, 1070 AS Amsterdam), the Netherlands, its statutory seat at Amsterdam is registered at the Chamber of Commerce for Amsterdam under file number 09007809, which has been checked by me, the undersigned notary through, inspection at the files at the Chamber of Commerce for Amsterdam, the Netherlands. The required patent applications will be filed by AKZO Nobel N.V. with a branch in Arnhem, place of business at Velperweg 76, NL-6824 BM Arnhem.

- Mr. **Petrus Hubertus van Deursen**, born at Balikpapan (Nederlands Indië), on the first day of November 1949 and
 - Mr. **Petrus Johannes Theodorus Alferink**, born at Zwolle (the Netherlands), on the fifth day of April 1958,
- are both "Intellectual Property Attorney's" and are authorized, jointly with another Intellectual Property Attorney or a member of the Board of Directors, to perform all acts on behalf of Akzo Nobel Chemicals International B.V. in the area of Intellectual Property, including the authorization to file, register, renew, extend, abandon, withdraw, transfer, take assignment, license, take license, of patents and patent applications, trademarks and trademark applications, databases, designs and design applications, utility models and applications of utility models, copyrighted works, trade secrets and domain names, as well as the handling of conflicts including negotiation, administrative or civil proceedings, mediation, arbitration and the execution of settlement agreements, co-existence agreements, consent agreements and development agreements with regard to such intellectual property rights;
- The signatures on the attached document are the genuine signatures of Mr. P.H. van Deursen and Mr. P.J.T. Alferink.



DIVISIÓN DE NUEVAS CREACIONES

RADICACIÓN EXPEDIENTE No. 07-56926

EL EXTRACTO DE LA PRESENTE SOLICITUD DE **PATENTE DE INVENCION**

FUE PUBLICADO EN LA GACETA DE PROPIEDAD INDUSTRIAL No **581** DE

FECHA **31 DE OCTUBRE DE 2007** EL TÉRMINO HÁBIL SEÑALADO POR LA

LEY EXPIRA EL **31 DE ENERO DE 2008**

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NO X

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(Convención de La Haya de Octubre de 1961)

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5 EN ARNHEM

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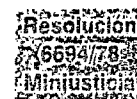
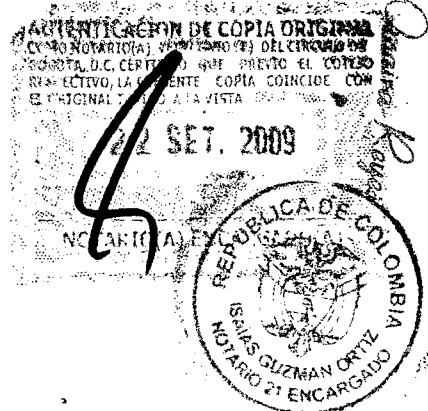
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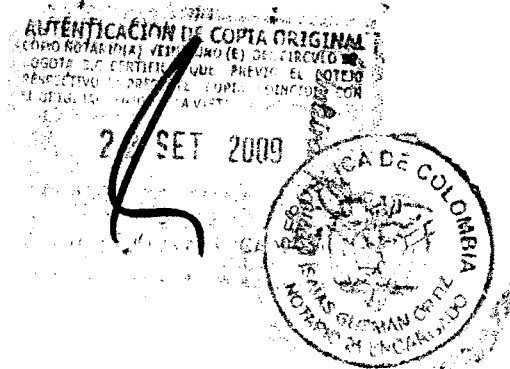
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KAREN A. VERKERK



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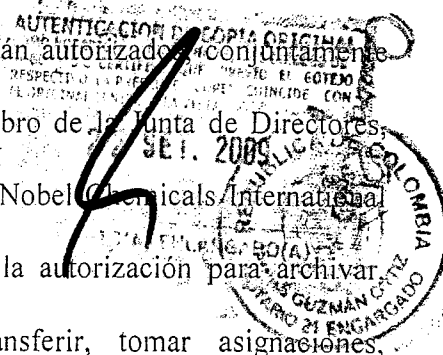
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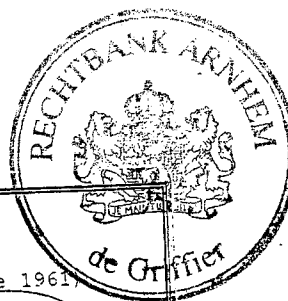
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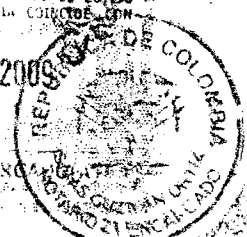
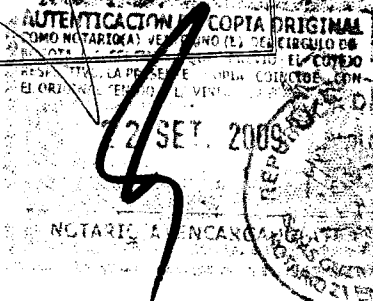
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Convention de La Haye du 5 octobre 1961

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5. at Arnhem 6. on 11 September 2009
7. by the clerk of the court (Rechtbank)
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Given and signed this 8th day of September 2009
In Arnhem

Signature(s)

Name of each signor Petrus Hubertus van Deursen
Position of each signor Authorized Signatory

Petrus Johannes Theodorus Alferink
Authorized Signatory

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