HU000027203T2

(19) **HU**

(11) Lajstromszám: **E 027 203**

(13) **T2**

MAGYARORSZÁG
Szellemi Tulajdon Nemzeti Hivatala

EURÓPAI SZABADALOM
SZÖVEGÉNEK FORDÍTÁSA

(21) Magyar ügyszám: **E 10 714570**
(22) A bejelentés napja: **2010. 03. 10.**

(96) Az európai bejelentés bejelentési száma:
EP 20100714570
(97) Az európai bejelentés közzétételi adatai:
EP 2406183 A1 **2010. 09. 16.**
(97) Az európai szabadalom megadásának meghirdetési adatai:
EP 2406183 B1 **2015. 05. 06.**

(51) Int. Cl.: ***D21C 9/16*** *(2006.01)*
C01B 33/32 *(2006.01)*
D21C 5/02 *(2006.01)*
D21C 9/10 *(2006.01)*

(86) A nemzetközi (PCT) bejelentési szám:
PCT/EP 10/001498
(87) A nemzetközi közzétételi szám:
WO 10102803

(30) Elsőbbségi adatok:
102009012468 **2009. 03. 12.** **DE**

(72) Feltaláló(k):
SCORDIALO, Angelo, 64380 Erzhausen (DE)

(73) Jogosult(ak):
HWT-wassertechnische Anlage GmbH, 64390 Erzhausen (DE)

(74) Képviselő:
Szabó Zsolt, DANUBIA Szabadalmi és Jogi Iroda Kft., Budapest

(54) **Eljárás vízüveg előállítására ipari felhasználáshoz**

METHOD FOR PROVIDING WATER GLASS FOR AN INDUSTRIAL APPLICATION

The invention relates to a method for preparing water glass for an industrial application. It also relates to the use of the prepared water glass.

Water glass (sodium and potassium silicate glass) is typically used in a wide range of applications and processes. These include use in the paper industry as part of the de-inking process of recovered paper and in the bleaching of fibres (groundwood pulp, TMP, recovered paper, etc.). Depending on the application, what is known as modified water glass may be used.

Firstly, the manufacturer modifies the standard water glass (also known as liquid glass) formed during the melting process, which has a SiO_2/Na_2O ratio of approximately 3.2 - 3.4, also referred to as the silicate modulus, by subsequently adding sodium hydroxide solution or by directly increasing the sodium hydroxide solution content during hydrothermal decomposition. The modulus can thereby be varied or reduced as required. Due to storage and transport, the water glass modified in this way is not used until several days or weeks later and therefore undergoes a certain disadvantageous ageing effect (deterioration of the properties of the product).

A process for the production of alkali silicates is known from GB 790 286A, in which a water glass solution with a silicate modulus of 3 is prepared by diluting a sodium silicate with sodium hydroxide solution. US 4,347,099 discloses the bleaching of recovered paper with a mixture of hydrogen peroxide, sodium silicate, sodium hydroxide solution and a polymer containing carboxyl groups.

The object of the invention is to disclose a method for preparing water glass for an industrial application, with which in a manner particularly in line with demand a water glass suitable for the specific intended use can be prepared in a particularly resource-saving manner. Furthermore, a particularly advantageous use of the prepared water glass is to be disclosed.

This object is achieved according to the invention by the features of claim 1 and, with respect to the use, by the features of claim 6.

The SiO_2/Na_2O or SiO_2/K_2O ratio, also referred to as the silicate modulus, can be used as the weight ratio or molar ratio, wherein for the conversion the molar ratio for sodium silicate can be obtained from 1.031 times the weight ratio and for potassium silicate it can be obtained from 1.563 times the weight ratio. The numerical data in the following specify weight ratios unless indicated to the contrary.

In laboratory tests for fundamentally reducing costs by making on-site modifications to water glass made of standard water glass, it was surprisingly found that the water glass modifications made in-house had clear advantages over commercial modifications with the same SiO_2/Na_2O and/or SiO_2/K_2O moduli and the same quantities used as a result of the development and use of intermediate water glass modifications, if they were used immediately:

De-inking and bleaching advantages

- Greater whiteness and lightness values as a result of an increased ink discharge
- Simultaneous improvement in yield
- Less yellowing of the fibres with a constant pH value in contrast to commercial modifications
- Reduction in the amount of sodium hydroxide solution additionally required for bleaching and de-

inking with the same resulting pH value

- Lower viscosity of the pulp suspension with the same pH value (improvement in dewatering)
- Improved flexographic printing particle removal
- Reduction in the amount of H_2O_2 in bleaching since an improved complexation of the H_2O_2-decomposing heavy metals and process stabilisation is achieved (increase in residual peroxide)
- thereby releasing a reduced amount of anionically active substances ("anionic trash") and COD, which results in further reduced system strain and thus a reduction in chemical additives
- Less of a tendency for deposits (particularly calcium deposits) in the bleaching devices and pipework

In further tests, which were actually aimed at improving the sludge dewatering, it was also found quite by chance that the incorporation of additional organic polymers metered to further improve the yield also improves the on-site water glass modification and increases the effect thereof as well. In this way, it was possible to have a positive impact not only on the dewatering but also on the effect of the water glass modified on-site. In addition to the increased effect by way of intermediate water glass modifications, there is a further improvement due to polymer being incorporated in the on-site water glass. The type and quantity of the polymers used in an advantageous manner correspond to the details revealed in DE 102 15 620 A1. In this respect, the disclosure of DE 102 15 620 A1 is explicitly incorporated by reference herein.

The intermediate modifications were made by setting the required modulus on the basis of water glass with a modulus of 3.25 by stoichiometrically adding sodium hydroxide solution. The water glass modifications were used after several minutes or hours instead of the standard supplier modifications. With the method of on-site modifications, it is possible to set arbitrary moduli with arbitrary maturing times and/or sodium/potassium quantities and to use them individually or also as mixtures.

Thus, in addition to the fundamentally more economical variant of in-house modification, a basis for further cost reductions was found by reducing the quantities of sodium hydroxide solution and H_2O_2, as were chemical/mechanical advantages (losses, printing ink elimination, increases in whiteness), which could then be verified in various practical tests.

The chemical backgrounds for the improved reaction of the water glass modified on-site as compared with the commercially available "aged" water glass modifications can be attributed to the formation of intermediate interim water glass:

For instance, using ^{29}Si-NMR analyses it was possible to provide evidence of a shift of the so-called Q_0-$Q_{4/n}$ phases (for a definition of the Q phases, see the known literature of well-known water glass manufacturers, e.g. PQ Europe: "*Natrium und Kalium Silikate*", Oct 2003, or G. Engelhardt *et al.*, "Z. *Anorg. Chemie*", 4288, 1975: "*Qualitative Interpretationen des Gleichgewichtes bei Silikat-Anionstrukturen*").

Normally, a modified product will have an increased amount of Q_0 to Q_2 (monomeric to trimeric linear silicates) as compared with standard water glass, but a reduced amount of branched and cyclic silicates. The product modified on-site has in most cases an increased amount of Q_1 and an increased amount of $Q_{3/4/n}$ but a reduced amount of Q_2/Q_3. This has the advantage that due to the short-chain amounts, there is a better dispersion and separating effect and at the same time there are advantages with respect to molecular sieve and complexation effects ($Q_{3/4/n}$) as a result of the branched and cyclic amounts. To all intents and purposes, the

advantages of the standard water glass and those of the modified water glass are exploited while the disadvantages of the linear Q_2 chains (deposits, increase in losses, viscosity etc.) are largely eliminated. To some extent, an intermediate wide-band water glass is created. This means a faster effect with lower consumption than is the case with aged water glass.

One way of determining the structure of the silicates is with $_{29}$Si-NMR. The structure groups are determined by way of the chemical shift which integrates the respective peaks and puts them in relation to one another. The table shows the change in the structure groups Q_0 to Q_4 with the respective modifications (manufacturer and on-site):

29Si-NMR					
Water glass	Standard	Modification	On-site modification	Modification	Water glass
Group designation	M = 3.25 pH= 12.2	M = 2.4 pH= 13.2	M = 2.4 pH= 13.2	M = 1.6 pH= 138	M = 1.6 pH= 13.8
Q0	**<1.0 %**	**1.80 %**	**0.50 %**	**6.60 %**	**4.60 %**
Q1	**4.60 %**	**7.20 %**	**9.20 %**	**24.80 %**	**32.40 %**
Q2	**<1.0 %**	**2.30 %**	**1.00 %**	**11.50 %**	**4.90 %**
Q2Q/3	**27.00 %**	**38%**	**32.10 %**	**41.70 %**	**36.10 %**
Q3	**55.60 %**	**45.20 %**	**49.40 %**	**15.40 %**	**17.80 %**
Q4	**12.50 %**	**6 %**	**7.80 %**	**0 %**	**4.20 %**

As a result of the ageing of on-site modifications the equilibrium described by G. Engelhardt, which is also present in commercial modifications, is then established again after several hours or days (approximately 120 hours). For this reason, the on-site modification preparations are selected with processing times of between 10 seconds and 120 hours. In the tests, times between 10 and 360 minutes were mostly found to be optimal. However, the times are dependent on the respective application and the optimum time is to be additionally determined for each individual case. Mixtures of different moduli and/or different maturity times are also possible. Mixtures with aged modifications or standard water glass can also be shown. This results in degrees of freedom for showing different charge densities (open charge carriers) and active reaction surfaces next to one another, and these degrees of freedom have to date not been possible with the application of (aged) commercially available water glass and the modifications thereof.

Due to the reactive surfaces and charge densities, this intermediate open-polymer embodiment of the modified water glass also allows for a sustained improvement, as compared with the shorter Q_2 chains, of the integration of organic polymers in the modified water glass, which can also support or improve the functions of the water glass.

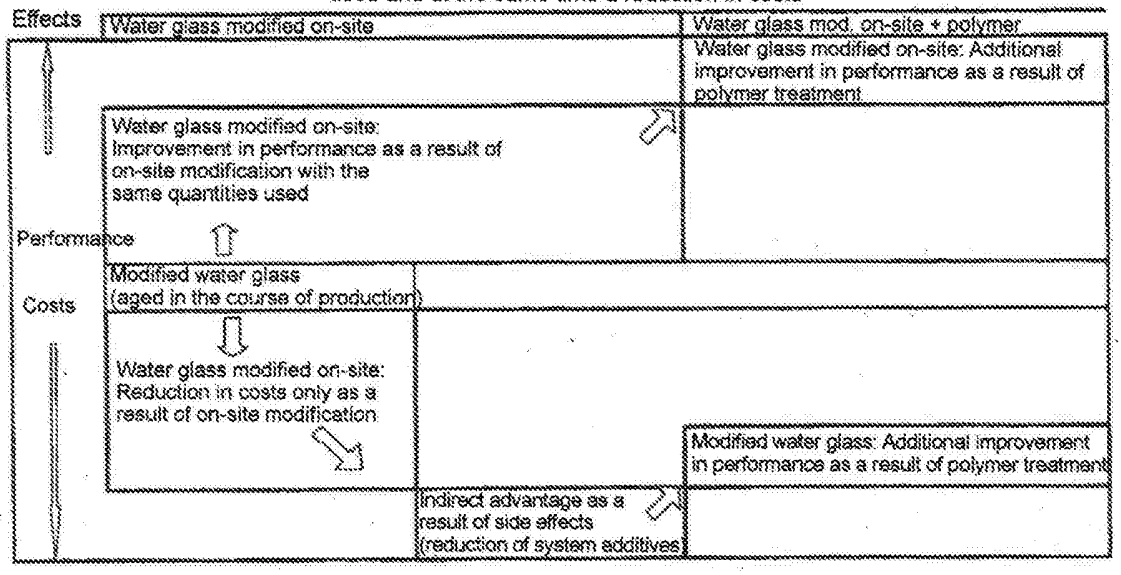
In principle, there are therefore two basic possibilities for using water glass modified on-site, wherein mixed forms can also be used:

Possibility A: Improved performance as a result of on-site modification with the same quantities used for the specific application and at the same time a reduction in costs

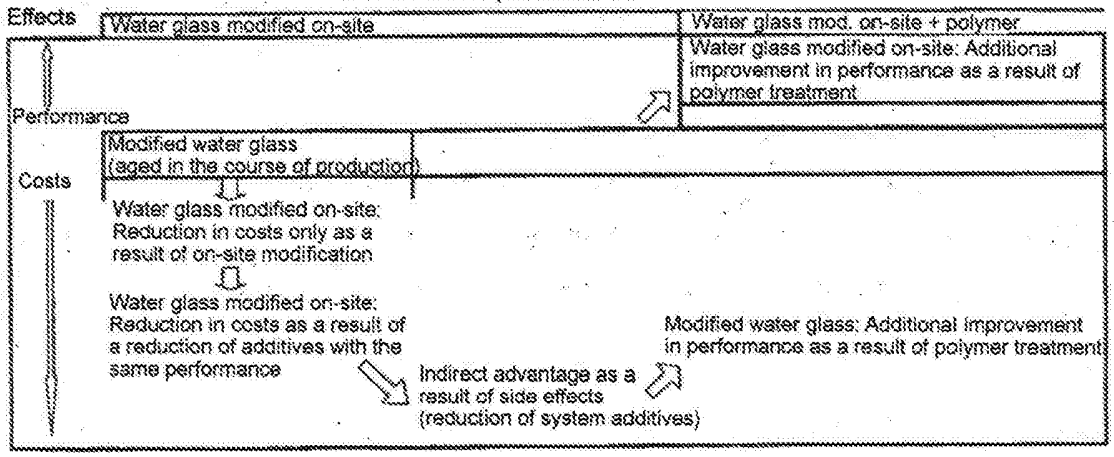
or

Possibility B: Double cost-saving effect as a result of on-site modification with the same performance. Further optimisations with polymers are also possible.

Possibility A: Improved performance as a result of on-site modification with the same quantities used and at the same time a reduction in costs



Possibility B: Double cost-saving effect as a result of on-site modification with the same performance



Description of the production of water glass modified on-site:

Water glass modified on-site is produced by simply mixing standard water glass (e.g. standard water glass 38/40: Modulus 3.2 - 3.4) or by further mixing already modified water glass with sodium hydroxide solution in any concentration, whereby the desired lower SiO_2/Na_2O modulus is then stoichiometrically set. The amounts of SiO_2 and Na_2O from the present water glass are taken into consideration, as are the amounts of Na_2O from the sodium hydroxide solution. Alternatively, caustic potash solution and/or a potassium water glass or potassium/sodium water glass may be used instead of the sodium hydroxide solution. The quantity-based mixing can either take place with commercially available mixers (e.g. static mixers) or with direct mixing in a mixing vessel with stirrers. Depending on the required reaction and maturing time of the modification,

corresponding receiver tanks for temporary storage may be necessary. The metering is carried out according to set times, wherein mixtures of different kinds of water glass with different moduli and maturing times and alkali additives are also possible. The integration of functional polymers during manufacture may additionally improve the performance of the water glass, wherein the on-site incorporation of the polymer is more effective than subsequent integration.

Typical applications are:
Flotation de-inking
Oxidative bleaching of groundwood pulp, TMP, CTMP and recovered paper (single- and double-floated)
Oxidative bleaching of pulp
Oxidative bleaching of alternative fibres
Cardboard box sizing
Tube winding

However, the application is, in principle, transferable to all other applications of silicates as described in all current brochures of water glass manufacturers, e.g. "*Natrium und Kalium-Silikate- Verbindungen für vielseitige Anwendungen*", PQ Europe, October 2003.

Example 1: De-inking laboratory tests

In the laboratory a recovered paper mixture consisting of 50 % newspaper, 30 % SC magazines and 20 % LWC magazines, which is intended to represent a typical composition of papers for de-inking, was subjected to standardised defibration (substance concentration 15 %, 45 °C, 20 min). Added to this process of breaking up the paper was 0.3 % 100 % NaOH, 0.45 % soap and 0.8 % H_2O_2 (100 %). The water glass addition amounted to 1.0 %. In each series of tests, a modified water glass with a SiO_2/Na_2O ratio of 1.87, a pH value of 12.9 and a density of 1.51 g/cm^3 was used as the water glass. A standard manufacturer modification of 1.87 and on-site modifications of 1.87 were used, which were produced from a standard water glass with a modulus of 3.25 by the stoichiometric addition of 75 % NaOH. The modifications were prepared in a beaker with moderate stirring at approximately 60 rpm. Maturing times of 15 minutes, 1 hour, 3 hours, 12 hours and 24 hours were set for the on-site modifications. The concentrations of 27.8 % SiO_2 and 14.9 % Na_2O were checked as to the plausibility of the preparations.

After the defibration the stock slurry was added to a Voith Delta 25 laboratory flotation cell at a concentration of 0.8 %. The analyses were made after 8 and 12 minutes respectively.

In all of the examples, the whiteness and colour values were measured in accordance with CIE ISO 2470 R457 and DIN 5033/5036, and the lightness value Y was measured with the Elrepho (DataColor) 2000/D65/10°. The dirt speck analysis was carried out with a DOT Counter 2.0. Losses are determined using a quantity difference analysis. The ash is determined at 425 °C.

Starting from a whiteness of 41.8 %, in the tests a whiteness of 59.3 % could be achieved for the aged modification of a water glass manufacturer (standard delivery of a modified water glass of 1.87) and a whiteness of from 59.9 to 60.8 % could be achieved when using water glass modified on-site with a different maturing time.

With a base lightness value of Y = 45.9 %, final lightness values of 62.6 % (manufacturer modification) and from 63.0 - 63.8 % (modified on-site) were achieved. Thus, with an optimum maturing time, after 12 minutes an increase by up to 1.5 % whiteness or 1.2 lightness values results when using a water glass modified on-site instead of a standard water glass modified by the manufacturer, with lower loss rates and less yellowing at the same time. The latter indicates higher activation of the hydrogen peroxide.

There were also advantages with respect to the dirt speck area corresponding to a better discharge of ink particles. The results are shown by way of example in the table below for a flotation time of 12 minutes:

Delta 25 after 12 minutes	Standard mod. Hrs > 120 hours	On-site modifications 15 minutes	1 hour	3 hours	12 hours	24 hours
Whiteness R457 %	59.3	60.8	60.4	60.3	60	59.9
Lightness v. Y %	62.6	63.8	63.4	63.4	63.1	63
b* value -	4.9	3.2	3.8	4	3.8	4.1
Loss %	19.8	18.2	19	19.6	19.4	19.6
Ash %	22.2	24.2	23.9	24	22.8	23
Dirt speck area mm^2/m^2	559	443	391	555	529	582

The water glass modified by the manufacturer (designated here by: Hrs > 120 hours) had had a storage period of at least 120 hours when it was removed from the tank. In repeat tests it was possible to confirm the identified differences on comparable levels. There were differences with respect to the optimum duration of the maturing time with different kinds of recovered paper. In general, the tendency was that for higher ash contents, shorter maturing times are needed and for lower ash contents in the recovered paper longer maturing times are needed.

Example 2: Paper mill with recovered paper de-inking

In a recovered paper plant having two parallel two-stage de-inking lines that are almost identical in terms of construction, tests were carried out concurrently, wherein in addition to the standard additives one line was treated with water glass modified by the manufacturer (modulus of 1.85) and the other line was treated with a water glass modified on-site from 3.4 to 1.85. At times, the water glass in both lines was additionally treated with polymer. A mixture of approximately 35 % newspaper and 65 % magazines was provided for de-inking. The following additive amounts were added to the defibration drum: H_2O_2 (100 %): 0.9 %; NaOH (100 %): 0.35 %; soap 0.35 %; water glass 1.85: 1.25 %; in some cases 50 ppm polymer (based on water glass).

In preliminary laboratory tests, maturing times of 1- 3 hours proved to be optimal for this application. Owing to the local conditions, it was only possible to select a product matured for 1 and 2 hours for the on-site tests. All test results are average values over a test period of 8 days.

Starting from an initial whiteness of 48 % in the dump chest, the results for both products modified on-site showed a whiteness gain in the finished stock of approximately 0.8 - 1 % and an average increase over two days from 61.7 to 62.5 - 62.7 % in a parallel course. The yellowness value b* fell from 5.2 to 4.4; less

yellowing is associated with this. The dirt speck area (measured on handsheets) reduced by approximately 20 % to 256 mm^2/m^2. It was possible to increase the yield from 82.5 to 83 %. The results of the 1-hour and 2-hour modifications differ only slightly in the tests, and so all further tests were only carried out with the 1-hour transformation. Specially collected flexographic printing material was used and fed in parallel for half a day. Surprisingly, the filtrate darkening (according to Ingede Method 3: optical assessment of de-inking filtrates) during the period of using water-based flexographic printing products fell from dY = 45 to approximately 31 % in the line with water glass modified on-site, which indicates an increased discharge of flexographic printing particles. With the addition of 50 ppm polymer (based on the amount of water glass), it was possible to further reduce this amount to 17 %.

Based on the results, the additives were reduced with the objective of achieving the same results in both lines.

It was found that in addition to the fundamental cost savings of approximately 20 - 40 % (depending on the desired modulus) achievable with on-site modification as compared with commercially available water glass modification, further cost reductions of approximately 10 - 15 % can be achieved by saving on additives, with no loss in the performance of the de-inking line.

Gradually, the water glass modified on-site was reduced from 1.25 to 1.05 %, the H_2O_2 from 0.9 to 0.7 % and the sodium hydroxide solution from 0.35 to 0.25 % until the same target parameters resulted again in both lines (the lines having the same performance). This also resulted in a reduction of the COD value in line 2 (on-site modification) from 1800 to 1400 mg/l, and the cationic demand (dissolved anionically organic components measured as mEq/l 1/1000n polydiallyl dimethyl ammonium chloride solution) and the dissolved SiO_2 content in the process water fell by approximately 25 %. In this way, the tendency for deposits of inorganic components (assessment on connected metal surfaces in the disc thickener filtrate) is also to reduce, as are the interactions with cationic auxiliary agents, as a result of which the dewatering performance at the disc thickeners (reduction in revolutions) and the retentions at the PM are improved by approximately 10 %.

At the same time, better buffering of the recovered paper processing systems could be identified (higher m value; measuring method according to DIN 38409H7 (base capacity K_B 4.3)).

The table below illustrates the test results with respect to improved performance:

De-inking system 35 % Newspaper/ 65 % Magazines	Line 1 Hrs > 120 hours	On-site modifications Line 2 1 hour	 1 hour + polymer 50ppm	Additives H2O2 100 % NaOH 100% Soap Waterglass	% 0.9 0.35 0.35 1.25
Whiteness R457 % Lightness v. Y %	61.7 -	62.5 -	62.7 -	1.87	

b* value	5.2	4.4	-
Yield %	82.5	83.1	83.4
Ash %	15	15.9	16.6
Dirt speck area mm^2/m^2	318	256	212
dY filtrate	45	31	17
COD	1820	1430	1320
Cat. demand µEq/	2800	2250	2190
SiO2 mg/l	165	128	126
m-alkalinity mmol/m	12.8	13.9	13.7

Furthermore, the table below shows the change in the additives used with the two de-inking lines being almost identical in terms of performance:

	Line 1	On-site modifications Line 2			
Additives	Hrs > 120 hours	1 hour	Saving %	1 hour + polymer 50ppm	Saving %
H2O2 100 %	0.9	0.7	-29	0.7	-29
NaOH 100 %	0.35	0.25	-40	0.25	-40
Soap	0.35	0.35	0	0.3	-17
Water glass 1.87	1.25	1.05	-19	0.95	-32

It was possible to achieve a further improvement by approximately 5 % with a mixture of a 1-hour modification and a 24-hour modification, which was tested over a short period. In this example, it was thus possible to achieve an improvement in the performance of the de-inking system with a cost saving of approximately 30 % for the water glass modified on-site and also with the addition of polymer or a double cost saving (cost saving as a result of water glass modified on-site and the reduction of additives) of approximately 45 % with the same performance.

Example 3: Bleaching of TMP (laboratory)

The laboratory tests were carried out on finished thermomechanical pulp stock from a TMP preparation in accordance with the standard bleaching method used in the paper industry. For this, 20 g of a well homogenised sample of finished TMP stock was heated in a plastic bag to a temperature of 75 °C for 15 minutes. Then, the respective bleach solution was added to the pulp, mixed with a Hobart mixer and held in the plastic bag for 80 minutes in a water bath at a constant temperature of 75 °C. 200 g/m^2 nutsche sheets were produced from a part of the pulp in order to measure the optical properties after drying; the other part of the 28 % pulp suspension was pressed and the aqueous phase analysed.

The bleach solution was added according to the following composition based on pulp: H_2O_2 (100 %) 1 - 2.5 %, NaOH (100 %) 0.4 %, DTPA solution 0.25 %, water glass 1.87 1.0%.

A water glass solution modified by the manufacturer was used, as well as on-site modifications with different maturing times and mixtures of different on-site modifications. It was found in this case that a mixture of an on-site variant matured for 1 hour with an on-site variant matured for 24 hours (referred to as 1h mod and 1+24h mod respectively in the table) in a ratio of 2:1 is optimal (optimal hydrogen peroxide activation with the least hydrogen peroxide decomposition).

The table below shows by way of example the averaged results over three test series for 2 % H_2O_2 (100 %) and 24h mod and 1+24h mod:

Control sample			
Whiteness R457 %	48.6		
L*	81.9		
b*	13.1		
After bleaching	Standard mod. 1.87	24h mod 1.87	1+24h mod 1.87
Whiteness R457 %	57.3	57.6	58.4
L*	86	86.8	87
b*	12.7	12.7	12.2
Whiteness gain	8.7	9	9.8
Residual H_2O_2 %	8.1	11.5	16.7

The mixture 1+24h mod shows the best bleach effect with the highest whiteness gain with the lowest yellowness value b* and the highest residual peroxide (measured using iodometry). In addition it should be noted that in the tests, the mixture (here 1:1) of water glass modified by the manufacturer and 1h-modified-on-site water glass lay more or less in the range of the results of the 24h modifications.

Example 4: Hydrogen peroxide dispersion bleaching of recovered paper

The finished pulp of a recovered paper processing plant was bleached using the standard composition, wherein the water glass modified by the manufacturer was replaced by an on-site modification. The results are average values from 5 days of tests and 2 days before and 3 days after the testing:

Before bleaching		
R457 starting value	62.12	62.36
Lightn. Y starting value	66.96	67.1
X starting value	0.3219	0.322
Y starting value	0.3249	0.3244
After bleaching	**6h on-site mod. 1.85**	**Standard 1.85**
pH	8.9	8.9
Residual peroxide, mg/l	2244	1870
Whiteness R457	68.09	67.87
Lightness [value] Y	72.39	72.30
x	0.3191	0.3201
y	0.3233	0.3241
Lightness	5.43	5.20
Degree of whiteness	5.97	5.51

The following composition was used according to the specifications of the paper manufacturer during the test period:

Composition %	
H2O2 (100 %)	2
NaOH (100)	0.45
Water glass	0.85
Complexing agents	0.1

The results again show here that the on-site modification optimised in advance in the laboratory for the specific application has advantages over the aged standard modification of the manufacturer with respect to the whiteness gain and lightness. It was possible to achieve a greater lightness here too, and therefore in addition to the fundamental savings with on-site modifications there is either a possibility of an improvement in performance or a reduction in the additive amounts, thereby further reducing the costs.

The amount of residual peroxide indicates an improved complexation property of the on-site modification variants, and the slightly smaller yellow shift indicates an improved pH-buffering property with sufficient free alkalinity.

The modified water glass with an appropriately set silicate modulus is preferably prepared for a process for increasing the degree of whiteness and the lightness value when de-inking recovered paper and bleaching organic fibres, for the manufacture of a means for reducing circuit strain (anionic charges and COD loading) with improved dirt particle discharge, for increasing the yield (reduction in losses) in the de-inking process, for improving the dewatering performance, for improving the complexation of metals and peroxide stabilisation, for improving the system buffering (free and combined alkalinity), for reducing the SiO_2 concentrations and

carryover into further circuits, for reducing water glass-based deposits, for reducing the yellowing of the fibres, for reducing costs of de-inking and fibre bleaching and all customary processes and uses of water glass, for reducing dirt specks and stickies, and/or for the arbitrary setting of the amounts of the Q_0 to $Q_{4/n}$ phases in the water glass.

5

ELJÁRÁS VÍZÜVEG ELŐÁLLÍTÁSÁRA IPARI FELHASZNÁLÁSHOZ

Szabadalmi igénypontok

10 1. Eljárás vízüveg előállítására ipari felhasználáshoz, amelynél a vízüveg SiO_2/Na_2O arányát egy a felhasználás céljától függően megválasztott előírt értékre állítjuk be úgy, hogy a felhasználás tervezett időpontját megelőzően egy legfeljebb 360 perc hosszúságú, az adott felhasználási célnak megfelelően meghatározott időtartamon belül szabvány vízüveget higítószerként kálilúggal, kálium-vízüveggel vagy nátronlúggal elegyítünk.

15 2. Az 1. igénypont szerinti eljárás, amelynél egy polimert is hozzákeverünk.

3. Az 1. vagy a 2. igénypont szerinti eljárás, amelynél a szilikát modulus beállításához legalább 2 másodperc hosszúságú időtartamot rögzítünk.

4. Az 1-3. igénypontok bármelyike szerinti eljárás, amelynél a szilikát modulus előírt értékét legalább 0,2 és legfeljebb 3,0 közé esőnek választjuk.

20 5. Az 1-4. igénypontok bármelyike szerint előállított vízüveg alkalmazása festékmentesítő folyamatban vagy szálak vagy rostos anyagok fehérítésére.