



(51) International Patent Classification:

C09D 15/00 (2006.01) **C09D 7/00** (2006.01)
C09D 101/00 (2006.01) **C09D 7/12** (2006.01)

(21) International Application Number:

PCT/US2017/054757

(22) International Filing Date:

02 October 2017 (02.10.2017)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/402,016 30 September 2016 (30.09.2016) US

(71) Applicant: **THE SHERWIN-WILLIAMS COMPANY**
[US/US]; Cleveland, Cleveland, OH 44115 (US).

(72) Inventor: **HALSTEAD, Joshua**; 1824 Lorimer Drive, Parma, OH 44134 (US).

(74) Agent: **LIN, Yi-Chia** et al.; Morgan, Lewis & Bockius LLP, 1111 Pennsylvania Avenue, NW, Washington, DC 20004 (US).

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: POLYSACCHARIDE-BASED WATER-COMPATIBLE WOOD STAIN

(57) Abstract: Water-based stains comprise or consist essentially of a polysaccharide resin and a crosslinking agent such as an isocyanate. Upon evaporation of water, the polysaccharide undergoes crosslinking with the isocyanate component, developing water resistance so that it will not redissolve upon application of a water-based or oil-based clearcoat; as a result, lifting is minimized after a drying time of, e.g., two to six hours.



POLYSACCHARIDE-BASED WATER-COMPATIBLE WOOD STAIN

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to and the benefit of, and incorporates herein by reference in its entirety, U.S. Provisional Patent Application No. 62/402,016, which was filed on September 30, 2016.

TECHNICAL FIELD

[0002] The subject matter hereof relates to staining of wood products such as hardwood floors and furniture.

BACKGROUND

[0003] Wood floors are frequently employed in quality housing and offices. The bare wood may be stained to alter its color, enabling, for example, the use of durable, damage-resistant wood whose natural color would be unsuitable for its surroundings. Stains may be oil-based or water-based. The latter offer numerous advantages such as soap-and-water cleanup, non-flammability, low odor, and minimal environmental impact. Currently, however, water-based wood stains are used primarily for small jobs. They have not been widely adopted in the flooring and large furniture sectors because they tend to exhibit various problems such as lapping, lifting, difficulty in application, and/or inconsistent appearance.

[0004] Lapping is a visual defect that occurs when applying stain to a large surface in sections. It results in a darker color in the areas where one stained section overlaps another. Lapping often results from pigment particles interacting strongly with water-based polymers, which themselves interact strongly with the wood surface. Lifting is observed when a stain is either not completely dry, or is water/solvent-sensitive when a topcoat is applied thereover. This results in reduced clarity and loss of adhesion between the stain and the topcoat.

[0005] Application difficulty often arises when staining large areas by hand using rags, as is common practice. Existing water-based stains are often “sticky” and require substantial effort in initially applying the stain and wiping excess away.

Following application, it is usually found that water-based stains lack the richness and warmth of oil/solvent based stains. This results in an inconsistent appearance that resembles plastic.

[0006] Accordingly, there is a need for stains that offer the advantages of a water-based product without the disadvantages noted above.

SUMMARY

[0007] In various embodiments, a water-based stain in accordance herewith comprises or consists essentially of a polysaccharide resin and an isocyanate. Upon evaporation of water, the polysaccharide undergoes crosslinking with the isocyanate component, developing water resistance so that it will not redissolve upon application of a water-based or oil-based clearcoat; as a result, lifting is minimized after a drying time of, e.g., two to six hours. The hydrophilicity of the polysaccharide component allows the composition to wet the polar cellulosic structure of wood and develop a consistent appearance. Because the polysaccharide is fully solubilized, the composition has low viscosity and is easily applied; this also provides advantageous lapping resistance because the composition can rewet and/or redissolve.

[0008] In one aspect, the invention pertains to a wood stain composition including an aqueous solution of a crosslinkable polysaccharide; a crosslinking agent crosslinkable with the polysaccharide upon drying of the aqueous solution; and a pigment dispersion. In one implementation, the crosslinking agent consists essentially of a monomeric aliphatic diisocyanate, a toluene diisocyanate, a hexamethylene diisocyanate, a naphthalene diisocyanate, a methylene bis-cyclohexylisocyanate, and/or an isophorone diisocyanate.

[0009] The composition may further include a thickener. The thickener may consist essentially of hydroxyethylcellulose, hydrophobically-modified ethylene oxide-based urethanes, hydrophobically-modified alkali soluble emulsions, and/or other alkali-soluble associative thickeners. In some embodiments, the composition includes a defoamer. In addition, the composition may include an amine; the amine may consist essentially of dimethylethanolamine, monoethylethanolamine, trimethylethanolamine, morpholine, and/or ammonia. In various embodiments, the composition further includes a surfactant. The surfactant may be a nonionic surfactant. In one embodiment, the surfactant is an octylphenol ethoxylate surfactant.

In some embodiments, the surfactant has a hydrophile-lipophile balance value between 5 and 15.

[0010] As used herein, the term “polysaccharide resin” means a film-forming polysaccharide polymer dissolved in a (typically aqueous) medium. The term “substantially” or “approximately” means $\pm 10\%$ (e.g., by weight or by volume), and in some embodiments, $\pm 5\%$. The term “consists essentially of” means excluding other materials that contribute to function or structure. For example, the optional pigment does not contribute to the performance of the coating and may be omitted; hence, it would not be excluded in a claim to a composition consisting essentially of other materials. Percentages refer to weight percentages unless otherwise indicated.

DETAILED DESCRIPTION

[0011] Polysaccharides are polymers of simple sugar building blocks, and may be crosslinked into hard, three-dimensional polymer networks. Compositions in accordance herewith include an aqueous solution of a crosslinkable polysaccharide and a crosslinking agent crosslinkable with the polysaccharide upon drying of the aqueous solution. These two components are generally packaged separately and combined just prior to application. The crosslinking agent may undergo an addition reaction with hydroxyl groups of the polysaccharide and may be, for example, an isocyanate (e.g., a monomeric aliphatic diisocyanate, a toluene diisocyanate, a hexamethylene diisocyanate, a naphthalene diisocyanate, a methylene bis-cyclohexylisocyanate, and/or an isophorone diisocyanate). Polymer network properties can be tailored by adjusting the concentration of the dissolved polysaccharide and the amount of crosslinking agent.

[0012] Suitable generic formulations are as follows:

Component	Weight %
Amine	0.1%-2%
Thickener	0.1%-2%
Defoamer	0.1%-1%
Octylphenol ethoxylate surfactant	0.1%-5%
Pigment dispersion	2%-15%
Polysaccharide solution	5%-40%
Isocyanate	3%-20%

[0013] The thickener is used to adjust the viscosity of the composition to a desired value. Suitable thickeners include hydroxyethylcellulose, hydrophobically-modified ethylene oxide-based urethanes, hydrophobically-modified alkali soluble emulsions, and/or other alkali-soluble associative thickeners. The amine, in turn, is used to activate the thickener. Suitable amines include dimethylethanolamine, monoethylethanolamine, trimethylethanolamine, morpholine, and/or ammonia. The defoamer is employed break foam generated during formula processing and/or application of the stain onto wood; suitable defoamers include deaerators such as AIREX 900, available from TEGO. All three of these components are optional. The surfactant may have a hydrophile-lipophile balance (HLB) value between 5 and 15.

[0014] A suitable polysaccharide is the LPR76 product supplied by Lorama Group Inc., Ontario, Canada, and a suitable isocyanate is the Bayer DESMODUR H (HDI) product. No drying agent is needed. The system can be pigmented using any suitable pigment composition (most common water-based pigments dispersions can be employed) to the desired color space.

[0015] The polysaccharide component may be formed by mixing the water, amine, thickener, defoamer, polysaccharide and pigment dispersions in a vessel until homogeneous. Just prior to stain application the isocyanate component is added.

[0016] While the invention has been described in conjunction with the specific embodiments thereof, one of ordinary skill in the art will understand that any alternatives, modifications, and variations of the types of the ingredients and/or the amounts thereof contained in the single formula finish are possible and are they within the scope of the present invention.

[0017] The terms and expressions employed herein are used as terms and expressions of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof. In addition, having described certain embodiments of the invention, it will be apparent to those of ordinary skill in the art that other embodiments incorporating the concepts disclosed herein may be used without departing from the spirit and scope of the invention. Accordingly, the described

embodiments are to be considered in all respects as only illustrative and not restrictive.

[0018] What is claimed is:

CLAIMS

1. A wood stain composition comprising:
an aqueous solution of a crosslinkable polysaccharide;
a crosslinking agent crosslinkable with the polysaccharide upon drying of the aqueous solution; and
a pigment dispersion.
2. The composition of claim 1, wherein the crosslinking agent consists essentially of a monomeric aliphatic diisocyanate, a toluene diisocyanate, a hexamethylene diisocyanate, a naphthalene diisocyanate, a methylene bis-cyclohexylisocyanate, or an isophorone diisocyanate.
3. The composition of claim 1, further comprising a thickener.
4. The composition of claim 3, wherein the thickener consists essentially of hydroxyethylcellulose, hydrophobically-modified ethylene oxide-based urethanes, or hydrophobically-modified alkali soluble emulsions.
5. The composition of claim 1, further comprising a defoamer.
6. The composition of claim 1, further comprising an amine.
7. The composition of claim 6, wherein the amine consists essentially of dimethylethanolamine, monoethylethanolamine, trimethylethanolamine, morpholine, or ammonia.
8. The composition of claim 1, further comprising a surfactant.
9. The composition of claim 8, wherein the surfactant is a nonionic surfactant.
10. The composition of claim 9, wherein the surfactant is an octylphenol ethoxylate surfactant.

11. The composition of claim 8, wherein the surfactant has a hydrophile-lipophile balance value between 5 and 15.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/054757**A. CLASSIFICATION OF SUBJECT MATTER****C09D 15/00(2006.01)i, C09D 101/00(2006.01)i, C09D 7/00(2006.01)i, C09D 7/12(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C09D 15/00; C08L 77/06; C08K 5/053; C08B 15/06; C08B 31/00; C08K 3/22; C09D 101/00; C09D 7/00; C09D 7/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: polysaccharide, wood stain, diisocyanate, crosslink, pigment

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01-35719 A2 (EASTMAN CHEMICAL COMPANY) 25 May 2001 See page 12, lines 3-4, 11-12; page 14, lines 32-33; and claims 1, 7.	1-11
A	US 2008-0275168 A1 (SCHIERLMANN, JOHN FRIEDERICH) 06 November 2008 See the entire document.	1-11
A	WO 2007-102877 A2 (BENJAMIN MOORE & CO.) 13 September 2007 See the entire document.	1-11
A	US 5116408 A (CROZER, VEVA W.) 26 May 1992 See the entire document.	1-11
A	EP 2682408 A1 (HUNTSMAN INTERNATIONAL LLC) 08 January 2014 See the entire document.	1-11



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

19 January 2018 (19.01.2018)

Date of mailing of the international search report

19 January 2018 (19.01.2018)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

Facsimile No. +82-42-481-8578

Authorized officer

JANG, Gijeong

Telephone No. +82-42-481-8364



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2017/054757

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 01-35719 A2	25/05/2001	None	
US 2008-0275168 A1	06/11/2008	CA 2630503 A1	03/11/2008
WO 2007-102877 A2	13/09/2007	CA 2635875 A1	13/09/2007
		CA 2635875 C	04/02/2014
		US 2007-0155886 A1	05/07/2007
		US 7754801 B2	13/07/2010
		WO 2007-102877 A3	04/12/2008
US 5116408 A	26/05/1992	US 4976782 A	11/12/1990
EP 2682408 A1	08/01/2014	CA 2874285 A1	09/01/2014
		CN 104640883 A	20/05/2015
		EP 2870181 A1	13/05/2015
		IN 9973DEN2014 A	14/08/2015
		RU 2015103729 A	27/08/2016
		US 2015-0152196 A1	04/06/2015
		US 9815911 B2	14/11/2017
		WO 2014-005779 A1	09/01/2014