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WINDSHIELD WIPERS

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This invention pertains to paper towels, more particularly, this invention pertains to wet-strengthened, chemically-treated paper towers suitable for wiping glass surfaces such as those of motor vehicles. The combinations of chemical components in the towel are also within the scope of the invention.

Prior art towels designed for wiping purposes have been altered either chemically or physically to improve the wiping action. For example, wet-strength chemicals have been used with the desired loose and fluffy towel stock to decrease its disintegration in water and increase its abrasive resistance. In order to avoid some of the problems of these weak sheets, as well as to improve their oil absorbency, attempts have been made to improve sheet strength by loosening or fluffing up the cellulose fibers in certain areas and keeping the sheet continuous and strong in others. For this purpose different types of embossing or perforations are used.

Other types of sheet alterations used to improve the wiping action of paper towels are crinkling, creping, texturizing and surface working. Most of these physically-treated sheets have also been wet-strengthened with different types of wet-strength resins.

In addition, some sheets are treated with different chemical agents to improve properties such as absorbency and cleaning ability. These agents, it has now been found, must be compatible with the wet-strengthened paper and of such nature that one agent does not minimize the effect of the other. Besides, these agents must have properties that do not change with ageing.

Most of the prior art wet-strength resins are of the urea-formaldehyde and melamine-formaldehyde condensate type. For enhanced affinity of the resin to cellulose or, more particularly, to the anhydroglucose unit, various urea-formaldehyde modifiers are added. Mostly, these are amine-modified cationic resins such as disclosed in Ser. No. 722,642, filed Mar. 20, 1958, now abandoned and patents mentioned therein. These resins are the preferred type. Only a limited number of wet-strength resins are known while a considerable number of detergents are known for cleaning purposes. Most of these detergents fall in the surfactant class and can be divided in three subclasses, i.e., anionic, cationic and non-ionic detergents. As the divisions suggest, these detergents have certain chemical properties and thus are useful in certain applications because of their properties. Therefore, these detergents are generally selected on the basis of their chemical nature.

Surfactants such as emulsifiers, wetting agents, spreading agents, solubilizers, penetrants and detergents in general, for one reason or another, lack the needed properties possessed by the novel towel. Although the physical properties of these detergents are analogous, each reacts differently toward the chemicals employed in wet-strengthened paper. For this reason there is no predictability among the detergents.

In developing an acceptable wiping towel for glass surfaces and, more particularly, glass surfaces of moving vehicles, the following requirements are important. The products must be of the throw-away variety, i.e., reasonably inexpensive. The detergent must foam with water on the glass to aid in removing visibility-obstructing dirt and grime, and the foam must break down within a short

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period after foaming. At the same time the towel must have sufficient absorbency to soak up all the detergent foam as well as the dirt, grime and loosened film layer. Moreover, the chemicals must not leave a visible or light-diffracting film obstructing the driver's visibility; and these films must resist condensation or fine droplet formation (i.e., fogging) of the windshield. These requirements eliminate most of the non-ionic detergents as these leave a distinct layer of film on the windshield. The cationic detergents are eliminated because they are substantive to cellulose and relatively unavailable. Additionally, the product should leave the glass as clean as possible and impart an ability to the glass surface to retard dirt adhesion and visibility-obscuring droplet formation. Of the various detergents tested the following non-ionic compositions are not suitable according to the established standard: poly ethoxy oleyl ether, poly ethoxy oleic ester, poly ethoxy nonyl phenol and coco fatty acid amine condensate. The following detergents were tested and found to be unsatisfactory: sodium oleyl tauride, dodecyl benzene sulfonate and alkyl polyphosphate ester.

While most of these formulation and preparation requirements are dictated by end-use applications, many problems encountered in the manufacture of an acceptable towel are equally troublesome. Often, these manufacturing problems, coupled with the above requirements, eliminate many promising detergents from ever achieving use as chemical-treating agents for windshield wiping towel applications. For example, some of these detergents may only be used after the wet-strengthened sheet has cured for a sufficient time. Obviously, this problem necessitates rehandling of paper (extra steps), increases manufacturing costs and requires warehousing of the curing paper product. Many other chemicals, when applied, require rewetting and redrying of the paper sheet if products of acceptable nature are to be obtained. Further, some of the chemicals used cannot be dried because of decomposition at the temperatures used in paper manufacture.

Other chemical detergents are unacceptable after a very limited period of storage or ageing because of the interaction of cationic wet-strength resins with the anionic detergent, or if made useful as much as a ten-fold amount of detergent must be employed to overcome the reaction.

The invention in its broader concept involves the use of an ester of an aliphatic dibasic acid having the formula:

$$\begin{array}{c} XOOC-\underset{\displaystyle SO_3M}{\underset{|}{R}}-COOX \end{array}$$

in which R is a carbon chain of two carbon atoms, M is an alkali metal cation derived from a base, preferably alkali metal salt such as sodium, and X is an alkyl group derived from an alkyl alcohol.

Preferably, the alkyl alcohol group contains at least five carbon atoms.

It has now been found that particularly useful wiping towel may be obtained if dioctyl sodium sulfo succinate is used as the detergent in conjunction with cationic wet-strength resins. The preferred dioctyl moiety is derived from 2-ethylhexyl alcohol.

Further, urea-formaldehyde, urea-melamine and/or urea-formaldehyde-amine wet-strength resin-treated paper towel comprised of dioctyl sodium sulfo succinate and citric acid sequestering agent composition of matter is especially useful for wiping glass surfaces such as windshields on motor vehicles.

It has been found that the present combination of chemicals, when applied to wet-strengthened wipers, cleans the glass surfaces, deposits an invisible yet dirt-adhesion-resistant film, does disperse water (rain) in a uniform film on the glass surface, loosens dirt by easily foaming

up in small quantities of water and shows excellent water absorbing properties. Further, oil from the service station attendants' hands is apparently not transferred to the wiping towel and thus does not streak the window.

Not only are the above properties unexpected, but the present composition of matter as applied to wet-strengthened towels has been successfully used on the sheet at various stages of the papermaking process including points where the sheet is about 60% wet. Obviously, this freedom of usage does not require the rehandling of material and the present products have proven to be storage-stable and chemical activity-retaining. In the event the paper has to be repulped the present combination also offers trouble-free operations. Thus a very desirable windshield wiper has been obtained giving highly reliable performance with excellent results and concomitant economic advantages.

In determining the efficacy of the various agents certain tests have been employed to evaluate the optimum stabilized-detergent, wet-strength additive system. A method for determining the stability of the detergent and the wet-strength system is carried out as follows.

A paper stock of 22 lb./ream (24 x 36 x 480 sheet) consisting of four pieces of paper 2½ inches square was cut from a sheet. This sample was then cut into 96 equal parts and put into a Waring Blendor containing 200 cc. of cold tap water at about 60° F. The blender was operated for 30 seconds at maximum r.p.m. An initial foam height in the blender was measured and recorded. A second reading was taken 30 seconds after the blender was stopped. Similarly, tests were run after the towel had aged for 3 days, 2 weeks and 4 weeks.

In order to get a first reading of detergent reactivity with the wet-strength resin the detergents were sprayed, when the sheet was about 60% wet, on a paper machine and then at the rewinder or reel. The following data show the use of liquid alkyl aryl sulfonate of the type known as Ultrawet 60L available from Atlantic Refining Company, Philadelphia, Pa. This commercial detergent solution consists of 60% active component and 40% water. The following data were obtained:

ULTRAWET 60L CATIONIC UREA-FORMALDEHYDE WET-STRENGTH RESIN INTERACTION

[Average amount of detergent on sheet is 1.8% based on B.D. (bone dry) sheet]

	Spraying After Yankee Dryer, Sheet Is About 60% Wet		Spraying at Reel or Rewinder, Sheet Is Dry	
	Init. Ht. of Foam	30 Sec.	Init. Ht. of Foam	30 Sec.
Average Height of Foam	1.08″	.667″	3.00″	2.16″

In the same manner tests were run with dioctyl sodium sulfo-succinate with citric acid sequestering agent impregnated paper towel.

The results were as follows:

1.0% Detergent Solids Based on Dry Fiber	Foam Height	
	Aged 11 days	Aged 24 days
After Yankee Dryer, sheet is about 60% wet	0.8125″	0.8125″
At the Reel	1.000″	0.9375″

As can be seen from the data the results change markedly with Ultrawet 60L but not with dioctyl sodium sulfosuccinate plus citric acid in a urea-formaldehyde wet-strength resin treated paper towel.

Data obtained by comparing these two detergents also illustrate dramatic differences in aging rates.

Other detergents having chemical properties even more closely related to DOSSS (dioctyl sodium sulfo succinate) than Ultrawet 60L have been tested and the DOSSS plus

citric acid combination performs better or possesses other advantages not encountered with other compositions.

In general the amount of DOSSS may vary from about 0.1% to about 2.5% (solid DOSSS) based on dry paper fibers. The preferred range is of from 0.5% to about 2.0% DOSSS while the most preferred range is of from 0.5% to about 1%. In commercial applications about 0.75% DOSSS based on dry paper appears to be most advantageous.

The amount of citric acid sequestering agent is about 0.01% to about 1.5% based on the solid DOSSS and generally amounts below 1.0% perform in an acceptable fashion.

The cleaning ability of the novel towel was evaluated by comparing it with liquid cleaners according to Federal Specification for Liquid Glass Cleaners P–G–406 adopted May 26, 1950. According to this method the instant paper towel performed in satisfactory manner when compared to the available liquid window cleaners. As can be appreciated, the elimination of a liquid window cleaner solution and merely the use of water in its stead simplified operations and eliminates transporting diluted liquids or a dangerous concentrated liquid as well as containers in many areas where glass surfaces have to be wiped such as in service stations.

What is claimed is:

1. A method for wiping and cleaning glass surfaces comprising the use of wet-strengthened paper towel having incorporated therein from about 0.1 percent by weight to about 2.5 percent by weight, based on the weight of the dry paper fibers in said towel, of dioctyl sodium sulfosuccinate; and from about 0.01 percent by weight to about 1.5 percent by weight, based on the weight of dioctyl sodium sulfosuccinate, of citric acid sequestering agent.

2. A method according to claim 1 wherein the glass surface is that of a motor vehicle windshield.

3. A substantially non-aging detergent composition suitable for use on cationic urea-formaldehyde resin wet-strengthened paper sheet consisting essentially of a dioctyl sodium sulfo succinate admixed with from about 0.01 percent by weight to about 1.5 percent by weight based on the weight of the dioctyl sodium sulfo succinate of a citric acid sequestering agent.

4. A wet-strengthened paper towel having incorporated therein

(A) from about 0.1 percent by weight to about 2.5 percent by weight, based on the weight of the dry paper fibers in said towel, of a dialkyl alkali metal sulfosuccinate detergent, wherein each of the alkyl groups contain from about 5 to about 12 carbon atoms; and

(B) from about 0.01 percent by weight to about 1.5 percent by weight, based on the weight of detergent, of citric acid sequestering agent.

5. A urea-formaldehyde resin wet-strengthened paper towel having incorporated therein

(A) from about 0.5 percent by weight to about 2.0 percent by weight, based on the weight of the dry paper fibers in said towel, of a dialkyl alkali metal sulfosuccinate detergent, wherein each of the alkyl groups contain from about 5 to about 12 carbon atoms; and

(B) from about 0.01 percent by weight to about 1.5 percent by weight, based on the weight of detergent, of citric acid sequestering agent.

6. A cationic urea-formaldehyde resin wet-strengthened paper towel having incorporated therein

(A) from about 0.5 percent to about 1.0 percent by weight, based on the weight of the dry paper fibers in said paper towel, of a dialkyl alkali metal sulfosuccinate detergent, wherein each of the alkyl groups contain from about 5 to about 12 carbon atoms; and

(B) from about 0.01 percent by weight to less than about 1.0 percent by weight, based on the weight of the detergent of a citric acid sequestering agent.

7. A cationic urea-formaldehyde resin wet-strengthened

paper towel as claimed in claim 6 wherein the dialkyl alkali metal sulfosuccinate detergent is di(2-ethylhexyl) sodium sulfosuccinate.

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