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PROCESS OF PREPARING A FILTER CLOTH

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2 Claims. (Cl. 117—121)

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The present invention relates to a process for preparing a filter cloth specifically for use in the filtration of alkaline aqueous liquids and to the cloth as prepared in accordance with the present invention.

The problem of filtration of highly alkaline liquids is a serious one in practice, particularly when means such as the usual filter presses are to be used. This is because most cloths such as are normally employed in presses or for covering the leaves of leaf filters are made of cotton; and this material is in effect destroyed chemically by reaction with the highly alkaline aqueous liquids to be filtered, if the cloth is used untreated. Consequently it is customary to treat the cloth.

In accordance with the present invention the cloth is not completely prepared in its eventual operative condition prior to its initial use, and the process for preparing the cloth can be carried out less expensively than by the use of previously-employed processes.

The process of the present invention is related to, but distinguishes from, my Canadian Patent No. 444,654, granted October 21, 1947, entitled "Methods of Treating Textile Materials," in that this prior patented process included a plurality of steps, in certain of which the cloth, which had been impregnated with any one of a number of salts of which cerium chloride was one, also was treated during the preparation of the cloth for use, with an alkaline liquid or a soap for precipitating an insoluble salt of cerium (or of some other rare earth element) in the fibers of the cloth. In accordance with the present process, it is found that if the cloth is merely impregnated with a soluble cerium salt in an adequate amount, then dried, the subsequent initial intended use of the cloth resulting in precipitating the desired insoluble salt in the fibers of the cloth is adequate, so that certain later steps taught to be done and considered essential in accordance with this prior patent are now omitted as unnecessary. This renders the present process of preparing the cloth much quicker and cheaper than was deemed possible when operating in accordance with the teaching of this prior patent.

Another feature of distinction between the present invention and the invention of the prior patent aforesaid is that the process of the present invention involves the use of a wetting agent in a minor, but effective, proportion, which enables a lower concentration of the cerium salt to be used in the dipping or treating solution than was thought possible in accordance with my said prior patent. This is believed to be due to the fact that

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the saturation of the cloth with the solution of the present invention is much more complete than was possible without the use of a wetting agent as an ingredient of the solution. As such, therefore, it is possible in accordance with the present invention to deposit in the fibers of the cloth more than the amount of cerium needed for the final cloth (when precipitated in an insoluble form), even though the dipping solution is in fact less concentrated than was found necessary in accordance with my prior patent aforesaid. In this way also the present process is cheaper to operate from a commercial point of view than was the prior patented process.

The present invention is also related to my prior and co-pending application in the United States, Serial No. 45,438, filed August 20, 1948, entitled "Filter Cloth and Process of Preparing Same," now Patent No. 2,528,847, issued November 7, 1950. In this co-pending application, the purpose, as in the present case, was to prepare a cloth including in the fibers thereof a soluble salt of a selected group of metals, mostly rare earth metals, and including as one example, cerium. In this prior application, however, it was also taught, in order to bind the cerium (or other metal) salt in the cloth sufficiently so that it could be precipitated prior to being washed out by the normal flow of filtrate through the cloth upon its initial use in filtering aqueous alkaline liquids, that wax, used in the dipping solution as an emulsion, was required. In accordance with the present invention, the use of this wax in emulsion, or in other form, is dispensed with. In lieu of this, the dipping solution is found to require a somewhat higher concentration of the water-soluble salt (cerium salt), so that even though in its initial use in filtering an aqueous alkaline liquid, some of the soluble salt present may be washed out of the cloth by the flow of filtrate, a sufficient amount will be left which will be converted into the corresponding desired insoluble compound by chemical reaction with the alkali in the filtrate, so that following the initial use, the cloth will be protected during its subsequent normal useful life. In this way, also, there is provided, in accordance with the present invention, a novel process and product which can be carried out and made more cheaply than when following the teachings of my prior United States Patent No. 2,528,847.

Following the teachings hereinabove noted as to the present invention in discussing the distinctions of the present invention from applicant's earlier patent and application, it is a primary

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general object of the present invention to provide a process and a product which may be more cheaply and simply carried out and made than was possible in accordance with any prior art process or corresponding product.

Other and more detailed objects of the present invention will appear from the following detailed specification and will be pointed out in the appended claims.

Inasmuch as the process of the present invention may be carried out by the use of conventional apparatus, which will immediately suggest itself to those skilled in the art from the description of the process, its illustration in drawings is deemed unnecessary. Briefly, the process of the present invention comprises impregnating a piece or continuous length of cloth of suitable character in a bath of a desired composition as herein-after set forth, then expressing or otherwise mechanically removing from the cloth any liquid of the impregnating bath in excess of that required completely to saturate the cloth, then drying the cloth in a conventional manner.

From a mechanical point of view, the impregnation may be conducted by passing the cloth a desired number of times around rolls, some of which are immersed beneath the surface of the desired impregnating bath contained in any suitable container or tank. The excess liquid may be removed from the cloth by conventional means, such as calender or squeeze rolls. If the cloth is in relatively small pieces, they may be placed in a centrifugal extractor.

The drying of the cloth may be effected in any suitable manner, for example by passing a continuous web thereof serially over heated drums or rolls or dry cans or by festooning or by placing in dry boxes.

The bath used for impregnating the cloth is preferably a single bath in accordance with the present invention, as only one single impregnation is required. This bath has two essential active ingredients: first, a water-soluble salt of cerium, which is selected from the group consisting of the chloride, acetate and sulphate of cerium, and, second, a suitable wetting agent in a minor proportion. Also, it will usually be necessary in order to control the pH to add a third ingredient, which is in effect a buffer. This may consist of one or more salts which will control the pH in a manner known in the art of buffering, so that the pH will have a selected value between 7 and about 9, in other words, on the alkaline side of neutral. This may be done practically by the addition of a suitable amount of a salt which hydrolyzes to give an alkaline reaction, such as sodium acetate. It may also be desired to use as an additional material having an alkaline reaction in aqueous solution, such materials as soda ash or even a very small amount of a strong alkali such as caustic soda. In any event, this buffer ingredient is added in a concentration and/or is of a nature such that it will be substantially neutral except for its buffering action as aforesaid.

Considering now the principal ingredient of the solution, i. e. the cerium salt, it is usually desired to employ a commercially available salt, such as a commercial grade of cerium chloride. On the other hand, both cerium acetate and cerium sulphate may be considered as equivalents as both are water-soluble to the extent necessary, i. e. to provide a solution having a cerium concentration (calculated as elemental cerium) of about 0.45 pound per gallon of solution.

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The amount of the cerium salt which will remain in the cloth is a function of the physical characteristics of the cloth itself. In practice it is determined by the amount of solution which the cloth will contain after it has been completely immersed in the solution, so as to adsorb as much solution as is possible in view of the physical characteristics of the cloth (saturation). Following this, excess solution is mechanically removed from the cloth in any of the ways known in the art as aforesaid, for example, by centrifuging or by squeezing the cloth between calender rolls. The amount of the cerium thus remaining in the cloth will be reasonably constant for any given type of cloth. In practice for example, it has been found that if a piece of the cloth is completely incinerated following its preparation as therein taught, it will have an ash content, probably substantially all cerium oxide, of about 5% to about 6% of the original weight of the dry treated cloth.

Following the removal of the excess solution, the cloth may be dried in any suitable way known to the art, for example by leaving a continuous web of cloth around heated drums as aforesaid.

The cloth is now ready for normal sale and for use in the filtration of aqueous alkaline liquids. The initial use of the cloth, for example, in a filter press, in filtering an aqueous liquid, will serve to convert a substantial amount of the cerium content thereof to an insoluble, colloidal and substantially gelatinous precipitate, which is formed and deposited in situ throughout the cloth fibers, so as to protect such fibers from subsequent chemical attack by the alkali content of the filtrate. This completes the preparation of the cloth for its normal useful life. The conversion of the cerium content to an insoluble precipitate is not, however, always an essential part of the invention, although it may be considered a part thereof from the point of view of the final form of the cloth in use. However, the cloth, prior to this actual initial use, is a salable article of commerce and is contemplated to be sold as such to a user, who will use it in accordance with his own principles and operation. In the event that the cloth is used in filtering caustic soda solutions, for example, the precipitate formed in the cloth will be cerium hydroxide. If, on the other hand, a highly alkaline (relatively concentrated) solution of soda ash is used as the liquid to be filtered, the cerium may be precipitated as cerium carbonate. Cerium hydroxide and cerium carbonate have similar physical and chemical characteristics, in that both are colloidal and gelatinous and are substantially insoluble in water. Both will serve to protect the fibers of the cloth during its subsequent normal use.

As a specific example of a dipping solution usable in accordance with the present invention the following is given:

Water	----- gallons	100
Cerium chloride (commercial grade having a cerium content of about 18½%)	----- pounds	262
Sodium acetate (buffer)	----- do	9
Wetting agent (such as either of those sold under the trade-mark names of "Triton NE" or "Duponol 80")	----- pounds	2½

"Triton NE" is stated in the literature relative thereto to be an alkylated aryl polyether alcohol, and to be a liquid, nonionic type wetting agent, soluble in water.

"Duponol 80" is stated in the literature relative thereto to be a sodium alcohol sulfate, and to be a water-soluble, liquid, anionic type wetting agent.

The above solution has a specific gravity of about 38° Tw. (about 1.19 on the ordinary specific gravity scale).

By calculation and knowing the exact composition of the commercial grade cerium chloride above referred to, it has been found that the materials given in the above example will yield about 108 gallons of solution and will have a total weight of about 1107 pounds. This solution will have a concentration of about 0.45 pound of cerium (calculated as elemental cerium) per gallon. It has further been found that the concentration of this dipping solution is substantially less than that taught in my prior Canadian Patent No. 444,654 aforesaid and yet yields a treated cloth, following the teaching of the present process, which has a sufficient cerium content, so that even though some of the cerium may be lost during the initial use of the cloth, at which time the remainder of the cerium is precipitated as aforesaid, an adequate amount of the cerium precipitate will remain in the cloth to give the necessary protection for the fibers thereof during normal subsequent use. This result is believed to be attributable in large part at least to the presence in the solution of the wetting agent aforesaid.

While two commercially available types of wetting agents have been specifically referred to hereinabove, many other types are known and are operable in the practice of this invention. The particular type is per se no part of the present invention, as any efficient wetting agent, commercially sold as such, may be used in a minor proportion in accordance with the teaching of the present invention, the two specifically referred to above being mentioned as examples only and not being intended as limiting.

At the same time the concentration of cerium in the dipping solution in accordance with the present invention, (and in the absence of wax, such as was taught to be used in accordance with my copending United States application, now Patent No. 2,528,847 aforesaid), is greater than was taught to be used in that co-pending application. However, this higher concentration is often more convenient for use than is the wax emulsion taught in my earlier co-pending application aforesaid and is found to give adequate final insoluble cerium content in the cloth, even though some cerium may be lost as aforesaid during the fixing of the remainder in the initial use of the cloth. It is noted that the present impregnating solution contains no wax of any kind or other means for mechanically or otherwise fixing the cerium into the cloth prior to the initial use of

the cloth, at which time the cerium is precipitated as aforesaid.

While there is herein described but one principal embodiment of the invention and certain equivalents have been suggested throughout the description, I do not wish to be limited except by the scope of the appended claims, which are to be construed validly, as broadly as the prior art permits.

What is claimed is:

1. The process of treating filter cloth to prepare it for use in the filtration of alkaline aqueous liquids, comprising the steps of impregnating the cloth in a single aqueous bath, the essential active ingredients of which consist of: (a) at least one water-soluble salt of cerium selected from the group consisting of cerium chloride, cerium acetate and cerium sulphate, said bath having a cerium concentration of about 0.45 pound per gallon, (b) at least one buffer ingredient effective to control the pH of the bath to a selected value in the range of 7 to about 9 and which ingredient is otherwise neutral, and (c) a minor proportion of a wetting agent; then mechanically removing from the cloth any liquid in excess of that amount required to saturate it; and thereafter drying the cloth to complete the preparation thereof in readiness for delivery to a user of said cloth.

2. The process in accordance with claim 1, wherein said single bath is made up in the proportion of:

Water	-----gallons	100
A commercial grade cerium chloride containing about 18½% cerium	-----pounds	262
Sodium acetate as buffer	-----do	9
Wetting agent	-----do	2½

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,634,793	Minaeff	July 5, 1927
2,528,847	Van Norden	Nov. 7, 1950

FOREIGN PATENTS

Number	Country	Date
444,654	Canada	Oct. 21, 1947

OTHER REFERENCES

Industrial and Engineering Chemistry, Aug. 1928, pages 801-4.