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ROOM-TEMPERATURE BLEACHING OF TEXTILES WITH PERACETIC ACID

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ABSTRACT OF THE DISCLOSURE

A process for bleaching cellulosic fabrics employing peracetic acid as the bleaching agent, by impregnating the fabric with an aqueous medium containing peracetic acid having a pH of from 3 to 7 and thereafter contacting the impregnated fabric with ammonia vapors at atmospheric conditions of temperature and pressure for up to about one hour.

This invention is concerned with a novel process for bleaching the peracetic acid. More particularly, this invention relates to a method for bleaching cellulosic fabrics with peracetic acid at low temperatures, particularly room temperature. In a still more particular aspect, this invention comprises bleaching cotton and other cellulosic fabrics by impregnating the fabric with an aqueous medium containing peracetic acid and thereafter contacting the impregnated fabric with ammonia vapors at about room temperature.

Today almost all large scale bleaching is done with hydrogen peroxide by the pad bath-steam method. Although this method is superior to the previously-employed chlorine bleaching processes, it nevertheless suffers from several disadvantages, including the requirement for extended periods of heating at elevated temperature, necessitating large, space-consuming bleaching chutes for continuous operation. Moreover, to maintain the desired pH of about 11 in the pad bath, it is necessary to employ sodium silicate in the bath. The sodium silicate has a tendency to adversely affect the hand of the bleached fabric, tends to collect in the bleaching chutes and often complicates dyeing of the bleached fabric by forming silicate rub marks or rope streaks.

Recently efforts have been made to perfect a process wherein peracetic acid is employed as the bleaching agent, thereby eliminating the necessity for sodium silicate and obviating the attendant disadvantages. Reported efforts, notably those of Rösch in "Deutsche Textiltechnik," 10, 191–5 (1960), have not been successful in achieving bleaching equivalent to that obtained with hydrogen peroxide. More recently, however, A. M. Sookne and C. A. Rader in pending application Ser. No. 468,601, filed June 30, 1965 discovered that effective bleaching could be obtained by employing as the pad bath an aqueous medium containing peracetic acid free of mineral acids and hydrogen peroxide and thereafter contacting the impregnated fabric with saturated steam at about atmospheric temperature for a period of time not exceeding 30 minutes, and preferably in the range of 5 to 10 minutes. Although this method is superior to the known processes employing peracetic acid, it still suffers from the expense of maintaining steamheated bleaching chutes. Further, to obtain optimum bleaching by this technique, it is necessary to adjust the pH of the pad bath to about 5.5 by the addition of an alkali metal hydroxide, which has a tendency to damage the fabric being treated, particularly on being heated at elevated temperatures.

It has been discovered by this invention that effective bleaching can be obtained by the use of peracetic acid by contacting the fabric, which has been impregnated

with an aqueous medium containing peracetic acid, with ammonia vapors at low temperatures, for example about room temperature.

Impregnation of the fabric is effected in any suitable manner, such as by spraying or padding the fabric with an aqueous peracetic acid-containing medium. The concentration of peracetic acid in the aqueous medium is not critical to this invention, but should be in an amount sufficient to provide effective bleaching, generally an amount sufficient to impregnate the fabric with from about 0.1 to about 5, preferably 0.2 to about 2.5, weight percent of peracetic acid, based upon the dry fabric.

In a preferred technique, the fabric is padded to about 100 percent wet pick-up and then subjected to the ammonia treatment of this invention. In this technique, the aqueous pad bath contains from 0.1 to 5, preferably 0.2 to 2.5, weight percent peracetic acid.

In addition to peracetic acid, it is preferred that the aqueous medium contain a wetting agent, for example, a sodium alkylsulfate, a sodium sulfate of an ethylene oxide adduct of an aliphatic alcohol or alkyl phenol and the like, and a sequestering agent, for example, an alkali metal, preferably sodium, salt of a condensed phosphate, such as sodium hexametaphosphate, sodium pyrophosphate, sodium tripolyphosphate and the like.

The pH of the aqueous medium will be about 3, but can be increased up to about 7 by the addition of base, for example, alkali metal hydroxide, if desired. The addition of base is unnecessary, however, and is preferably not employed to avoid potential damage to the fabric.

The impregnated fabric is contacted with ammonia vapors by any suitable technique. The conditions of time, temperature, pressure and ammonia concentration are not highly critical to this invention. The ammonia can be pure or diluted with other gases such as air, oxygen, nitrogen and the like. The contact is generally effected at normal atmospheric conditions of temperature and pressure. The time is that period sufficient to effect the desired degree of bleaching, with periods of up to about one hour normally being sufficient to obtain a high degree of bleaching.

Following the ammonia treatment, the fabric is washed and dried.

The following examples are illustrative. In the examples, the bleached fabrics were evaluated by the following techniques.

(1) Reflectance—Determined with a Hunter Multipurpose Reflectometer employing green, blue and amber filters, with the reflectometer calibrated to read 100% reflectance from a magnesium oxide block. Green and blue reflectances are reported as percents of the reflectance from a magnesium oxide block.

(2) Whiteness was calculated by the equation:

$$\text{Whiteness} = (4 \times \text{blue reflectance}) - (3 \times \text{green reflectance})$$

(3) Yellowness index was calculated by the equation:

$$\text{Yellowness} = \frac{\text{amber reflectance} - \text{blue reflectance}}{\text{green reflectance}}$$

EXAMPLE 1

A piece of scoured cotton printcloth was padded to about 100 percent wet pick-up with an aqueous solution having a pH of 3 and containing 2.4 weight percent peracetic acid, 0.5 weight percent sodium lauryl sulfate as a wetting agent and 0.2 weight percent sodium hexametaphosphate as a stabilizer. The impregnated fabric was then treated with ammonia vapors for a period of one hour, washed and dried. A second piece of printcloth was impregnated with the same solution, air dried for one hour and then washed and dried. The analyses of these

two fabrics are summarized in Table I, together with the data for the untreated fabric for comparison.

TABLE I

Property	Ammonia treatment	Air dry	Untreated
Blue reflectance, percent	84.2	74.6	65.2
Green reflectance, percent	89.0	82.2	72.1
Whiteness, percent	69.8	52.0	44.5
Yellowness index	0.064	0.118	0.12

EXAMPLE 2

The experiment of Example 1 was repeated, except that the aqueous bath also contained 1.25 weight percent sodium hydroxide to adjust the pH to 5.5. The results for this experiment are summarized in Table II.

TABLE II

Property	Ammonia treatment	Air dry	Untreated
Blue reflectance, percent	84.4	80.0	65.2
Green reflectance, percent	89.0	86.2	72.1
Whiteness, percent	70.6	61.2	44.5
Yellowness index	0.060	0.089	0.12

A comparison of the results of Examples 1 and 2 indicated that the pH of the pad bath has little effect on the extent of bleaching by the ammonia treatment of this invention, although a significant effect is observed with the air dry.

What is claimed is:

1. In the process for bleaching cellulosic fabrics employing peracetic acid as the bleaching agent, the improvement of effecting said bleaching by impregnating said fabric with an aqueous medium containing peracetic acid having a pH of from 3 to 7 and thereafter contacting the impregnated fabric with ammonia vapors at atmospheric conditions of temperature and pressure for up to about 1 hour.

2. The process as claimed in claim 1 wherein said aqueous medium contains no added base.

References Cited

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