United States Patent [19]

Weil

[11] 3,864,156

[45] Feb. 4, 1975

[54] **PROCESS FOR FLAMEPROOFING SYNTHETIC TEXTILES AND THE FIRE RETARDANT TEXTILE FORMED THEREFROM**

[75] Inventor: **Edward D. Weil,** Hastings-on-Hudson, N.Y.

[73] Assignee: **Stauffer Chemical Company,** Westport, Conn.

[22] Filed: **July 10, 1972**

[21] Appl. No.: **270,110**

Related U.S. Application Data

[63] Continuation of Ser. No. 23,493, March 27, 1970, abandoned.

[52] **U.S. Cl.**..... **117/136,** 117/93.31, 117/138.8 E, 117/138.8 F, 117/138.8 N, 117/138.8 UA, 117/143 A, 117/145

[51] **Int. Cl.**..... **C09d 1/00,** B44d 1/50

[58] **Field of Search**..... 117/136, 138.8 E, 138.8 F, 117/138.8 N, 138.8 UA, 143 R, 143 A, 145, 144, 93.31

[56] **References Cited**

UNITED STATES PATENTS

2,670,483	3/1954	Brophy	117/93.31 X
2,803,562	8/1957	Erbel et al.	117/136
2,888,434	5/1926	Shashoua	8/115.5 X
3,163,627	12/1964	Craver	260/861
3,403,044	9/1968	Chance et al.	117/136 X
3,407,088	10/1968	Feibush et al.	117/93.31
3,489,706	1/1970	Mikofalvy	117/143 X
3,501,339	3/1970	Guigiolo	117/136

Primary Examiner—William D. Martin
Assistant Examiner—Theodore G. Davis

[57] **ABSTRACT**

The present invention provides a process for flameproofing synthetic textiles which comprises passing a textile through an aqueous padding solution containing a polycondensed vinylphosphonate monomer and curing said monomer on said textile, and thereby rendering the textile flame retardant. The present invention also includes the flame retardant textile produced by the process.

18 Claims, No Drawings

PROCESS FOR FLAMEPROOFING SYNTHETIC TEXTILES AND THE FIRE RETARDANT TEXTILE FORMED THEREFROM

This is a continuation of application Ser. No. 23,493 filed Mar. 27, 1970, now abandoned.

This invention relates to a flame retardant textile finish. More particularly, this invention relates to a process for flameproofing textiles which comprises passing the textile through an aqueous padding solution containing a polycondensed vinylphosphonate monomer, and then drying the solution and curing the monomer on the textile to render the textile flame retardant.

By a textile is meant hereinafter a fabric, filament, staple, or yarn, or products made therefrom.

The flameproofing of textile is of importance for improvement of the fire safety characteristics of apparel, bedding, protective clothing, tentcloth, carpets, home furnishings, aircraft and automobile interior fabrics, and industrial fabrics, which may be woven, knitted, tufted, and non-woven.

There are various methods known for flameproofing textiles, which include the application of chlorinated paraffins with antimony oxide or tris (dibromopropyl) phosphate plus a resinous binder. Such procedures generally have the disadvantages of requiring a large addition of solids with resulting deleterious effect in the quality of the fabric and furthermore are quite limited in the durability to laundering and dry cleaning. There have been especially designed finishes which are durable for cotton. For example, those based on tetrakis (hydromethyl) phosphonium chloride or on phosphonated N-methylamides, but these are of little value on synthetic non-cellulosic fabrics. Furthermore, they generally require high temperature acid catalyzed curing conditions which are deleterious to cellulosic fibers and are found ineffectual on synthetic fibers such as polyesters or polypropylene.

In addition, it is known to use bis(2-chloroethyl) vinylphosphonate alone as a flame retardant, to flameproof cellulosics. However, this compound is soluble and can readily be lost into the solution in which a fabric or textile is treated, or in subsequent laundering or dry cleaning.

It is therefore a very important object of the present invention to make available flame retardant finishes which can be used on natural and cellulosic textiles, and particularly on synthetic textiles.

It is a further object to make available textile finishes which are durable to washing and dry cleaning.

Still another object of the present invention is to make available textile finishes which are curable under very mild conditions without excessive heating and without the need for acid catalysts.

According to the present invention, there is provided a process for flameproofing textiles with a finish which can be cured with a minimum of heat and which is durable when the textile is laundered or dry cleaned.

The present flameproofing process comprises passing a textile (which may be fabric, filament, staple, or yarn), through an aqueous padding solution containing a polycondensed vinylphosphonate monomer. Then, the solution is dried and the monomer is cured on the textile to effect the polymerization of the monomer to render the textile flame retardant. According to the present invention, the polycondensed vinylphosphonate monomer may be cured on the textile either by a

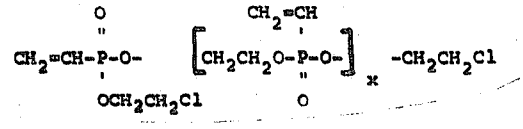
mold heating means, such as with steam, or by means of radiation.

The finish of the present invention is applicable to cotton, but in contrast to the prior art cotton flameproofing finishes which are known to work poorly on synthetic non-cellulosic fibers, the finish of the present invention is highly effective on synthetic non-cellulosic fibers or blends thereof with cellulosic fibers.

Thus, the flameproofing finish provided by the present invention may be effectively applied to various types of synthetic non-cellulosic textiles, including acetate, acrylics, modacrylics, fiberglass containing flammable binders, nylon, polypropylene, and polyesters such as polyethylene terephthalate, as well as blends of these with each other or with cellulosics, such as cotton-polyester blends, cottonnylon blends, and viscose-rayon polyester blends.

The aqueous padding bath through which the textile is passed contains the polycondensed vinylphosphonate monomer, a wetting agent and water. In addition, to assist or aid the curing and polymerization of the monomer on the textile, a free-radical generating catalyst such as ammonium persulfate may be added to the bath.

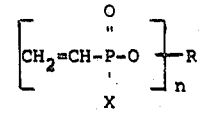
The preferred polycondensed vinylphosphonate monomer according to the present invention has the structure:



wherein x is an integer of 1 to 20, and preferably 1 to 10. This monomer is preferred because of its high percent of phosphorus, ease of manufacture, and high flame retardant efficacy.

The polycondensed vinylphosphonate monomer can be prepared according to the process described in copending U.S. application Ser. No. 828,781, filed May 29, 1969, now U.S. Pat. No. 3,641,202, issued Feb. 8, 1972. In that process, the monomer is prepared by reacting bis (2-chloroethyl) vinylphosphonate in the presence of a basic alkali metal or alkaline earth metal compound such as sodium carbonate, potassium carbonate, lithium carbonate, or the corresponding bicarbonate, calcium hydroxide and the like at a temperature of from about 140° C. to about 250° C. and removing the ethylene dichloride formed. The condensation can be stopped when the amount of ethylene dichloride liberated corresponds to the desired degree of condensation.

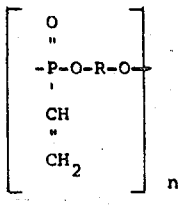
Generally, a polycondensed vinylphosphonate monomer having more than one vinyl group may be used as the monomer in the process of this invention, such as the species disclosed in German Pat. No. 1,243,192, having the structure:



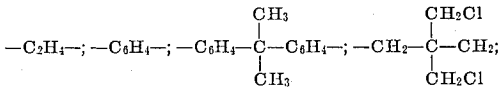
wherein X is an alkoxy, cycloalkoxy, aralkoxy, aryloxy, or N-dialkylamino; R is a di-or polyvalent aliphatic or

aromatic radical of two to 12 carbon atoms; and *n* is an integer of 2 to 6.

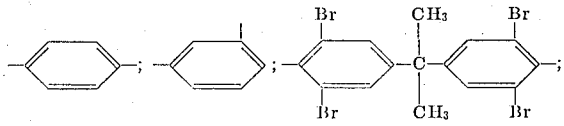
Another group of polycondensed vinylphosphonate monomers that may be used according to the present invention have the basic structure:



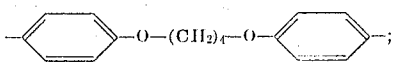
wherein R is



C_3—C_{12} alkylene



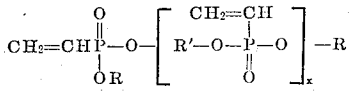
or



and *n* is a large integer of 10 to 1000.

Synthesis of these polycondensed vinylphosphonates is done in accordance with the processes described in the publications by I.K. Rubtsova et al., in *Plasticheskie Massy*, (No. 2) pages 22–24 (1961), and (No. 3) pages 13–14 (1961).

Other suitable polycondensed vinylphosphonate monomers which are synthesized according to the processes described in these publications of I.K. Rubtsova, et al. have the structure:

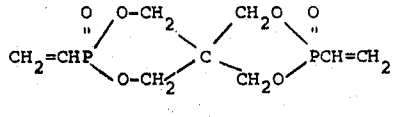


wherein R is an alkyl of 1 to 18 carbon atoms, haloalkyl, hydroxyalkyl, aryl (such as phenyl); and R′ is an alkylene or halogenated alkylene of two to 18 carbon atoms, arylene such as phenylene R and R′ can also be conjoined.

Examples of R include methyl, ethyl, 2-chloroethyl, 2-hydroxyethyl, 2-hydroxypropyl, 2-hydroxy-2-chloroisopropyl, $-CH_2C(CH_3)_2-CH_2OH$, and the like.

Examples of R′ include $-CH_2CH_2-$, $-CH_2CH_2CH_2CH_2-$, $-CH_2CH{=}CHCH_2-$, $-CH_2C{=}CCH_2-$, $CH_2CH_2OCH_2CH_2-$, $-CH_2C(CH_3)_2CH_2-$, $-CH_2C(CH_2Br)_2CH_2-$.

Examples where R and R′ are conjoined include



The polycondensed vinylphosphonate monomers provide a textile finish which can be rapidly ured under mild conditions to a cross-linked polymer and therefore highly durable finish, i.e., durable to both laundering and dry cleaning.

The catalysts that may be optionally included in the padding bath in addition to the polycondensed vinylphosphonate monomer include such free radical generating materials as ammonium persulfate, potassium persulfate, sodium persulfate, sodium perborate, hydrogen peroxide, acetyl peroxide, peracetic acid, benzoyl peroxide, lauroyl peroxide, t-butylhydroperoxide, acetone peroxide, methylethylketone peroxide, t-butyl perbenzoate, azobisisobutylonitrile, azobisisovaleronitrile, and the like.

Where especially fast catalysts is desired, a reducing component such as a bisulfite, ascorbic acid, a ferrous salt, or the like may also be added to the peroxygen compounds listed above. To avoid unduly short life of the aqueous padding bath, the oxidizing and reducing components may be added in separate padding operations.

It is a purpose of this invention not to use acid catalysts which may be deleterious to the textile being flameproofed.

A third monomer may optionally be present to modify the "hand" or other physical properties of the finish to provide sites of attachment for dyes or durable press finishes, or impart soil release properties. Suitable termonomers of this sort include vinylphosphonic acid, mono-2-chloroethylvinylphosphonate, and other lower alkyl acid vinylphosphonates, C_1–C_{18} alkyl acylates, glycol acrylates, acrylic acid or vinyl lower-alkyl ethers. When a second monomer of this sort is present, it should comprise less than 50% of the monomer content by weight, so as not to dilute unduly the flame retardant properties of the finish. The preferred monomers are those which are water-soluble and relatively low in volatility, namely the acid monomer named above, or the glycol acrylates.

The finishing formulations of the invention may optionally contain other ingredients of the types per se known in the textile finishing art for example, water and soil repellents, optical brighteners and colorants, softening agents (such as polyethylene emulsions), hand-modifying agents, and buffering agents and pH-controlling agents which may be acids or bases. Emulsified waxes, chlorowaxes (chlorinated paraffins), polyvinyl chloride, polyvinylidene chloride, acrylate polymers and copolymers, and other resinous finishing agents may be added in conjunction with the finishing agents of the invention. In cases where extremely high flame retardance is required, it is possible to employ antimony oxide plus a resinous binder particularly a chlorine containing one such as chlorowax or polyvinyl chloride, along with the finishing system of the invention.

The amount of polycondensed vinylphosphonate monomer to be used depends greatly on the nature of the textile and its weight and weave, the degree of flameproofing required and other technical and economical factors well understood by those skilled in the art of textile finishing. However, generally, the vinylphosphonate should be added to the padding solution in a sufficient amount so that about 0.2 to 8.0% phosphorus remains on the cloth or textile being treated, and preferably 0.4 to 4.0% phosphorus. Therefore, the amount of polycondensed vinylphosphonate monmer added to the padding bath is greatly dependent upon

the product desired, i.e., the amount of flame retardance of the flameproofed textile.

A catalyst such as ammonium persulfate may be added only in nomimal amount such as from about 0.1 to about 2.5% of the weight of the aqueous padding bath. As indicated, the finishing agents of the present invention can be applied by several means such as the use of the padding bath which is most useful in a continuous process where the textile is run through a mill. The textile may also be treated or finished with a flame retardant material by spraying or by any other technique which assures an even and complete distribution of the finishing solution on the textile. However, it is preferred to use the padding bath since it is most efficient in a continuous process.

According to the present invention, the textile is passed through the aqueous padding solution to have the polycondensed monomer absorbed or coated thereon.

After the fabric has passed through the aqueous padding solution, the solution is dried on the fabric and the monomer is cured so as to effect the polymerization of the polycondensed vinylphosphonate monomer in situ on the textile to render it flame retardant. One method of drying and curing flameproofing the finish on the fabric is by heating the fabric with either steam or with hot gases. When using steam or another form of heat, it is preferable to maintain the heat at a temperature ranging from ambient to about 200° C., and preferably from about 70° to about 170° C. The monomer may be cured in a short period of time, in as little time as 1 second and up to several days, or one week, depending upon the temperature and catalyst chosen. Using particular catalysts, such as oxidation reduction systems described below, the curing of the monomer at room temperature is possible within a short time.

The temperature at which the monomers are heated, and the particular catalyst added to the monomer will largely determine the period of time in which the finish will be cured.

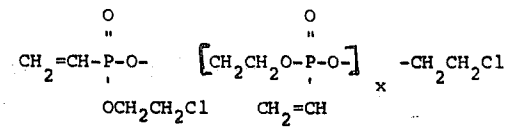
Accordingly, depending upon which catalyst is used, the finish will be cured in a shorter time when subjected to the higher temperatures, such as from about 150° to about 200°C.

Generally, the rate of cure is adversely influenced by the presence of atmospheric oxygen; therefore, for optimum cure rate it is advantageous to exclude oxygen by use of an inert gas which can be steam, nitrogen, carbon dioxide, or the like. A particularly convenient way to accomplish this is to conduct the final drying of the finish at the cure temperature so that the steam being evolved forms an air-excluding blanket. In the textile mill this is easily accomplished by passing the cloth from the padder over heated "cans" at such a rate and temperature as to initiate curing while some moisture still remains.

Another suitable method, according to the present invention, of curing the finish on the textile is by radiation. With radiation, there is no need of using heat or catalyst, either of which may be detrimental or destructive to the textile and the cure rate is relatively insensitive to oxygen. The radiation may be effected with beta rays, gamma rays, X-rays, ulta-violet rays, or by a corona discharge (cold plasma). It has been found that by using such radiation the finish, in addition to being flame retardant, will be tightly cured so as to provide it with greater durability to laundering and dry cleaning.

Another advantage of the radiation curing is that it can be conducted without heating, and with great rapidity, i.e., from about 0.1 second to several minutes. A further advantage of radiation curing, is that since catalysts and heating are not required, the fabric is generally found not to have undergone any degradation of its physical properties such as color, tear strength, and abrasion resistance.

Although it is possible to cure a finish without the use of a catalyst, i.e., thermally at a relatively high temperature, it is preferred to cure the finish by using a catalyst and/or by subjecting the finish to radiation. A preferred flame retardant textile provided by the process of the present invention comprises a fabric having a polymer of a polycondensed vinylphossphonate monomer having the structure:



wherein x is an integer of 1 to 20, absorbed throughout or present on at least one surface of the fabric.

The textile, after being treated with the flameproofing finish of this invention, may be tested for its flame retardant qualities. In the standard tests, the textile is placed at various positions ranging from vertical to horizontal and a flame is ignited on its bottom edge. If the textile is self-extinguishing in the vertical position, it is acceptable for stringent applications. If the textile is self-extinguishing when positioned at a 45° angle, it is acceptable for most applications. However, if a textile is only self-extinguishing when in a horizontal position, the finish is only acceptable for use in non-critical applications.

The application of the finishing reagent of the invention is not limited to woven or knitted fabrics but may also be employed on the broad class of fabrics known as non-woven fabrics which consist of continuous or discontinuous fibers bonded to form a fabric by mechanical entanglement, thermal interfiber bonding, or by use of adhesive or bonding substances. Such non-woven fabrics may contain a certain percentage of wood pulp as well as conventional textile fibers in which case part of the bonding is by hydrogen bonding between the cellulosic pulp fibers. In non-woven fabrics, the finishing agents of the invention can serve not only as flame retardant finishes but can contribute interfiber bonding and can serve as all or part of the adhesive or bonding resin. The same double role can be played by the finishing agents of the invention in fabric laminates where the finishing agent can at the same time serve as the interlaminar bonding agent and as the flame retardant. In both such systems, i.e., non-woven fabrics and laminated fabrics, the finishing agent of the invention can also be blended with the more customary bonding agents such as acrylic emulsion polymers, polyvinyl acetate emulsion, styrene-butadiene rubber emulsion, urethane resin emulsion, polyvinylchloride emulsion, polyvinylchlorideacrylate emulsions, polyacrylates modified by vinylcarboxylic acid comnomer, and the like.

The following examples will further show the advantages and various embodiments of the present invention.

EXAMPLE 1

Polycondensed bis(2-chloroethyl) vinylphosphonate

A solution was prepared consisting of 30% of polycondensed bis(2-chloroethyl) vinylphosphonate (degree of condensation about 4) and 69% water plus 0.5% ammonium persulfate and 0.5% of a wetting agent. Polypropylene swatches were passed through this bath and dried at 100° C. and held at this temperature for 1 hour to complete curing. The original analysis for percent of phosphorus on the cloth was found to be about 1.6%. After being washed with hot water, the phosphorus analysis was still 1.0 percent.

Both before and after washing, the cloth was self-extinguishing in the 45° position.

EXAMPLE 2

A 30% solution of polycondensed bis(2-chloroethyl) vinylphosphonate (average degree of condensation 4) in water was used to impregnate polyester, i.e., a polyethylene tetephthalate fabric. After drying at 30° to 40° C., the fabric was found to have 30% weight gain. It was then exposed to 5 megarads of 0.3-Kv. electron beam irradiation from a Dynacoat electron accelerator. The treated fabric was then washed in hot water and finally given an accelerated laundering test (to confirm the durability of the finish) by boiling with a 0.5% soap and 0.2% sodium carbonate solution for 3 hours. The thus-treated fabric was found to have 2.3% phosphorus by analysis, and was self-extinguishing in air.

Similar results were obtained where a polyester-cotton blended fabric, a nylon fabric, and an acrylic (i.e., acrylonitrile copolymer) fabric, were each treated with the polycondensed vinylphosphonate as described above.

EXAMPLE 3

A polyester fabric was treated as in the preceding example, except that 2% ammonium persulfate was used as the curing catalyst and the dried padded fabric was cured for 2 hours under nitrogen at 100° to 110° C. After the accelerated laundering treatment, the fabric retained 1.12% phosphorus and was extremely slow burning in air.

After a hot water washing and prior to boiling with the alkaline soap solution, the fabric was self-extinguishing in air even in the vertical position.

The use and effect of the flame retardant finishes of the present invention, on various fabrics are further illustrated in Examples 4 thru 10, the results of which are recorded in Table I.

TABLE I

EXAMPLE	FABRIC	COMPOSITION OF PADDING RATH (% by Weight)	CURING CATALYST	CURING TEMP.	RESULT
4	Polyacrylonitrile (Acrilon)	pentaerythritol bis-(cyclic) vinylphosphonate (20)	1% $(NH_4)_2S_2O_8$	100°–110° (Steam)	self-extinguishing after laundering
5	cellulose acetate	poly(butylene glycol vinylphosphonate), mw. 2000 (30), polyethylene emulsion (2)	0.5% t-butyl hydro peroxide	130° (Steam)	self-extinguishing after laundering hand improved by the polyethylene
6	nylon	ethylene glycol bis(2-chloroethyl vinylphosphonate (30)	0.5%$K_2S_2O_8$	110°–120° Steam	self-extinguishing after laundering,
7	cellulose triacetate	ethylene glycol bis (2-chloroethyl vinylphosphonate (20); 2-hydroxyethyl acrylate (10)	0.5% $(NH_4)_2S_2O_8$	80°–85° Under N_2	self-extinguishing after laundering, laundering, improved hand, compared to similar treatment without acrylate
8	poly(cyclohexane dimethanol terephthalate)	polycondensed bis(2-chloroethyl) vinylphosphonate (20), acrylic acid (2)	radiation (4 megarad electron)	80°–90° under N_2	self-extinguishing after laundering, and soil release properties,
9	non-woven rayon	polycondensed bis(2-chloroethyl) vinylphosphonate (20), self-curing acrylic emulsion (80)*	0.5% $(NH_4)_2S_2O_8$	100°	bonded and rendered self-extinguishing
10	fiberglass bonded by melamine resin	polycondensed bis(2-chloroethyl) vinylphosphonate (10), curable melamine formaldehyde resin (90)*	0.1% benzoyl peroxide	150°	smouldering of bonding resin prevented

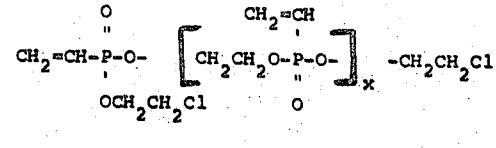
*Applied by spraying rather than by padding.

What is claimed is:

1. A process for flameproofing synthetic textiles which comprises:
   a. applying an aqueous solution containing a polycondensed vinylphosphonate monomer to a synthetic textile; and
   b. curing the monomer on said textile so as to affect the polymerization of said monomer in situ on said textile to render the textile flame retardant.

2. A process according to claim 1, wherein said polycondensed vinylphosphonate monomer is cured on said textile material at a temperature ranging from ambient to 200° C. for a period of about 1 second to about 1 week.

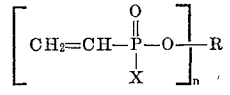
3. A process according to claim 1, wherein the polycondensed vinylphosphonate monomer has the structure:



wherein x is an integer of 1 to 20.

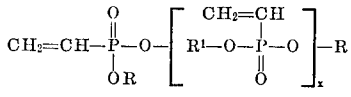
4. A process according to claim 1, wherein the textile is nylon, polypropylene, acrylics, modacrylics, fiberglass containing flammable binders, cellulose acetate, polyesters, cotton-polyester blends, cotton-nylon blends, or viscose-rayon polyester blends.

5. A process according to claim 1, wherein the polycondensed vinylphosphonate monomer has the structure:



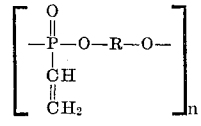
wherein X is an alkoxy, aralkoxy, cycloalkoxy, aryloxy, or N-dialkylamino; R is a di-or polyvalent aliphatic or aromatic radical of two to 12 carbon atoms, and n is an integer of 2 to 6.

6. A process according to claim 1, wherein the polycondensed vinylphosphonate monomer has the structure:

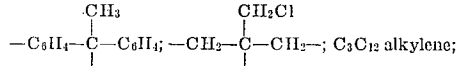


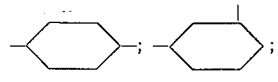
wherein R is an alkyl of one to 18 carbon atoms, haloalkyl, hydroxyalkyl or aryl; and R^1 is an alkylene or halogenated alkylene of two to 18 carbon atoms.

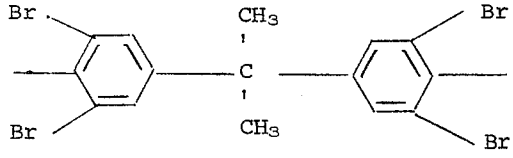
7. A process according to claim 1, wherein the polycondensed vinylphosphonate monomer has the structure:



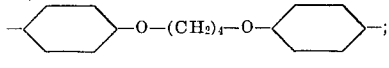
wherein R is $-C_2H_4-$; $-C_6H_4-$;







or



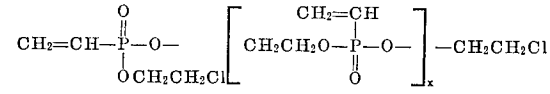
and n is an integer of 10 to 1,000.

8. A process according to claim 1, wherein the polycondensed vinylphosphonate monomer is added to the solution in a sufficient amount to result in the application of from about 0.8 to about 8.0% phosphorus on said textile.

9. A process according to claim 1, wherein the solution is dried and the monomer is cured on said textile by means of radiation.

10. A process according to claim 6, wherein the radiation is carried out by means of beta rays, gamma rays, X-rays, ultra-violet rays, or a corona discharge.

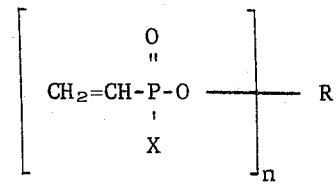
11. A flame retardant textile comprising a synthetic fabric having a polymer of a polycondensed vinylphosphonate monomer having the structure:



wherein x is an integer of 1 to 20, absorbed throughout or present on at least one surface of said fabric.

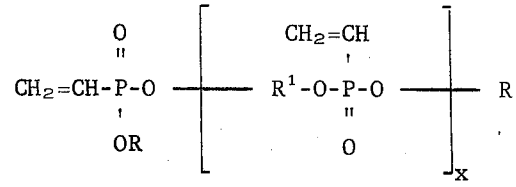
12. A textile according to claim 11, wherein the fabric is nylon, polypropylene, acrylics, modacrylics, fiberglass containing flammable binders, cellulose acetate, polyesters, cotton-polyester blends, cotton-nylon blends, or viscose-rayon polyester blends.

13. A flame retardant textile comprising a synthetic fabric having a polymer of a polycondensed vinylphosphonate monomer having the structure:



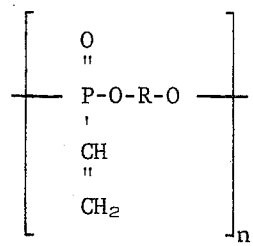
wherein X is an alkoxy, aralkoxy, cycloalkoxy, aryloxy, or N-dialkylamino; R is a di- or polyvalent aliphatic or aromatic radical of two to 12 carbon atoms, and n is an integer of 2 to 6, absorbed throughout or present on at least one surface of said fabric.

14. A flame retardant textile comprising a synthetic fabric having a polymer of a polycondensed vinylphosphonate monomer having the structure:

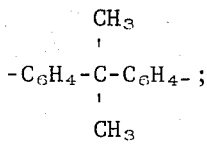


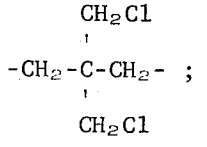
wherein R is an alkyl of one to 18 carbon atoms, haloalkyl, hydroxyalkyl, or aryl; R^1 is an alkylene or halogenated alkylene of two to 18 carbon atoms, absorbed throughout or present on at least one surface of said fabric.

15. A flame retardant textile comprising a synthetic fabric having a polymer of a polycondensed vinylphosphonate having the structure:

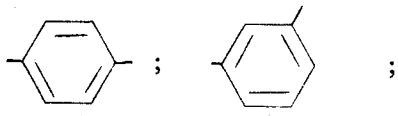


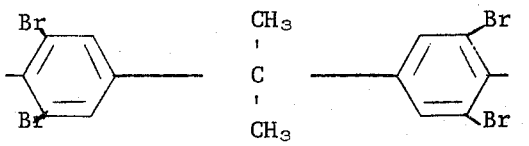
wherein R is $-C_2H_4-$; $-C_6H_4-$;

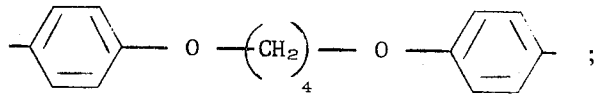




C_3-C_{12} alkylene;







and *n* is an integer of 10 to 1,000, absorbed throughout or present on at least one surface of said fabric.

16. A textile according to claim **13** wherein the fabric is nylon, polypropylene, acrylics, modacrylics, fiberglass containing flammable binders, cellulose acetate, polyesters, cotton-polyester blends, cotton-nylon blends or viscose-rayon polyester blends.

17. A textile according to claim **14,** wherein the fabric is nylon, polypropylene, acrylics, modacrylics, fiberglass containing flammable binders, cellulose acetate, polyesters, cotton-polyester blends, cotton-nylon blends or viscose-rayon polyester blends.

18. A textile according to claim **15,** wherein the fabric is nylon, polypropylene, acrylics, modacrylics, fiberglass containing flammable binders, cellulose acetate, polyesters, cotton-polyester blends, cotton-nylon blends or viscose-rayon polyester blends.

* * * * *