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IMPARTING BACTERIA-RESISTANT PROPERTIES TO TEXTILE MATERIALS

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This invention relates primarily to the sizing, filling and coating of textiles and other fabrics composed at least in part of cellulose, including not only the fabric itself, whether woven, knitted, netted or felted, but also fibres, yarns, threads and the various associations thereof. Its chief object is to provide, in the sizing, filling or coating treatment, a substantial degree of immunity, and in many cases virtually complete immunity, from damage by the attack of micro-organisms especially bacteria (or more correctly schizomycetes) of the mildew group of which aspergillus and penecelium are prominent examples. The invention further relates to sizing, filling or coating compositions; compositions containing gelatin, albumin, or casein; cellulose solutions, as for example viscose, nitro-cellulose, and cellulose acetate in hydrocarbon and other solvents; rubber solutions; solutions of so-called synthetic rubber, and also rubber substitutes, such as the varnish-gum solutions used for coating fabrics; and solutions of other gums such as tragacanth, tragasol, and arabic. Another object is to provide sizing, filling and coating compositions, and other compositions of the classes mentioned, which shall not only themselves be immune or resistant to attack but will impart a substantial degree of resistance or immunity to cellulose material when applied thereto. To these and other ends the invention comprises the novel features hereinafter described.

For sizing or filling cellulose textile materials (including in this term not only fabrics but also fibres, threads, yarns, etc.) the compositions most commonly employed are composed largely of farinaceous materials or starches, such as wheat, corn, rice and potato starch, sago, tapioca, and the like. These are themselves susceptible to attack by micro-organisms, and hence are apt to, and in many cases do, greatly increase the hazard of the textile material in which they are incorporated. Efforts have been made to prevent this increase of hazard, and also to attain complete immunity not only of the sizing composition but also, through it, of the textile material itself, by including in the sizing composition sterilizing or antiseptic substances, but such efforts have never, so far as we are aware, been completely successful. For example, there are many promising coal tar derivatives and the like, such as phenols, cresols, thymols, benzoates, and salicylates, which, while effective for a time, soon lose their efficiency through gradual volatilization, polymerization into innocuous compounds, or actual chemical changes which destroy their distinctive character. A familiar case is that of sodium salicylate, a strong antiseptic which in the presence of alkali quickly loses its anti-bacterial effectiveness. Such chemical agents as salts of copper, zinc and magnesium, the most promising of which are zinc salts, have been tried with varying but never complete success. A typical case is that of zinc chlorid, which to be effective must be used in large amount, rising to as much as ten per cent of the material treated. The zinc salt being comparatively cheap the cost is not prohibitive; but its hygroscopic properties, by attracting moisture, tend to increase the susceptibility of the textile material itself to the attack of micro-organisms. The use of copper compounds is restricted by their poisonous character (the same applies of course of arsenic compounds) and by their pronounced color and ready reaction with certain dyestuffs. Magnesium salts are relatively inert and hence must be used in large amount. All of these agents have the disadvantage of setting free acidic ions under certain conditions of temperature and moisture, resulting in pronounced tendering and in some cases actual destruction of the fabric.

We have found that when compounds of the metals of the rare earth groups, and of the equivalent elements thorium, zirconium, and uranium, are added to the composition employed for sizing, filling or coating textile materials and for other purposes, the resistance of the composition is of a degree that in some cases amounts to virtual immunity from bacterial invasion. The effect of relatively small proportions of the salts referred to is manifested in marked retardation of the rate of bacterial growth, the ac-

tion when not actually inhibited being very greatly slowed down, as well as localized. The effect of thorium compounds is especially striking, the addition of quantities as small as one tenth (0.1) of one per cent (or even less) in some cases conferring a resistance that approaches immunization. At the same time the addition of minute quantities of thorium compounds along with compounds of zirconium and uranium and the rare earth metals markedly increases the already great resistance to the attack of micro-organisms which these compounds impart to sizing and other compositions. With rare exceptions the compounds referred to are entirely non-hygroscopic, and with the exception of uranium compounds they are non-poisonous; and the uranium compounds are not dangerously or even objectionably poisonous. Moreover, they are, as a general rule, difficultly soluble, and hence are lost but slowly if at all in the normal operations of laundering, thus making the protection more lasting in the case of fabrics that are washed frequently. Nor are they subject to polymerization or volatilization, or to destruction of their antiseptic qualities through a change of linkage or chemical decomposition into compounds which are innocuous or less repellant to micro-organisms.

The well known compounds of these metals with phenols, cresols, thymols, naphthaline compounds, and salicylic and benzoic acids, are stable and difficultly soluble, thus adding an element of permanency to the antiseptic qualities of these organic compounds, as well as reinforcing or increasing their antiseptic power or ability to inhibit or restrain the growth of moulds, fungi, and other micro-organisms. Such compounds are less volatile, more permanent, and far more difficultly removable than is the case with hydrocarbons and coal tar derivations uncombined with the chemical elements referred to.

The immunizing or resisting compound may be added to the sizing, filling, coating or other composition at any stage of its production, or afterwards. It has been found advantageous, however, in the case of compositions containing farinaceous or starchy ingredients, to mix the resistance-imparting compound with the ingredient mentioned.

The preferred rare earth metal and zirconium, thorium and uranium compounds are the soluble or slightly soluble compounds, as they afford greater protection than the insoluble oxids and hydroxids. Among the former compounds are sulfates, acetates, silicates, nitrates, fatty acid salts and halogen salts, and our experience indicates that fluorids are the most advantageous.

In general, thorium compounds are preferred, and of these from one-half to two per cent is usually ample, whereas from one to four per cent of compounds of the other metals would be required for equivalent results.

With the foregoing general rules in mind a few specific examples will be sufficient. These are suitable for sizing cellulose fibres, yarns, threads and fabrics.

	A	B	C
Farina	224 lbs.	224 lbs.	240 lbs.
Tallow	20	25	50
Soft soap	5		
Glycerin	7	14	
Caustic soda (70 Twaddell)	3 pts.	4 pts.	
Thorium (sulfate, oleate, fluorid, or other salt)	1 lb.	2 lbs.	1½ lbs.
Water	220 gal.	450 gal.	90 gal.
Sago		224 lbs.	
Sulphonated oil			20 lbs.
China clay			448 lbs.
Blue clay			½ pt.
Magnesium chlorid (60 Twaddell)			9 gal.

In the above, the thorium salt or salts can be replaced wholly or in part with other rare earth metal, zirconium and uranium salts.

	D	E	F	G
China clay	280 lbs.	560	336	896
Mag. chlorid (60 Tw.)			16	30
Flour	280	280	520	460
Cocoanut oil	20	30		
Sod. sulfate			224	336
Tallow			70	150
Water	Sufficient	Suf.	Suf.	Suf.
Cerium, lanthanum or didymium sulphate, oleate, etc.	7 lbs.	7	12	14

In the above compositions the cerium, lanthanum and didymium salt or salts may be replaced entirely or partly by thorium compounds, the higher efficiency of the latter making it possible to use correspondingly smaller quantities, as indicated by the first series of examples.

It is to be understood that the invention is not limited to the details herein described but can be carried out in other ways without departure from its spirit. In the appended claims the term rare earth element is intended to include thorium, zirconium and uranium.

We claim—

1. A composition of matter for sizing, filling, coating or other purposes, containing an organic ingredient which is itself susceptible to attack by micro-organisms and containing also a compound of a rare earth element serving to impart resistance to such attack.

2. A composition of matter for sizing, filling, coating or other purposes, containing an organic ingredient which is itself susceptible to attack by micro-organisms and containing a difficulty soluble salt of a rare earth element serving to impart resistance to such attack.

3. A composition of matter for sizing, filling, coating or other purposes, containing an organic ingredient which is itself susceptible to attack by micro-organisms and containing a thorium compound serving to impart resistance to such attack.

4. A composition of matter for sizing, filling, coating or other purposes, containing an organic ingredient which is itself susceptible to attack by micro-organisms and containing thorium fluorid to impart resistance to such attack.

5. A composition of matter for sizing, filling, coating or other purposes, containing a farinaceous ingredient and also containing a compound of a rare earth element acting to impart resistance to attack by micro-organisms.

6. A composition of matter for sizing, filling, coating or other purposes, containing a farinaceous ingredient and also containing a thorium compound acting to impart resistance to attack by micro-organisms.

7. A composition of matter for sizing, filling, coating or other purposes, containing a farinaceous ingredient and also containing thorium fluoride to impart resistance to attack by micro-organisms.

8. The herein described method of rendering textile materials resistant to the attack of micro-organisms, comprising sizing the textile material with a composition containing an organic ingredient which is itself susceptible to attack by micro-organisms, and containing also a compound of a rare earth element.

9. The herein described method of rendering textile materials resistant to the attack of micro-organisms, comprising sizing the textile material with a composition containing an organic ingredient which is itself susceptible to attack by micro-organisms, and containing also a thorium compound.

10. The herein described method of rendering textile materials resistant to the attack of micro-organisms, comprising sizing the textile material with a composition containing an organic ingredient which is itself susceptible to attack by micro-organisms, and containing also thorium fluoride.

11. Textile material sized with a composition containing an organic ingredient which is itself susceptible to attack by micro-organisms, and containing also a compound of a rare earth element.

12. Textile material sized with a composition containing a farinaceous ingredient and a thorium compound.

13. Textile material sized with a composition containing a farinaceous ingredient and thorium fluorid.

In testimony whereof we hereto affix our signatures.

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