

A Study on the Antimicrobial Finishing of Rodalon on Silken Carpet

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Abstract: In Iranian culture, carpet is the first choice for covering the floor; it is a very suitable substrate for growing pathogenic microbes. In this research, the main aim is to investigate the antibacterial effectiveness of rodalon solutions on silken fibers by spraying method used in silken carpet. Silken pile carpet laid in a public place (in VIP of The Homa hotel) for 30 days and some microbes found on them were investigated. The antimicrobial effect of different Rodalon solutions on the identified microbes was studied in vitro. The silken fibers were treated with solutions of Rodalon like before and the antimicrobial effectiveness was assessed by the zone of inhibition method at different times. Two pieces of carpet untreated and treated with Rodalon solution were sewed together and laid for two weeks in a public place and the amounts of bacterial growth on it was determined by colony count method and the results were compared. Finally some mechanical properties of treated silken fibers were measured after 30 days and was compared with untreated one. The results showed the presence of some pathogenic microbes on the laid carpet such as *Escherichia coli* and *Staphylococcus aureus*. The inhalation time for treated silken fibers was found to be improved. The amount of colony growth on treated carpet reduced considerably and moreover the mechanical test results showed no significant deterioration effect of studied properties in comparison to the untreated yarn.

Keywords: Rodalon, silken carpet, inhalation time, colony count, *escherichia coli*, *staphylococcus aureus*.

1. Introduction

Micro organism is a part of our life. Activities of microorganisms on the textile products will result in three major problems: risk human health, produce bad odour and finally destruction of good [1,2]. Carpet is a famous textile, it is a very suitable substrate for growth of microorganisms such as pathogenic microbes, due to direct contact with human body, long washing periods and laying on the floor [3-5].

The silken carpet in comparison with other carpets has a special position, for this reason it needs some special methods to maintain the quality of these goods, and protect from the action of microorganisms. In the recent years, for prevention from the action and transition of harmful microbes many researches (be a complied) on antimicrobial material with short and long term effects in production, construction and completion of fibers [6,7]. It is very important to pay attention to the health and cleanliness part of it. Mentioned, two different aspects of antimicrobial protection provided by chemical finishes can be defined. The first is the protection of the textile user against pathogenic or odour causing microorganisms

(Hygiene finishes). The second aspect is the protection of the textile itself from damage caused by mould, mildew or rot producing microorganisms that it can be called antibacterial protection finish. According to Schindler and Hauser (2004) and Vigo (1997) many agents including inorganic salts, organometallics, iodophors (substances that slowly release iodine), phenols and thiophenols, onium salts, antibiotics, heterocyclics with anionic groups, nitro compounds, urea and related compounds, formaldehyde derivatives, biopolymers and amines have been used as antibacterial agent for hygiene finish or antibacterial protection finish. There are many studies in this field using these compounds [3,6-10].

Many antimicrobial agents have been used as antimicrobial agent for hygiene finish or antibacterial protection finish [11,12]. Between these antimicrobial agents quaternary ammonium salts exhibit marked antibacterial activity against a wide range of bacteria. These compounds have a central nitrogen atom which is joined by four organic radicals and one acid radical. Quaternary ammonium halide cationic surfactants are widely used for antibacterial surface-active and detergent properties [13-17].

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Rodalon shown in Fig. 1 is one of the conventional quaternary ammonium salts. Its solutions are rapidly act as anti-infective agents with a moderately long duration of action. They are active against bacteria, some viruses, fungi and protozoa. Solutions are bacteriostatic or bactericidal according to their concentration [3,4].

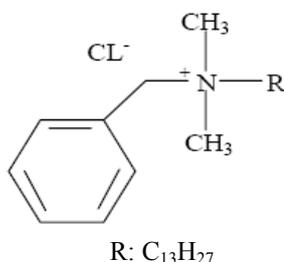


Figure 1 Molecular structure of Rodalon.

The exact mechanism of bacterial action is unknown but it is thought to be due to enzyme inactivation. Activity generally increases with increasing temperature and PH. It has been used in textile industry, as an insecticidal, or antimicrobial [4,18,19] agent.

In this study a conventional antiseptic agent, Rodalon (e.g. Roda) was applied through spraying method for improving silken carpet's inhibition against some pathogenic microbes and the antibacterial effectiveness of the carpet was evaluated by standard test methods.

2. Material and Methods

2.1. Material

Rodalon was purchased from Asalib Co. (Table 1). The carpets were purchased from Saran Co. (Table 2). Silken yarns were prepared from Saran Co. (8/2 Nm). The pure bacteria were supplied by the Bouali Hospital, Tehran, Iran and all tests were done in the Laboratories of Tarbiat modarres University, Islamic Azad University Science and Research Campus Branch and Islamic Azad University of Shahre-Rey in 2008.

Table 1 Technical data of the applied Rodalon

Trade name	Rodalon 50
Product	A 50%v/v solution of alkal benzyl dimethyl ammonium chloride, complying with BP2003 and USP 26-NK 21 monograph.
Appearance ^{20°C}	Clear liquid
Color	Colorless to pale yellow
Density at 20°C	0.99G.cm ⁻³
Viscosity at 20°C	120CS
Assay(mmw=349.8)	50 ± 1
Non-quaternished amine(mmw=223.3)	0.5%max
Sulphated ash	0.2%max
PH(5% in water)	6.5-8.5

Table 2 Specifications of the applied carpets

Color	Ivory(mostly)
Pile yarn	100% silk
Pile length	11±1mm
warp yarn	100% silk
weft yarn	Cotton/Polyester(35/65)%

2.2. Methods

For investigating the kind of bacteria present on carpet, (especially pathogenic ones) carpets were laid in a public place (in VIP of the Homa Hotel) for 30 days (everyday approximately 300 people had stepped on it), thereafter some fibers were cut from the carpets randomly and immersed in Thioglycolate and Nutrient broth mediums. After incubating for 24 hrs at 37°C, the solutions of each media were sub-cultured in Nutrient and Blood agar mediums and after incubating in Nutrient and Blood agar mediums for 48 hrs at 37°C the colonies of microbes were cultured by streak test method. For identifying the kind of cultured microbes the gram stain, catalase, oxidase, citrate agar, Christensen's urea broth and TSI agar tests were done. The cultured microbes were kept in skimmed milk as the next step. Ditch plates method was used for evaluating the antibacterial effectiveness of Rodalon against the detected bacteria on the carpet. Ditch plates were prepared by allowing the Mueller Hinton Agar to solidify in a Petri dish and ditches (with diameter of approximately 4 mm) produced on it by removing the agar. Ditches were inoculated by different Rodalon solutions (1/100, 1/500, 1/1000 and 1/2000 v/v solutions of Rodalon).