

Pretreatment of Angora Rabbit Fibers

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Abstract Angora rabbit fibers are very attractive for the consumers because of its physical and chemical properties. It has been used as a textile good for a long time but the production and consumption rates were low. This makes it popular and a sign of the wealthy. On the other hand the processing of Angora rabbit fibers has to be managed cautiously because of its structure. As a result of this, pretreatment of them has great importance in terms of the saving its original properties. These fibers are clean and no heavy pretreatment is needed. Even so in the need of the pretreatment processes, it is recommended to use the pretreatment methods valid for the wool but in mild conditions. In this review article, information on the pretreatment of Angora rabbit fibers were compiled and recent studies on angora fibers in terms of the issue were summarized.

Keywords: Angora, rabbit, fiber, pretreatment

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1. Introduction

Angora rabbit fiber is a kind of natural protein fiber and belongs to a subgroup named as animal hair fibers [1]. Angora rabbit is one of the oldest known domesticated breeds of rabbit. They were introduced to Europe from Ankara, the town of Turkey [2]. The consumption of wool as an apparel fiber is limited. It was reported as 3.3 % of overall fiber consumption in developed countries in 2010 was belonged to wool fiber [3] and the consumption of angora fibers can be noticed as much lower than the wool consumption. Besides this, its annual consumption is greatly influenced by the fashion and accordingly changes between 5000 and 6000 tons [4]. Although these fibers represent a very small segment of the textile industry, the value of these fibers is high and their usage can never be disregarded [5].

Rabbit hair is principally used for knitting and usually spun on the woollen system [4]. Rabbit hair and fur are generally used for making felts and for the knitted goods such as cardigans, gloves and berets [6]. Angora fiber is well known for its high thermal insulation and its extreme lightness in weight [7,8]. Angora fiber has widespread use in health products for arthritis patients and in thermal underwear for cold climates too [9].

The hair of Angora rabbit, cultivated in Europe and East Asia, can be counted amongst the finest of the animal hairs. The hair is mostly pure white, lustrous and silk-like [10]. Owing to its fine and smooth structure of the fibers, it is difficult to spin [4]. Therefore, these fibers are frequently spun with wool, a proportion of synthetic fiber or with cotton because of technological reasons [10].

Parameters designated the quality of an Angora rabbit fleece are: fiber length, the proportions of the different types of fibers, mean fiber diameter, the proportion of medullated fibers, crimp and absence of felt [11]. Among these parameters, the fiber and medulla diameter was found related with the environmental temperature [12].

Chemically, angora is a keratin fiber. The polypeptide chains of angora keratin are composed of approximately 20 different amino acids [10]. The chemical behavior of these fibers is generally similar to that of wool and other animal fibers [6]. So it can be advised to get help from the methods valid for the pretreatment of wool fibers during processing of Angora rabbit fibers.

2. Pretreatment of Angora Rabbit Fibers

Chemical structure of angora fibers has some similarities with the other animal fibers [5]. The only significant differences among the amino acid compositions of the fibers are cystine and cysteic acid contents [13]. They have more sensitive structure, so during the processes like washing, bleaching and dyeing, these fibers must be treated cautiously [5]. In wool pretreatment, different conventional processes can be applied depending on the end use of the fiber. In general scouring is managed firstly. It is a strenuous work and it can influence the destiny of the wool for subsequent usages. The aim is to terminate the impurities which can weigh the half or more of the raw wool [14]. However Angora rabbit fibers do not need scouring because the angora fibers are very clean. The rabbits produce only 2% of their fiber weight in skin excretions, and also rabbits clean their own fur too [15]. On the other hand, it is well

known that yarns often must undergo additional processing before they are ready for use in forming of a textile substrate. The yarns may need to be rewound onto appropriate packages, reinforced by application of size, lubricated by application of spinning oil, and/or drawn-in and tied into the machine used in fabric forming [16]. So the spinning oils used during formation of the textile materials then should be removed by washing. Different from wool, water is absorbed less readily by rabbit fibers and hot water tends to soften or to plasticize the fibers [6]. So washing of the fibers should be managed gently.



Figure 1. The shorn Angora rabbit fleece

Moreover carbonizing which can be done to remove the cellulosic impurities from wool by treatment with acid or acid producing salts [1] is not needed to be applied because of the clean structure of the Angora rabbit fiber.

The other conventional pretreatment process in wool finishing is bleaching. Approximately 10% of the total world production of wool is bleached [17]. The Angora rabbit produces hairs of several colors but strain bred for textile fibers is an albino strain that produces white fibers only [4]. However, in some cases, bleaching processes can be carried out. The main bleaching agents for wool are oxidizing and reducing agents, which can also be an alternative for Angora rabbit fibers too [15].



Figure 2. The white Angora rabbit fur

As seen from the Figure 1 and Figure 2 the fibers are generally clean and white so the pretreatment processes are generally focused on preparation of fibers to dyeing processes and to improve their processability.

Perincek et al. studied on the usability of ozone gas for the pretreatment of the Angora rabbit fibers. They have managed ozonation in different conditions and tested the whiteness changes as well as the dyeability. They reported that by the ozonation process, the whiteness degrees and dyeability of Angora rabbit fibers enhanced. The ozonation time, medium temperature, the pH of the water

used for the moisturization of the fiber and the moisture content of the fiber during the ozonation process were tested in the study. They obtained the best whiteness degrees and color yields after ozonation at room temperature of Angora rabbit fiber impregnated with water at pH 7 with water pick up value of 60%. Increase in ozonation time showed increase in whiteness degrees and color efficiencies. The surface modifications of the fibers after ozonation were also tested and it was reported that ozone processes damaged the outer layer of the Angora fiber surface [15].

In another study, *Perincek et al.* have investigated the fiber moisture adsorption and desorption properties after ozonation and then dyeing. As a result of ozonation, an increase in moisture adsorption-desorption capacities and dyeability were obtained. Meanwhile ultrasound was also tested during dyeing processes too [9].

Danish et al. studied surface modification of angora fibers by dielectric barrier discharge of helium and helium + air. It was reported that macromolecules of angora fiber were oxidized, degraded and roughened by the plasma treatment. It was emphasized that by these changes, shedding of the fibers were reduced and dyeability increased with a decrease in whiteness index [18].

Jingjia et al. treated fabrics produced from Angora rabbit fibers with plasma in different atmosphere conditions and with different monomers. The surface modifications by these different applications of plasma were investigated then the friction coefficients of surfaces were tested [19]. Similarly *Jhala et al.* also studied the plasma etching to increase the surface friction of Angora rabbit fibers [7].

Like plasma and ozone treatment, enzymatic treatment of angora fibers was also investigated by the researchers too. For example; *Akçakoca et al.* investigated the effects of proteases before dyeing of protein based textile materials. It was found that the protease treatment had a positive effect on Angora rabbit fibers in terms of color efficiencies [5].

In another study, the effect of protease enzyme treatment on rabbit hair characteristics was investigated. For this aim, the rabbit hair was first treated with hydrogen peroxide solution and subsequently by enzymatic treatment. A suitable process of enzymatic treatment was determined, and finally the fiber surface friction coefficient, inter-fiber cohesion, and spinnability were enhanced [20].

3. Conclusions

Textile materials are one of the goods that the human have great interaction. First aim to use textile garments is of course to protect the body from the environmental effects. But today this perception is in change. Now beyond these demands there are different considerations such as fashion, comfort, multifunctionality and etc. Moreover some people are much more aware to use natural based materials and so natural fibers too. In these respects it is believed that use of Angora rabbit fibers will conserve their use in textile materials like other natural fibers. Beyond this, its original properties will take the attention of the consumer hereafter. The common belief on treatment of angora fibers is to make treatments

cautiously in order to save their luster and soft handle. Hence, the finishers should be specialized in the treatment of Angora rabbit fibers.

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