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Authors [Yun Li](#), [Dang Ge Gao](#), [Jian Zhong Ma](#), [Bin Lü](#)

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Abstract Vinyl polymer (dimethyl diallyl ammonium chloride /acrylic acid/2-hydroxyethyl acrylate/acrylamide) was synthesized via free radical polymerization, and then vinyl polymer/zinc oxide nano composite (PDM/ ZnO) was prepared by ultrasonic treatment and used for leather tanning agent. PDM and PDM/ZnO was characterized by FT-IR and XRD. The morphology of nano composite was observed by TEM. Moreover, PDM and PDM/ZnO combined with 2% chromate tanning agent were applied in leather tanning process and then the thermal and mechanical properties of the resultant leather were measured. FTIR results revealed that the polymerization reaction of PDM was complete and the carboxyl groups of PDM could react with the hydroxyl groups on the surface ZnO. The crystalline structure of the ZnO nanoparticles in the nano composite was not altered according to the XRD patterns. TEM results showed that nano ZnO was encapsulated on the surface of PDM copolymer chain and nano composites particles dispersed evenly. The results indicated that the tensile strength increased by 11.90% and the tearing strength improved by 23.72%. Compared with PDM, TGA plots showed that the thermal stability of the resultant leather tanned by PDM/ZnO nano composites was improved to a certain extent.

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Synthesis of Vinyl Polymer/ ZnO Nano Composite and Its Application in Leather Tanning Agent

Yun Li ^{1,a}, Dangge Gao ^{1,b}, Jianzhong Ma ^{1,c}, Bin LÜ ^{1,d}

¹ College of Resources and Environment, Shaanxi University of Science & Technology,

Xi'an 710021 P. R. China

^a liyun605@126.com, ^b dangge2000@126.com, ^c majz@sust.edu.cn, ^d lvbin@sust.edu.cn

Keywords: vinyl polymer, leather tanning agent, nano ZnO composite

Abstract. Vinyl polymer (dimethyl diallyl ammonium chloride /acrylic acid/2-hydroxyethyl acrylate/acrylamide) was synthesized via free radical polymerization, and then vinyl polymer/zinc oxide nano composite (PDM/ ZnO) was prepared by ultrasonic treatment and used for leather tanning agent. PDM and PDM/ZnO was characterized by FT-IR and XRD. The morphology of nano composite was observed by TEM. Moreover, PDM and PDM/ZnO combined with 2% chromate tanning agent were applied in leather tanning process and then the thermal and mechanical properties of the resultant leather were measured. FTIR results revealed that the polymerization reaction of PDM was complete and the carboxyl groups of PDM could react with the hydroxyl groups on the surface ZnO. The crystalline structure of the ZnO nanoparticles in the nano composite was not altered according to the XRD patterns. TEM results showed that nano ZnO was encapsulated on the surface of PDM copolymer chain and nano composites particles dispersed evenly. The results indicated that the tensile strength increased by 11.90% and the tearing strength improved by 23.72%. Compared with PDM, TGA plots showed that the thermal stability of the resultant leather tanned by PDM/ZnO nano composites was improved to a certain extent.

Introduction

With the rapid development of leather manufacture which is one of the pillars of light industry of china, China, having the most active markets in the world, is becoming a global leather trade centre. More than 90% of global leather production is through chrome-tanning process currently. However, the conventional methods employed for tanning lead to significant material loss and serious environmental concern [1]. Conventional chrome tanning in leather processing discharges significant amounts of chromium, and disposal of these waste becomes a serious problem that chromium leads to cell death and structural modification of proteins. Hence, tanners are looking for new product-process innovations towards low-waste and high exhaust chrome tanning.

When two or more materials with different properties are combined together, they form a composite material [2-3]. The properties of composite materials, in general, are superior in many respects to those of the individual constituents. This has provided the main motivation for the research and development of composite materials. Collagen is a natural macromolecule with a lot of active groups which combine with nanoparticles via physical and chemical reactions. In addition, the connection degree between the collagen fibers can be increased. Thus the properties of the resultant leather such as moisture thermo resistant properties, intensity, toughness and fullness are improved. ZnO with very stable chemical properties is a rich source of metal oxides. ZnO crystal belongs to hexagonal system. Nanosized ZnO, as a very important nano-material which is widely used in preparing solar cells [4], catalysts [5], electrical and optical devices [6], and in daily chemical industry has attracted much attention because of its outstanding characteristics.

Dimethyl diallyl ammonium chloride(DMDAAC) is a kind of water-soluble cationic monomer with non-conjugated diolefine which cause homopolymerization and copolymerization reactions. DMDAAC polymer chains always contain positive charges and cyclic structure. Furthermore,

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