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SYNTHESIS OF NEW PLASTICIZERS BASED ON CITRIC ACID

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ANNOTATION

With rising environmental concerns and depletion of petrochemical resources, biomass-based chemicals have been paid more attention. Polyvinyl chloride plasticizersderived from biomass resources (vegetable oil, cardanol, vegetable fatty acid, glycerol and citric acid) have been widely studied to replace petroleum-based o-phthalate plasticizers. These bio-based plasticizers mainly include epoxidized plasticizer, polyester plasticizer, macromolecular plasticizer,flame retardant plasticizer, citric acid ester plasticizer, glyceryl ester plasticizer and internal plasticizer.This article discusses the synthesis of a new plasticizer based on citric acid.

Keywords: Amorphous cellulose; Microcrystalline cellulose; Plasticizer; Citric acid; Glycerol; Tensile properties; ceramic material.

INTRODUCTION

In the manufacture of permanent and disposable articles for daily use, plasticity is a very important factor in construction. Plastic materials can be easily made in different ways. The oldest material used by humans for this purpose is ceramic material, which has been used and improved since the Stone Age. Although ceramics are still important, they also have disadvantages, especially for disposable items. Because they cannot burn and are relatively heavy, this is a characteristic they share with metals. Plastic materials are widely used in global consumption (packaging, buildings, cars, household items, and toys), and most of the plastics used today are polymer-based materials with plasticity. Lignocellulose-based materials are generally renewable and biodegradable, and therefore are an attractive alternative to petroleum-based plastics. An alternative method is to convert cellulose into plastic cellulose derivatives, such as cellulose acetate, but high cost is an issue. Products based on conventional pulp fibers are much cheaper, but the possibilities of forming materials are limited, despite products such as medium density fibreboard and egg boxes.

Materials to which they have been added (for example, plastic, concrete, drywall, and clay). Furthermore, citric acid is a potential crosslinking agent under acidic conditions, it is relatively inexpensive and non-toxic, and it has been used to improve the performance of cellulose and protein in textile applications. It is one of the most common organic chemicals produced by fermentation and is a natural component of many vegetables and fruits. In addition, it is a non-toxic human metabolite (Krebs cycle or citric acid) and has been approved by the FDA for use in humans. The production of biodiesel through the transesterification reaction of vegetable oils or animal fats results in a large excess of glycerin by-products. By mixing them with starch and polysaccharides, many plasticizers such as citric acid, glycerin, polyethylene glycol, sorbitol, xylitol, maltitol and urea have been used as coating agents. Recently, catalyst-free thermal polyesterification has become a potential strategy for designing biodegradable thermosetting polymers (especially polyol-based polyesters), which are synthesized by the polycondensation reaction of polyols and polyacids. No catalyst or solvent is required. The study of synthesizing copolyesters from citric acid and glycerin has been demonstrated.

In this work, a new cellulose-based material was developed based on the cross-linking reaction of cellulose molecules with glycerol\/citric acid polyester without chemical catalysts or solvents. Through an autocatalytic condensation reaction, citric acid dissolved in glycerol is preheated to a constant weight at 40\u00b0C and cured at 175\u00b0C for 1 hour to form a polymer. The curing reaction is a condensation reaction driven by the removal of water, so it can occur at temperatures higher than 100\u00b0C. As the temperature increases, the reaction accelerates. As explained, thermostatic polyester can be synthesized by heating monomers (polyols and polyacids) in a normal atmosphere or partial vacuum, and then performing a post-curing procedure. In principle, the polymer can be inserted into all alcohol-containing components during the polymerization process. Since wood polymers (such as cellulose, hemicellulose, and lignin) are rich in alcohol, this system is suitable for covalently cross-linking components. This concept is attractive because both glycerin and citric acid are relatively inexpensive and renewable chemicals.

The remaining problem is foam due to the formation of water during the curing process. In this work, a material based on cellulose and lignocellulose (mainly glycerin and citric acid) was studied, where glycerin and citric acid covalently crosslink lignocellulose polymers, and glycerin acts as plasticizer \/ medium. The material behaves like a thermosetting gel, in which an object of any shape can be formed and cured into a hard material by heat treatment. The materials were prepared with different combinations of amorphous cellulose (6% and 10%) and microcrystalline cellulose (20% and 25%), glycerol/citric acid (GC) and ethylene glycol/ citric acid (EGC), respectively. In addition, the physical properties of heat-treated hard materials are determined, such as tensile test, water absorption (WA), and ash content. It has been shown that lignocellulosic biomass can be converted into new biomaterials through the use of plasticizers. In order to improve the flexibility and processability of plastic resins, it is necessary to incorporate plasticizers into the polymer matrix. This has led to plasticizers being used in the production of cables, paints, building materials, toys, and flexible packaging. Wide range of applications. food. Film and medical products, such as tubes or gloves.

The most commonly used type of plasticizer is phthalates, so there is a great deal of concern about the health and environmental consequences associated with their use. The health and environmental impact of phthalates and increasingly stringent environmental regulations have led to their partial replacement by dibenzoate plasticizers in many plastic applications. However, previous studies have shown that incomplete microbial degradation of dibenzoate-based plasticizers may result in the accumulation of dibenzoate-based plasticizers. The toxicity of monobenzoate is much higher than that of the original plasticizer. The non-toxic citrate plasticizer is based on an ingenious natural derived product, citric acid, which has been approved by the U.S. Food and Drug Administration (FDA) and the European Union (EU) as a phthalate and dibenzoate base Alternatives to plasticizers. Its outstanding toxicological properties support its worldwide applications, such as medical plastics, personal care and food contact additives. Its benefits have been recognized in more and more applications, and have promoted the trend of environmentally friendly products, such as various polymers and plasticizers in cellulose acetate.

Effective plasticizer citrates include triethyl citrate, acetylated triethyl citrate, tributyl citrate (TBC) and acetylated tributyl citrate (ATBC). Although many types of citrate esters can be used as plasticizers, many disadvantages including low thermal stability, low flexibility, low solvent resistance and low migration resistance limit their use in these available plasticizers. The main reason is the relatively low molecular weight of these plasticizers. High-molecular-weight plasticizers are known for their excellent low temperature and low volatility, and are extremely versatile. They are declared risk-free in tests conducted in the European Union. Therefore, high molecular weight plasticizers with appropriate Ap/Po values \u200b\u200b(defined as the ratio of the number of non-polar aliphatic carbon atoms to the number of polar acetate groups) have received unprecedented attention and have received the most research . Chemical material.

Until now, a number of high molecular weight products based on citric acid, such as stearyl tributyl citrate, have been investigated and developed. In this work, a series of new relatively high molecular weight plasticizers based on citric acid have been designed and synthesized. Compared to traditional plasticizers (such as TBC and ATBC), the performance and weight loss ability of these new plasticizers were evaluated. Under ferrous chloride catalysis, commercially available citric acid is treated with n-butanol. The product obtained is reacted with different dichlorides to obtain the desired target molecule. In short, our new strategy for designing and synthesizing new environmentally friendly non-toxic plasticizers has been proven to be reasonable and effective. In this work, a new plasticizer synthesized from citric acid can replace traditional plasticizers due to its excellent properties (such as non-toxic, high safety, low volatility and good flexibility). These plasticizers have shown promising applications as new additives, especially in toys and medical applications.

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