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Preparation, Rhelogical and Mechanical Properties of Poly Lactic Acid and Acrylo Nitrile Butadiene Styrene Polymers Blend

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Abstract:

In current years, there has been a noticeable growth in the interest in use of biodegradable materials in, agricultural, tissue engineering, medical appliance, packaging and automobile industries. In agricultural field, bio degradable composite polymers are widely used for many applications. In now a day's global warming is increasing due to producing of various plastics products etc. bio degradable composite plastics has worthy mechanical properties easy handling and also free from the environment. In this article gives full information about preparation, mechanical, rheological and morphology properties of poly lactic acid and acrylo nitrile butadiene styrene polymers blend the rheological properties are inspected of poly (lactic acid) (PLA) and acrylo nitrile butadiene styrene blends in molten state. Rheological properties were calculated conducted test on capillarity rheometer, shear rate, and shear viscosity. Mechanical properties were studied in terms of tensile properties stress at break and young's modulus properties were explained in this review article .and also include the effect of the composition on the rheological, morphology and mechanical properties, classification of polymers and their structure.

Keywords — Poly Lactic Acid, Acrylo Nitrile Butadiene Styrene, Rhelogical and Mechanical Properties.

INTRODUCTION

Due to its initial production costs, the starting applications of PLA have been alert on high value products such as medical devices [1]. Developments in the polymerization technology have significantly reduced the production cost and have added to make PLA economically inexpensive with petroleum-based polymers. PLA's possible for food packaging is very high due to its easiness, mechanical properties and acceptable wetness process ability for waterless food junk PLA is the one of the most important in the plastic industries blends of this PLA with other polymers like polystyrene , low density poly ethylene, high density poly ethylene etc and co polymers and also homo polymers with use of different processes of plastics [2]. However, there are some disadvantages, such as its high breakability and humble crystallization behavior that limit its current use in food pack (PLA)[3]. Preparation and characterization of PLA/PS biodegradable composites polymer blends were reported in many works (PLA/PS)[1-2]. In order to reduce the volume of waste several biopolymers such as starch, cellulose, PLA, PCL, etc. Plastics are very low temperatures compare to the metal metrics and which are having light weight, plastics are also having good mechanical characteristics i.e. means good tensile strength and poor electrical properties low density and high compactness used for packaging purposes. The current trend in food packaging is the use of blends of different biopolymers like starch-PLA blends Bottles aerosol parts, packaging films, disposable cups;, household and institutional refuse bags and film; boxes and baskets etc. [5].

1. Preparation of Lactic Acid Method

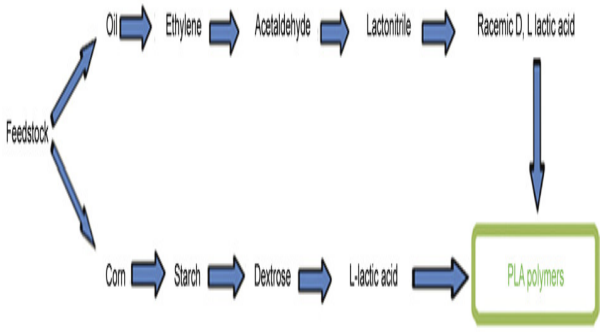

Figure.1. Lactic acid preparation processes

Biodegradable composite polymers attracted considerable consideration in therapeutic applications because they displayed Benefits over the non-biodegradable polymers, as well as an exclusion of the essential to remove implants and biocompatibility. Just, PLA and its systems played an operative role in therapeutic claims, wherever the use of PLA in these applications was not based exclusively on its biodegradability because it was made from renewable assets, but PLA was being used because it worked very well and so long as the excellent properties at a low cost as [7].

2. Properties of poly lactic acid

2.1. Rheological properties

The rheological properties of PLA and its schemes (PLA blends and composites) were investigated widely using a variety of rheological characterization methods, such as capillary and balanced rheometers[8-12]. Similar to all thermoplastic polymers, as shown in Figure 4. Many studies reported the rheological performance of PLA and showed that PLA followed the power law (Equation (1)) over a certain range of shear rates and

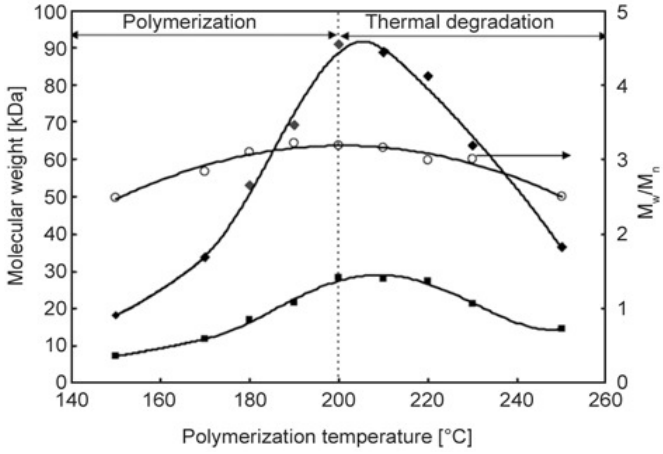

Figure 2. Effect of the PC reaction temperature on molecular weights of PLA polymers

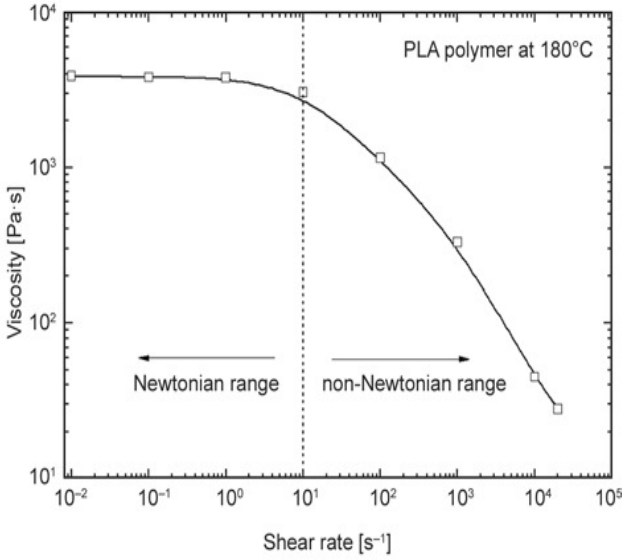

Figure 3. Viscosity curve of PLA at 180°C presentation shear viscosity as a purpose of shear rate [23]
Temperatures in the same way where extra polymers followed

[19–23]: J = K''ɳ (1)

Where j is the shear stress, $''$ is the shear rate, K is the consistency index, and n is the non-Newtonian Index. The value of n described the transformation from Newtonian fluid flow manners, so it was also called the flow performance index. A higher n value indicated that the shear rate had a less consequence on the flow behavior. In other words, the changes in viscosity with the shear rate were not obvious. In addition, it was found that a PLA melt obeyed Equation (2) (Arrhenius equation form) at different shear rates and shear Stresses

$$\eta = Ae^{(E/RT)} \quad (2)$$

Where E is the flow activation energy, A is the consistency related to the structure and formulation and
R is the gas constant. The flow activation energy reflected the temperature-sensitivity of the viscosity.
Hence, a larger E indicated a higher temperature sensitivity of the materials behavior. The effects of the composition (L- and D-isomers) on the rheological properties of the PLA polymers were reported in the end of 1990s [9]. The results showed that the shear viscosity of the polymer increased with increasing L-isomer in the L/D-isomer mixture because of the increasing crystallinity of PLA, where the crystallinity increased with increasing L-isomer content[17].. Investigated the effect of the structure of PLA on the rheological properties using two different types of PLA, such as linear and branched. This was recognized to the shear thinning behavior of the polymer, resulting in a lower viscosity at high shear rates[19-20].

3. Mechanical properties

The mechanical properties described the behavior of the material under the effect of different loading modes, such as tensile, impact, shear, and pressure. PLA had good mechanical properties (particularly tensile Young's modulus, tensile strength, flexural strength) compared to traditional polymers, such as polypropylene (PP), polystyrene (PS) and polyethylene (PE). Which has interested the significant awareness toward the toughening of PLA over last five years.[15]. in Figure 4 (a). The impact strength of PLA could be improved by adding the agent (30%) and by annealing at 90°C for 2.5 h. Figure 4 (b). shows that the allocation of the EGMA phase in the PLA matrix was finer in the material fabricated from the high molecular weight PLA (PLA-H) compared to that fabricated from the low molecular weight PLA (PLA-L). This facilitated the pull-out of the copolymers generated from the interface to the PLA matrix, leading to the generation of more co-polymers in the interfacial regions and the finer distribution of the EGMA phase. In a work reported by Sun *et al*. [22

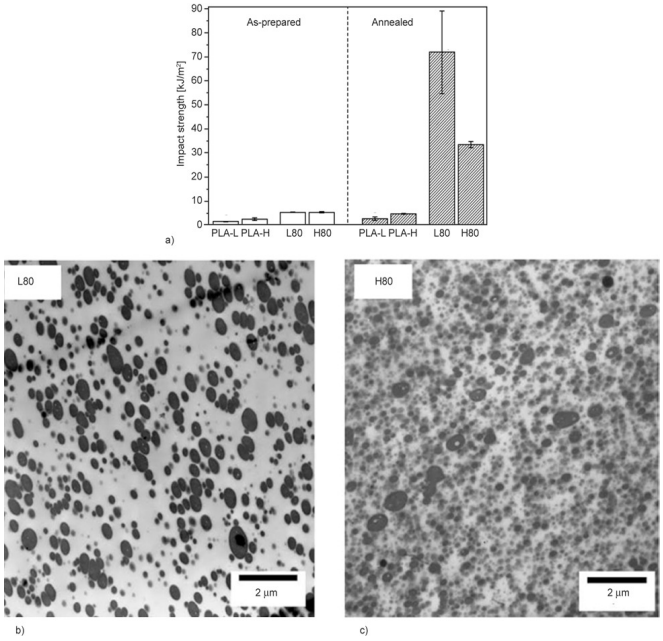

Figure 4. (a) Effective strength of PLA/ABS blends before and after annealing treatment at 90°C for 2.5 h

4. Conclusion

In this paper rheological, morphology and mechanical properties of PLA and ABS blends of poly(lactic acid), and acrylonitrile-butadiene-styrene were studied. IMPACT. Rheological results showed that the primary blend (PLA/ABS) The mechanical results showed that the stress at break and Young's modulus of the binary blend are better than those of the primary blend.. Finally concluded that by increasing Abs mixture to PLA mixture from the standard ratios of rheological And mechanical properties were grater improved then pure of PLA so it is very useful for in food faking, automobile industries and agricultural products .

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