PRODUCTION OF BIO-PLASTICS FROM WASTES OF CASSAVA TO PROMOTE THEIR BIOMASSWEB VALUES

Adigun, I.A.*; Raji, A.O.*; Adefisan, O.O*; Ojewumi, O.B.*; Asiru, W.B.**; Abass, A.***; Bankole, L**

*University of Ibadan, Oyo state; **Federal Institute of Industrial Research, Oshodi, Lagos; ***International Institute for Tropical agriculture, Ibadan. Oyo state

ABSTRACT

In this study, the use of agricultural waste for production of bio-gel fuel and bioplastic is explore. The project seek to reduce the GHG and environmental pollution by the use waste of cassava, to produce bioplastic to replace the existing products currently in market that are not environmentally friendly. The research work will have considerable impacts on the vision of bio-economy launched by many African countries, which is to be achieved through the creation and growth of novel industries that generate and develop bio-based services and products. It will also support the local content initiative of Nigeria government.

INTRODUCTION

Globally, 140 billion metric tons of biomass is generated every year from agriculture. This volume of biomass can be converted to an enormous amount of energy and raw materials. Equivalent to approximately 50 billion tons of oil, agricultural waste converted to energy can substantially displace fossil fuel, reduce emissions of greenhouse gases and provide renewable energy to some 1.6 billion people in developing countries, which still lack access to electricity. This in turn reduce the carbon footprints in the system. As raw materials, biomass wastes have attractive potentials for large-scale industries and community-level enterprises especially in bioplastics which are used for packaging food and non-food materials. However bioplastics have not reached their full potential as viable and permanent solution to replace petroplastics, because several performance criteria such as strength, flexibility and moisture resistance are yet to be fully investigated for most bio-materials

OBJECTIVES

The main objectives of the project is to develop sound technologies for converting cellulosic biomass into bioplastics and investigate the effect of plasticizer on the strength and biodegradability of the bioplastic

METHODS

Wet cassava starch (600g) was mixed with plasticizers (30g) and acetic acid (30g) in ratio of 20:1:1 and also repeated for ratio 20:1:2. These were cooked in a non-sticky pot over a gas burner until

. The bio-resin (PFA) formed was poured into a rectangular mould of 30cm×30cm×1cm and sundried for 2 weeks and subjected to chemical, mechanical and biodegradable tests.

Cassava Peels | Starch from Peels | Bio-resin (PFA) | Bioplastic

RESULTS

- It was confirmed that treatment of cassava peel starch with acetic acid and plasticizers formed plastic resin (PFA).
- The results of the flexural test shown in Table 1 indicates tensile strength, strain, energy and extension ranged from 1.30-2.87MPa, 0.086-0.093, 0.1-0.278J and 5.83-7.06mm respectively.
- The result of the biodegradability test as shown in Table 2. indicates degradability rate ranged from approximately 14% (day 3) to 86% (day 12)
- The functional groups present in the composites from Table 3. are hydroxyl, alkane, carbonyl, alcohol, ester and alkenes. These components have no hazardous environmental effects.

TABLE 1. FLEXURAL OF BIOPLASTIC

Materials	Stress (MPa)	Strain	Energy (J)	Extension (mm)
Cassava Peels Starch +Sorbitol	2.87^{A}	0.086^{A}	0.278^{A}	6.50^{A}
Cassava Peels Starch +Glycerol	1.13^{B}	0.093^{A}	0.100^{AB}	7.06^{A}

TABLE 2. RATE OF BIODEGRADIBILITY OF BIOPLASTIC

Days	Weight (g)	Rate of degradation (%)
0	11.04	100
0 – 3	9.54	13.59
4 – 6	5.32	50.81
7 – 9	3.12	71.74
10 – 12	1.51	86.32

TABLE 3. FTIR FUNCTIONAL GROUP OF THE COMPOSITE STARCH, GLYCEROL AND ACETIC ACID MIXTURES

Type of bonds	Functional Groups	Infrared (IR) Values (cm^{-1})
$O-H_{st}$	Free Hydroxyl group (alcohol)	3789
$C-H_{st}$	Alkane	2921
$C=O_{st}$	Carbonyl	1755
$C-O$	CO of alcohol or ester	1160-1033
$C=C$	Alkene	1665

CONCLUSIONS

- It is feasible to make bioplastics from cassava peels .
- The bioplastics produced has appropriate strength properties
- The bioplastics had a higher degradable rate as also confirmed in the FTIR

ACKNOWLEDGEMENTS

The Authors Acknowledged BiomassWeb Project-ZEF and FARA for sponsoring the project. Also the managements of UI and FIIRO is also acknowledged for their support