

UIC150701

# **FIRST PROJECT REPORT**

**COMPANY NAME: ISOPLAS SDN. BHD.**

## **PROJECT TITLE**

*PREPARATION OF BIOPLASTIC USING POLYPROPYLENE  
AND STARCH AS FILLER*

**UMP**

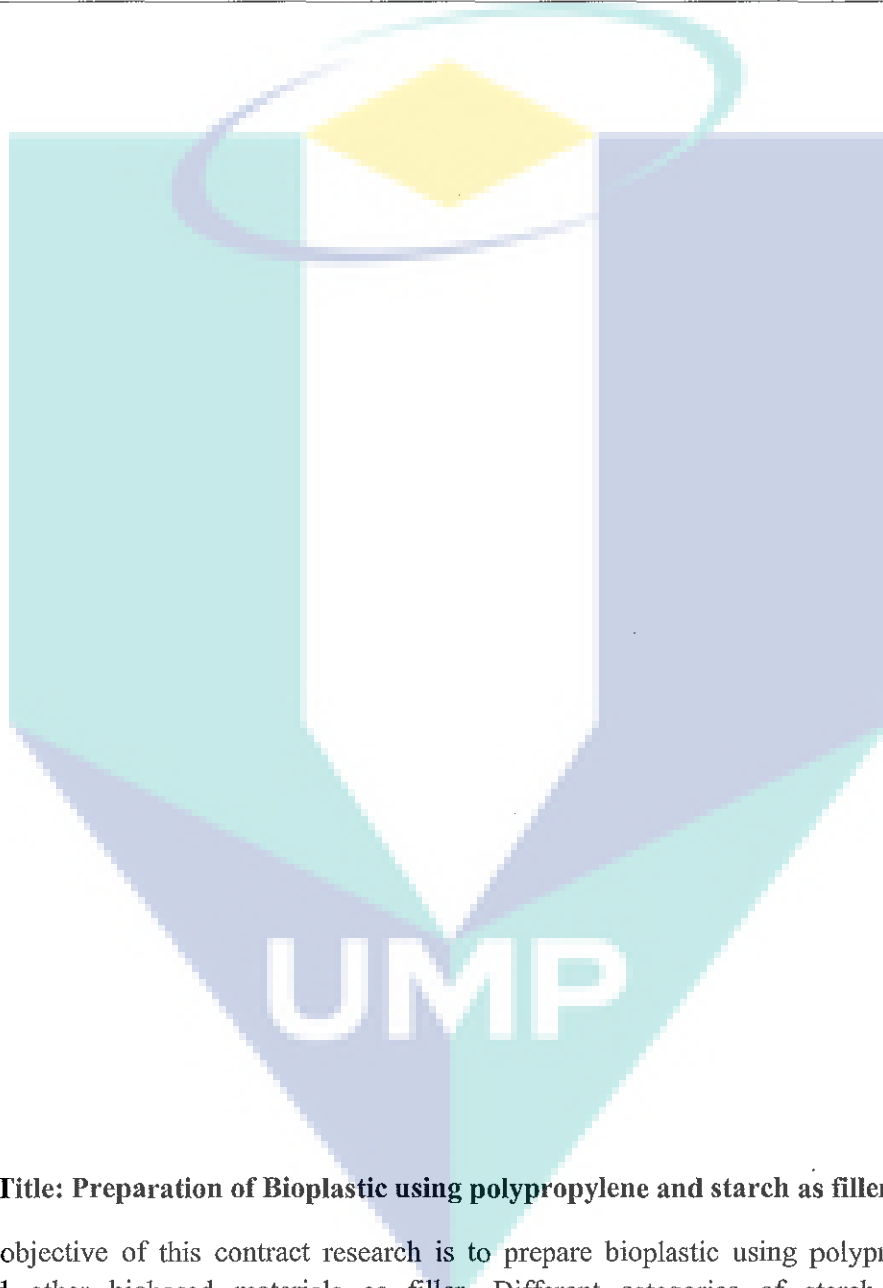
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## TABLE OF CONTENT

NO	CONTENT	PAGE
1	Material and method	
2	Result and Discussion	
3	Conclusion	



### **Title: Preparation of Bioplastic using polypropylene and starch as filler**

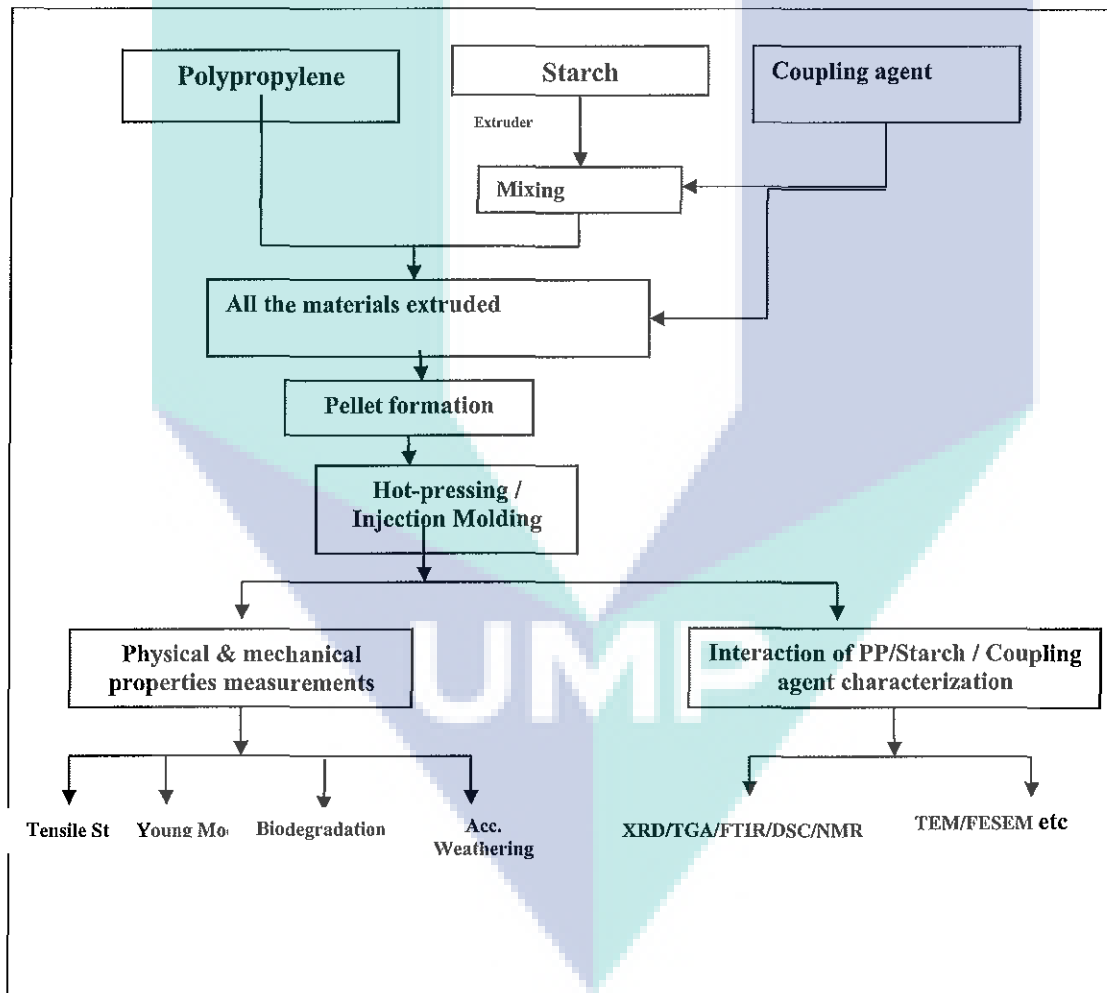
The main objective of this contract research is to prepare bioplastic using polypropylene as matrix and other biobased materials as filler. Different categories of starch and other biodegradable materials will be used to prepare it.

### The project was divided into following four stages

1. Synthesis of polypropylene based bioplastic
2. Preparation of thin film using extruder, hot press and injection molding. .
3. Conducting the mechanical tests young's modulus, tensile strength and biodegradable tests.
4. Analysing the results and repeating the experiments

In the first stage, we have synthesized bioplastic using rice starch as filler and MAPP as a matrix. The rice starch is added in different percentage. First the PP and starch is extruded in the form of pellets and later on thin sheets were prepared in the hot press. Once the samples are ready, then the mechanical testing was conducted using Universal testing machine. The detail results are given below. For conducting biodegradability test, specific enzymes were ordered. The samples were also kept inside the soil from the farm.

### Experimental flow chart



## 1. Material and Method

### 1.1 Sample Preparation

The samples of bioplastic wrapped formulations with rice starch (RS) and polypropylene (PP) with and without additives maleic anhydride poly propylene (MAPP) were prepared and characterized for their mechanical and biodegradability properties.

Samples were prepared in 8 compositions and for each compositions was prepared using 0.5kg of material

**Table 1: Composition of bioplastics**

Trait	Percentage of Material
S0	100% PP
S1	5% RS + 95% PP
S2	10% RS + 90% PP
S3	15% RS + 85% PP
M1	5%RS + 91%PP + 4%MAPP
M2	10%RS + 86%PP + 4%MAPP
M3	15%RS + 81%PP + 4%MAPP

As a pre-eliminary step, RS flour was dried in hot air oven at 80°C for 15 hour before processing. Dried RS flour is mixed with PP as shown in table 1. The mixture was fed into a twin-screw extruder (Prism Eurolab 16 XL, Thermo Scientific) with three controllable temperature zones (Figure 1) maintained from 165 to 130°C. The extruded bioplastics were pelletized into about 5mm sizes.



**Figure 1: Twin screw extruder**

Samples for mechanical testing were molded using a hot & cold molding press (model: LS-22025; Lotus Scientific) with a maximum press capacity of 25 tons (Figure 2). The optimum mold temperature was 180°C. The specimens were molded into dumbbell and rectangular shapes for mechanical measurements.



**Figure 2:** Hot& Cold Molding Press

## **1.2 Mechanical Properties**

Tensile tests were conducted using universal testing machine equipped with 10kN electronic load cell and mechanical grips. Tensile testing was conducted according to ASTM D638 with a crosshead speed of 5mm/min for sample type iv. Flectural modulus of samples was also measured as specified in ASTM D790.



**Figure 3:** Universal testing machine (UTM)

### 1.3 Biodegradability Testing

#### Soil Compost Analysis

Samples sized 2cm×2cm were prepared to test its biodegradability in soil compost. Soil compost was obtained from vegetable farm at Kampung Sawah Padi, Segamat, Johor Bahru. Samples were dried and weighed to obtain initial dry weight. The soil compost containing samples were placed under natural condition and were observed (Figure 3). The dry weight of samples was taken every 10 days. Compost soil is changed every 20 days to increase the efficiency of degradation.

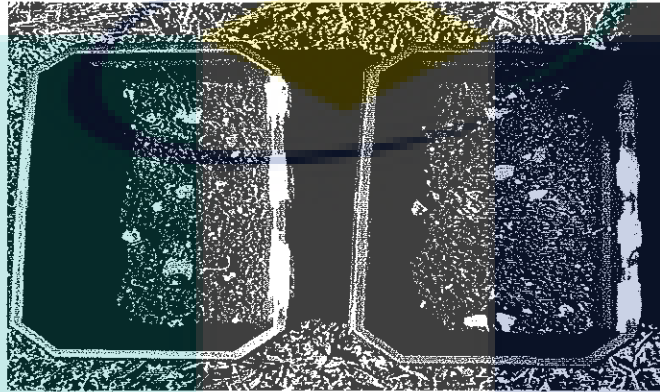


Figure 3: Soil compost containing soil is kept under atmospheric condition

## 2.0 Result and Discussion

### 2.1 Tensile Properties

Samples with different compositions as in Table 1 were tested to determine its tensile strength and elongation. The first batch results are shown as in Table 2.

Table 2: Results from UTM

Traits	Tensile strength, N/mm <sup>2</sup>	Elongation (%)
S0	28.0	151
S1	43.0	6.17
S2	33.0	0.90
S3	24.0	3.02
M1	35.0	6.19
M2	29.0	2.45
M3	18.0	1.73

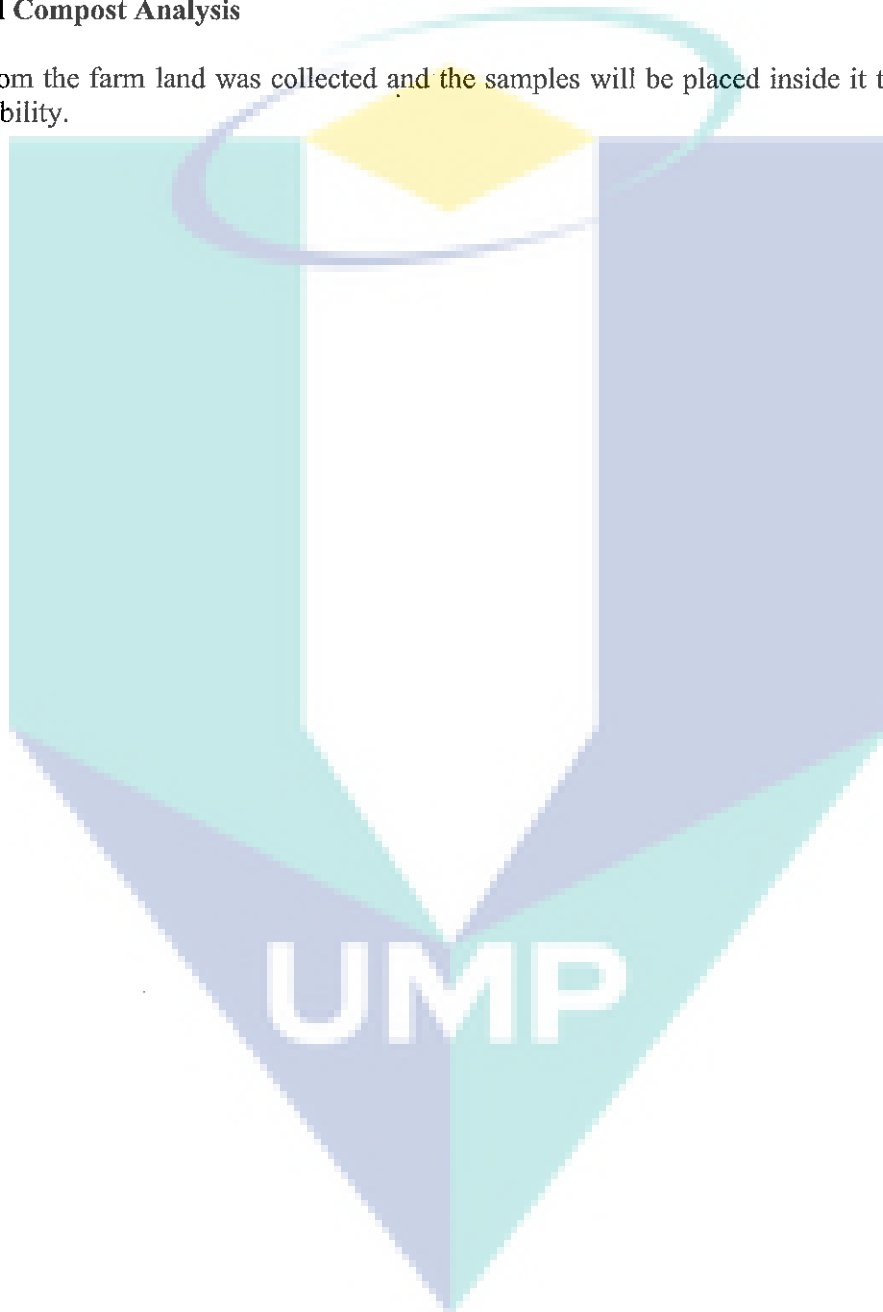
The result shows that addition of starch as filler improves the strength of bioplastics compared to plastics from pure PP. S1 (5%RS + 95%PP) has the highest tensile strength of all the compositions. Addition of MAPP reduces the tensile strength in samples M1, M2, and M3. These factor need to be revised for more valid result. From the above result, the MAPP is not

improving the strength, so need to be replaced with the other coupling agent. The bioplastic synthesized using starch as filler is strong enough to be used as a food container.

The second stage of the project work is to use other biobased filler such as corn starch. To develop the method for the uniform distribution of the biobased material in the matrix and conduct the biodegradability test.

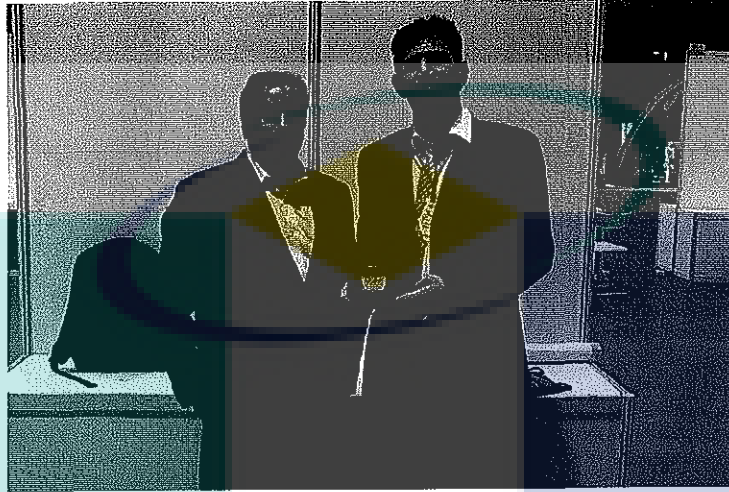
## 2.2 Soil Compost Analysis

The soil from the farm land was collected and the samples will be placed inside it to check the biodegradability.



### 3. Awards (One Gold Medal & One Silver Medal)

The present project received Gold medal in CITREX 2015 exhibition in UMP and Silver medal in ITEX 2015 exhibition in Kuala Lumpur.



Received Gold Medal in CITREX exhibition 2015



Received Silver Medal in ITEX 2015, KL

### Conclusion

In the first stage we have successfully synthesized the bioplastic using PP and rice starch. The quality of the board is good and has passed the mechanical strength. In the second stage different



types of biobased materials will be added. The project was terminated, as the company (Isoplas Sdn.Bhd) have not payed the second instalment. University have send several request for one year. But the company didn't pay, so due to lack of funding and commitment from the company project was terminated.

