HYDROPHOBIC EDIBLE PACKAGING FILM

Suhana Ezzureen M Suhaimi, Nurul Aimi Zakaria*, Ahmad Nazib Alias, Zubainun Mohamed Zabidi, Muhammad Kamarul Thaqif Kamarul Ariffin, Nur Lailatul Syafiqah Abdul Rahim and Aiman Haiqal Faizai Junaid

Faculty of Applied Sciences, Universiti Teknologi MARA Perak Branch, Tapah Campus 35350 Tapah Road Perak, MALAYSIA

**Email: nnurula5028@uitm.edu.my*

ABSTRACT

Nowadays, plastic usage had increased drastically compared to 10 years ago. This is caused by the plastics are required to be used due to their various ability in as packaging in the food industry such as plastic bags, cups, spoon, plates, and bowl. This had caused the increase in the amount of plastic pollution that had occurred all around the world because the improper disposal of the plastic will lead to a huge waste because plastic generally took about 1000 years for it to fully decay. Therefore, the purpose of our project is to create an edible bio-plastic to help even at least slightly at alleviating the issue of plastic pollution since our bioplastic will be edible both to human and animal and also the plastic would biodegradable which means it would take a shorter time for it to fully decay. The bio-plastic was made with cassava mix separately with agar and gelatin to further enhance the properties of the plastic. This plastic was tested for tensile and elongations with 3:1 ration of Gelatin and Cassava being the best bio-plastic in terms of the test.

Keywords: edible plastic, thin film, green technology, bio-plastic, biodegradable

1. INTRODUCTION

Nowadays, plastic usage had increased drastically compared to 10 years ago. This is caused by the plastics are required to be used due to their various ability in as packaging in the food industry such as plastic bags, cups, spoon, plates, and bowl. The increasing in the amount of plastic pollution that had occurred all around the world because the improper disposal of the plastic will lead to a huge waste because plastic generally took about 1000 years to fully decay[1]. If the plastic waste was spread to the wildlife habitat, the animals could accidentally consume the plastic which would cause a major hazard towards them. In previous research, an article had stated that if a turtle had consumed 14 plastics it would have a 50% probability of dying [2]. The purpose of our project is to create an edible plastic to help even at least slightly alleviate the issue of plastic pollution since our plastic will be edible both to humans and animals. This bio-plastic also is a biodegradable polymer. This biodegradable polymer takes a shorter time to decompose. The edible plastic is very helpful in preserving the wildlife for the future generation of mankind, saving the environment, and also reduce plastic waste.

2. METHODOLOGY

Three hosts of the biopolymer have been studies which are cassava, agar, and gelatin. The host was mixed according to the following composition; agar and cassava with a ratio of 1:1, 1:3, and 3:1 and gelatin and cassava with a ratio of 1:1, 1:3, and 3:1. To enhance the binding of the composition, the citric acid which is a crosslinking agent was added [3]. The mixture is then heated until it turns to the slurry. Then the paste

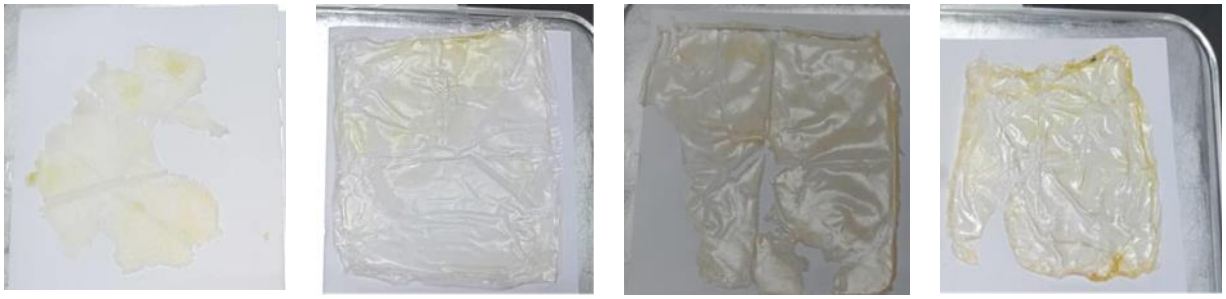
was poured into the mould and dried using an oven. The sample Tensile and Elongation test has been studies and it is conducted using Material Lab with Data Capture TQ MF 40.

3. RESULTS AND DISCUSSION

Table 1 shows the tensile and elongation result of the samples. The results obtained show that Gelatin and Cassava with composition 3:1 is the optimum composition ratio of the sample. This may be due to the degree of cross-link is the highest in this composition [4]. Hence produce the polymer blends from thermo-setting to thermos-plastic This condition will cause the good quality of the polymer morphology and thus increase the tensile value of the sample.

Table 1. Tensile and Elongation result of the samples.

Sample	Tensile(g)	Elongation (cm)
Agar +Cassava		
1:1	339	0.10
1:3	792	0.10
3:1	2300	0.10
Gelatin +Cassava		
1:1	591	0.40
1:3	369	0.50
3:1	735	0.70



(a) (b) (c) (d)

Figure 1. The morphology of thin film polymer cross-link for (a) Agar: Cassava with composition 1:1; (b) Agar: Cassava with composition 3:1; (c) Gelatin: Cassava with composition 1:1 and (d) Gelatin: Cassava with composition 3:1

Morphology for all the thin films soft and non-sticky. This shows that all the thin film is hydrophobic. The thin film of Agar: Cassava with composition 1:1 shown poor mechanical and morphology properties. This thin film was easy to fracture. This plausible due to in this composition the process of degree cross-link does not occur completely [5]. Morphology for Gelatin: Cassava with composition 1:1 and 1:3 shows nearly the same properties. The best morphology is Agar: Cassava with composition 3:1. This result in line with the tensile strength result which has the highest tensile strength.

4. CONCLUSION

In this project, we have succeeded to develop a novel edible plastic based on agar, cassava, and gelatin at different compositions. All the thin films were soft and non-sticky. This shows that all the thin film is hydrophobic. The best composition is Agar: Cassava with the ratio 3:1. This ratio shows the high tensile strength and morphology. Followed by Gelatin +Cassava with ratio 3:1 and 1:1. The thin film of Agar: Cassava with composition 1:1 shows the poor quality of morphology and also mechanical properties. As a recommendation, further investigation on the degree of cross-link is still in progress using FTIR analysis.

REFERENCES

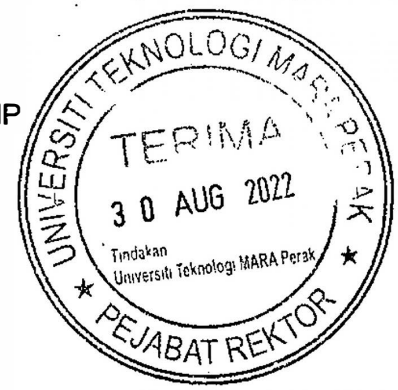
1. Tang, X. and Chen, E.Y.X., (2019). Toward infinitely recyclable plastics derived from renewable cyclic esters. Chem, 5, 2, 284-312.
2. Blettler, M.C. and Wantzen, K.M., (2019). Threats underestimated in freshwater plastic pollution: mini-review. Water, Air, & Soil Pollution, 230, 7, 174.
3. Seligra, P.G., Jaramillo, C.M., Famá, L. and Goyanes, S., (2016). Biodegradable and non-retrogradable eco-films based on starch–glycerol with citric acid as crosslinking agent. Carbohydrate Polymers, 138, 6-74.
4. Perez-Puyana, V., Jiménez-Rosado, M., Romero, A. and Guerrero, A., (2019). Crosslinking of hybrid scaffolds produced from collagen and chitosan. International journal of biological macromolecules, 139, 262-269.
5. Butt, A., Jabeen, S., Nisar, N., Islam, A., Gull, N., Iqbal, S.S., Khan, S.M. and Yameen, B., (2019). Controlled release of cephradine by biopolymers based target specific crosslinked hydrogels. International journal of biological macromolecules, 121, 104-112.

Pejabat Perpustakaan
Librarian Office

Universiti Teknologi MARA
Cawangan Perak
Kampus Seri Iskandar
32610 Bandar Baru Seri Iskandar,
Perak Darul Ridzuan, MALAYSIA
Tel: (+605) 374 2093/2453 Faks: (+605) 374 2299

UNIVERSITI TEKNOLOGI MARA

Surat kami : 700-KPK (PRP.UP.1/20/1)
Tarikh : 30 Ogos 2022



YBhg. Profesor Ts Sr Dr Md Yusof Hamid, PMP, AMP
Rektor
Universiti Teknologi MARA
Cawangan Perak

YBhg. Profesor

PERMOHONAN KELULUSAN MEMUAT NAIK PENERBITAN UiTM CAWANGAN PERAK MELALUI REPOSITORI INSTITUSI UiTM (IR)

Perkara di atas adalah dirujuk.

2. Pihak Perpustakaan ingin memohon kelulusan YBhg. Profesor untuk membuat imbasan (*digitize*) dan memuat naik semua jenis penerbitan di bawah UiTM Cawangan Perak melalui Repositori Institusi UiTM, PTAR.

3. Tujuan permohonan ini adalah bagi membolehkan akses yang lebih meluas oleh pengguna Perpustakaan terhadap semua bahan penerbitan UiTM melalui laman Web PTAR UiTM Cawangan Perak.

Kelulusan daripada pihak YBhg. Profesor dalam perkara ini amat dihargai.

Sekian, terima kasih.

"WAWASAN KEMAKMURAN BERSAMA 2030"

"BERKHIDMAT UNTUK NEGARA"

Yang benar