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PROXIMATE COMPOSITION OF JACKFRUIT PEEL AS INFLUENCED BY FUNGI FROM VERMICAST THROUGH SOLID STATE FERMENTATION

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ABSTRACT

This present study elucidated the effect of *Aspergillus niger, Rhizopus stolonifer, Rhizo mucorpusillus* and *Aspergillus fumigates* isolated from vermicast on the proximate composition of jack fruit peel. The proximate composition which includes crude protein, crude fat, crude fiber, moisture content, and ash content after SSF were computed.

Among the four fungal organisms tested, *R. stolonifer* had enriched the proximate composition of jack fruit peel. Overall, the increase in crude protein led to the increase of ash content, crude fat and crude fiber content and a reduction in the moisture. Meanwhile, the reduction in crude protein resulted to the increase in moisture content and decrease in ash content, crude fat and crude fiber content of the substrate.

INTRODUCTION

Many cellulosic wastes from agricultural crops and fruits have been investigated as substrate for the production of protein enriched animal feeds. During the process, these cellulosic waste products are rich in nutrients which could support microbial growth, further, can be turned into an enriched alternative feeds by microorganisms [1, 2, 3].

Jackfruit (*Artocarpus heterophyllus* Lam) which belongs to the *Moraceae,* bear fruits which consist of bulb (the fleshy edible

region). Its fruit is known as a good source of vitamins, amino acids, and minerals [4, 5, 6, 7]. Meanwhile, like any other fruits its peel are not edible, no commercial use and adds up to the world's agricultural waste. In a recent study of Soetardji [8] revealed the potential of jackfruit peel waste as source of bio-oil and Zhang *et al* [9] showed the anti-oxidant potential, total phenolic and flavonoid content. With this, the present study was conducted primarily to evaluate the effect of the fungi isolated from vermicast on the proximate composition of jack fruit peel waste. Thus, this would lead further to the utilization of both the fungi and the fruit peel as an alternative food source.

MATERIALS AND METHODS

The study was carried out following the procedure by Valentino *et al* [10], with some modifications.

Preparation of the Culture Media and Subcultures

Thirty-nine (39) grams of Potato Dextrose Agar were suspended in 1 liter of distilled water. This mixture was heated while stirring continuously to fully homogenized all the components, half of this was contained in a flask sealed with cotton plug and aluminium foil while the other half was placed on test tubes sealed also with cotton plug. Then, to totally eradicate the possible microorganisms present in it, it was sterilized using an autoclave at 121° C, 15 psi for 30 minutes.

After sterilization, the prepared media on the test tubes were slanted. Then, the fungal isolates were aseptically inoculated to come up with subcultures. They were incubated and grown for seven days.

Preparation of Substrates

The jackfruit peel was collected from Brgy. Linglingay, Science City of Muñoz, Nueva Ecija, Philippines. They were sun-dried and pulverized into powdered form. One hundred (100) grams of the dried jackfruit peel were placed in a clean wide mouth bottle and 200 ml distilled water were poured to the substrate. They were then sterilized at 15 psi at 121°C for 30 minutes.

Preparation and Inoculation of the Mycelial Disc

The previously prepared media were then poured into the petri plates. Then, each fungal collection was aseptically inoculated into the plated media, grown and incubated for seven days. After the mycelia had fully ramified the disc, each fungal isolates were aseptically inoculated into the substrate using a sterile 10 mm cork borer and an inoculating needle. The inoculants were allowed to grow in the substrate for 20 days at room

temperature maintaining its moisture content of 60-65 %.

Harvesting and Drying

After 20 days of solid state fermentation, the cultures were sterilized at 15 psi, 121°C for 30 minutes. They were spread in a clean paper individually and air dried for seven days. Dried samples were pulverized using sterilize mortar and pestle. Samples were sent to Lipa Quality Control Center, Bocaue, Bulacan for the analysis of crude protein content (CPC). The fungal enriched jackfruit peel served as the final CPC. Whereas, the CPC of the inoculated jackfruit peel served as the initial CPC. The increase in CPC of the jackfruit peel was computed using the following formula:

$$\textbf{\% increase in protein} = \frac{\textbf{Final \% CPC} - \textbf{Initial \% CPC}}{\textbf{Initial \% CPC}} \textbf{X100}$$

Proximate Composition

Jackfruit peel (250 g) were sent to Lipa Quality Control Center, Bocaue, Bulacan for the proximate analysis of its nutritional content including crude protein, crude fat, crude fiber, moisture content and ash content. Moisture content, ash content, crude fiber, crude fat and crude protein were based on the guidelines of the Association of Official Analytical Chemist [11].

RESULTS AND DISCUSSION

After 20 days of SSF, the varying effects of *Aspergillus niger, Rhizopus stolonifer, Rhizo mucorpusillus* and *Aspergillus fumigatus* in the crude protein, ash content, crude fiber, moisture content, crude fat, total carbohydrates and total energy values of the jackfruit peel were recorded (Table 1). Proximate composition of the substrates will determine microbial growth and proliferation which will further caused enrichment or deterioration of the primate composition of the substrate. Also, it was found that the mycelial yield of fungal biomass varies depending upon the substrates and the organisms used [12].

For the ash content, increment was observed when treated with *R. stolonifer* and *R. pusillis* with 6.80% and 6.53%, respectively. For the crude fiber, a significant reduction was observed when treated with *A. niger* with 18.60% and an increase when treated with *R. stolonifer* with 23.47%. Additionally, increase in moisture content was recorded in all treated jackfruit wherein the highest moisture content was obtained in *A. niger* and *A. fumigatus* with 26.14% and 27.59%. For the crude fat increment was only observed in *R. stolonifer* and *R. pusillus* with 8.43% and 8.17%, respectively. Finally for

the crude protein, *R. stolonifer* led to an increase which resulted to CPC of 7.25%.

Table 1: Proximate compositionof fungal enriched jackfruit peel

TREATMENTS	ASH	CRUDE FIBER	MOISTURE	CRUDE FAT	CRUDE PROTEIN
Uninoculated jackfruit peel	5.58	20.50	8.23	7.47	6.52
A. niger- treated jackfruit peel	5.72^{ns}	18.60^{*}	26.14^{**}	5.71^{ns}	6.26^{ns}
R. stolonifer- treated jackfruit peel	6.80^{*}	23.47^{*}	10.78^{*}	8.43^{*}	7.25^{*}
R. pusillus- treated jackfruit peel	6.53^{*}	20.91^{ns}	12.38^{*}	8.17^{*}	6.63^{ns}
A. fumigatus- treated jackfruit peel	5.71^{ns}	18.79^{ns}	27.59^{**}	6.08^{ns}	6.28^{ns}

*** means significant compared to control; ** means highly significant compared to control; ns means not significant compared to control.**

Results of the study, coincides with various studies wherein increase in the crude protein content of the substrate can be accounted torapid fungal growth and proliferation of the fungal biomass in the form of proteins [13, 14]. Also, similar results on the improved nutritional contents of the substrates by *R. stolonifer* was illustrated by Lateef *et al.* [15]. On the other hand, production of proteases caused reduction of CPC of the substrates [16].

Meanwhile, change in ash content is directly proportional to that of crude protein wherein the higher the ash content is the higher the crude protein is and vice versa. And the increase in ash content can be attributed to the biosynthetic or hydrolytic mechanisms increasing the inorganic mineral elements of the substrate [17, 18, 19, 20].

Varying effect of fungi on the crude fiber of the substrate is in due to cellulose degrading enzymes [21, 22, 23, 24]. And the increase in crude fat can be attributed to transformation of carbohydrates to fat during the fermentation process and their ability to synthesize fatty acids and other unsaturated lipids [25, 26, 27].

CONCLUSION

Considering the effect of fungal isolates in the proximate composition of jackfruit peel, *R. stolonifer* enhanced the proximate composition of the substrate which resulted to a higher value of ash, crude fiber, crude fat, moisture and crude protein.

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