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Proximate Composition of Corn Bran as a Potential Substrate for the Production of Xylanase Using *Aspergillus niger*

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

Proximate Composition of corn bran was studied to determine its viability or efficacy as a potential substrate for the cultivation of *A. niger*. Corn bran for this study was obtained from a local milling house in Kaduna metropolis Nigeria and the Association of Analytical Chemist (AOAC) method was applied. Our study yielded the following percentage proximate composition of corn bran: Moisture, 2.10, Ash 1.20, Crude protein 15.00, Fat 5.05, Crude fibre 49. 20 and Carbohydrate 27. 45. Our findings support the conclusion that this unique composition of corn bran is rich in fibre, carbohydrate and protein which serve as essential block for the growth of fungi such as *Aspergillus niger*, thereby enhancing the synthesis of xylanase and other important enzymes.

Keywords: Corn bran; proximate; xylanase; Aspergillus niger.

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1. INTRODUCTION

Proximate analysis is the determination of the amount of water, protein, fat (ether extract), ash and fiber, with nitrogen-free extract. Corn, (*Zea mays*), also called Indian corn or maize is a cereal crop of the grass family (Poaceae) originated in America and is one of the most widely distributed of the world's food crops [1]. Varieties of yellow and white corn are the most popular as food, though there are varieties with red, blue, pink and black kernels, often banded, spotted or striped [2,3].

The grains have three parts: The bran, the endosperm, and the germ. The bran is the hard outer shell which protects the grain from the elements. Inside the bran is the endosperm, the bulk of the grain, with the nutrient-rich germ at one end of the grain. In the event that the grain is develops into a seedling, the bran eventually splits open to allow the roots and leaves of the offspring to emerge [1].

Corn bran is a food product made from the tough outer layer of corn. Like the brans from other grain crops, it is very high in fiber, and it can be used in a wide variety of ways. Many commercial food producers use this substance as filler in their foods, and to reduce the caloric value of snack foods. It can also be used in home cooking to increase the fiber content of various foods and to add texture [4]. Therefore, because of its differs use in feeding and sustaining lives, it is expedient to research its nutritional viability as a substrate for the growth of *Aspergillus niger* and possibly foster the production of xylanase enzyme.

Other Agricultural wastes/residues such as wheat bran, Corn cob, sugar cane bagasse, and rice husk have been used by many investigators for the production of some quantities of xylanase [5,6]. When palm kernel cake was used as a substrate, the crude enzyme produced higher xylanase activity (26.97 u/g) [7].

The use of microorganisms in the production of xylanase has been preferred over plant and animal sources due to their availability, structural stability and easy genetic manipulation [5]. The conversion of biomass into fermentable sugars through enzymes obtained from indigenous microorganisms offers potential to reduce environmental pollution [8].

Over the years, a number of microorganisms of the genus *Penicilium*, *Trichoderma*, *Pleurotus*, *Aspergillus*, *Streptomyces* and *Bacillus* have been manipulated for xylanase biosynthesis [9,5,10]. However, *Aspergillus niger* has been described as the most potent organism for xylanase production [5].

2. MATERIALS AND METHODS

2.1 Collection of Corn Bran

Corn bran was collected from a local milling house located within Kaduna metropolis, Kaduna state in Nigeria. It was transferred into a sterile polyethylene bag and dispatched to the Microbiology Laboratory, Kaduna State University, Nigeria and kept at ambient temperature till use.

2.2 Determination of Proximate Composition of Corn Bran

Proximate analysis was carried out following the method and procedure of [11].

The total carbohydrate was determined by differential method i.e. by subtracting the total protein, lipid, moisture and ash content from 100.

Thus: % carbohydrate = (100 – (% moisture + % ash+ % fat + % protein + % fiber)

3. RESULTS AND DISCUSSION

The percentage proximate compositions of corn bran are shown in Table 1. The results indicated that corn bran has high percentage fiber (49.20 ± 3.89 %) and carbohydrate (27.45 ± 2.09%) contents. The percentage crude proteins and fat contents were 15.00 ± 0.50% and 5.05± 0.09% respectively. However, percentage crude ash of 1.20 ± 0.12% was the least proximate component of corn bran recorded as observed.

Table 1. Proximate composition of corn bran

Parameters (%)	Percentage composition
Moisture	2.10 ± 0.34
Ash content	1.20 ± 0.12
Crude protein	15.00 ± 0.50
Fat content	5.05± 0.09
Crude fiber	49.20 ± 3.89
Carbohydrate	27.45 ± 2.09

Values are mean ± SEM of 3 determinations

Determination of proximate composition of corn bran provides information on its nutritive value as a suitable substrate for the growth of *Aspergillus niger.* The moisture content of the corn bran in

this study is at variance to the earlier researches. Findings from [12,13] show that the values for moisture content were 20.33% and 19% respectively. This difference could be attributed to the maize variety used, agricultural or planting method or other environmental factors. The lower moisture content is important as it could hinder the growth and fungal contamination thereby enabling long storage of the corn bran.

The percentage ash content in this study is low (1.20%). Enyisi et al. [12] in a similar study reported 1.10% ash content. The low ash content is a reflection of the mineral content preserved in the corn. The result, therefore, suggests a low deposit of mineral elements which may affect the growth of microorganisms such as *A. niger* which uses the corn bran as its substrate. Our analysis in this study establishes that corn bran can be ranged as a protein rich supplement for the growth of *A. niger* when compared with compositions of bran from other product. The protein content of corn bran can be improved through technological processes by moving the gene(s) responsible for protein synthesis from the ribosomal DNA of high protein plant [12].

The percentage fat content obtained in this study is in close relationship with that reported by Ujabadeniyi and Adebolu [14], but differs from that of Ikenie et al. [15]. The observed difference may be due to environmental factors such as climate and the type of soil used for cultivation.

Crude fiber had the highest percentage content in this study. This however is slightly different from the finding of Enyisi et al. [12] who reported a lower content of less than 30%. The carbohydrate content of the corn bran used in this study was the second highest chemical. This was; however, lower than the findings of Mlay et al. [16] who reported a higher carbohydrate content of 73.3%. The observed difference is attributed to the variety of maize from which the bran is obtained [12].

4. CONCLUSION AND RECOMMENDATION

The result of this study clearly shows the nutritional importance of the corn bran. Although regarded as a waste, corn bran contains very high percentage of crude protein, fiber and carbohydrate among other nutrients and therefore can support the growth of *Aspergillus niger*. Further research is conducted to confirm these observations and obtain more precise information and conclusions that will support real applications of this research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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