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Valorization and Characterization of Starch from Ginger (Zingiber Officinale)

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ABSTRACT- The aim of research was to extract the starch from ginger. It contains gingerol, fat, starch and volatile oil. It is the rhizome of the plant Zingiber Officinale. Ginger is belonging to the family Zingiberaceae is an ancient Indian medicine used in several disorders. It is a popular spice with important nutraceuticals attributes is cultivated extensively in India. after extraction of starch from ginger. The obtained starch had a yield of 13%. The prepared starch was characterized by FTIR and TGA to investigate the chemical composition, thermal properties. From these findings results suggested that the ginger can be used to extract starch. Due to biodegradable and biocompatible in nature. It will be used for biodegradable film and biomedical applications.

KEYWORDS- Ginger, Starch, Rhizome, Biodegradable, Biomedical application.

I. INTRODUCTION

Among all organic compounds, starch is one of the most prevalent. Because it is generated in plastids, it can be found in the leaves of green plants. Furthermore, it is produced in the chemical storage form of energy is found in amyloplasts found in seeds, grains, roots, and tubers of most plants [1]. There are several industrial uses for starch, a naturally occurring biodegradable biopolymer. Given its greater nutritional value over low molecular weight carbohydrates or sugars, starch is the only digestible polysaccharide that is qualitatively significant [2]. Several sources of starches have been studied and shown to be useful as mucilage or dry powder medicinal excipients as well as binder. Starch has a wide range of possible applications in industry. For example, unmodified starch can be utilized in the paper, building, mining, and pharmaceutical sectors. It can be changed and transformed into derivatives of starch [3]. In the culinary, textile, cosmetics, plastics, adhesives, paper, and pharmaceutical industries, starch is also one of the most extensively utilized biomaterials. Starch is used extensively in industry because of its good physicochemical qualities, high calorific value, and inexpensive availability. potato, cassava, and maize [4]. Ginger, or Zingiber officinale, is a herbaceous perennial plant that is a member of the Zingiberaceae family and the Scitamineae order. It is an annual reed-like perennial plant that grows to a height of one meter (3–4 feet) with green stems. It is a common herb and root crop that is widely cultivated around the globe for its fragrant, aromatic underground stem, or rhizome, which contributes to its importance [5]. Zingiber officinale is the plant whose rhizome is used as a spice, medicinal, and delicacy. The Zingiberaceae family is the source of it. East Africa and the Caribbean have since adopted ginger farming, which originated in South Asia [6]. In the present study Ginger were used to extract starch. and other functional characteristics were studied.

II. EXPERIMENTAL

A. Materials

Ginger was purchased from local market of Lucknow, Uttar Pradesh. Distilled water a form of purified water, obtained by simple distillation free from impurities was of laboratory grade.

B. Methodology

- Extraction of Starch from Ginger- About 250 g of fresh ginger roots were peeled and washed. After that the ginger were chopped into small pieces and soaked into water (700 ml) at room temperature 25 °C. Thereafter, the root pieces were removed and wet milled into slurry using greater. The paste was dispersed in a large volume of beaker and filter through plastic strainer. The suspension was centrifuged at 3500 rpm for 10 min. to facilitate the removal of dirty, the supernatant was carefully decanted and the mucilage scraped off. After mucilage filtered through plastic strainer, leave the solution for sedimentation process for 30 min. The resulting, starch was settled down. Further the starch was dried at 60 °C in hot air oven, pulverized, weighted and stored in an airtight container as illustrated in Figure 1 [7]
- Yield Calculation-Yield percentage can be calculated by using the eq. (1) stated as follows:

$$\text{Yeild (\%)} = \frac{\text{Total weight of obtained starch}}{\text{Total weight of ginger}} \times 100 \qquad (1)$$

III. CHARACTERIZATION

A. Fourier Transform Infrared Spectroscopy (FTIR)

FT-IR spectra were recorded at room temperature using a Thermo-Scientific Nicolet 6700. FT-IR Spectrometer (Thermo Nicolet Limited, USA) on a diamond disc in the range of 4000-400cm^{-1}.

B. Thermo-Gravimetric Analysis (TGA)

The thermal analysis of keratin in the room temperature to 800˚C was evaluated using Perkin Elmer Pyris .TGA (Waltham, Massachusetts USA) at a heating rate of 10˚C/min in a nitrogen atmosphere.

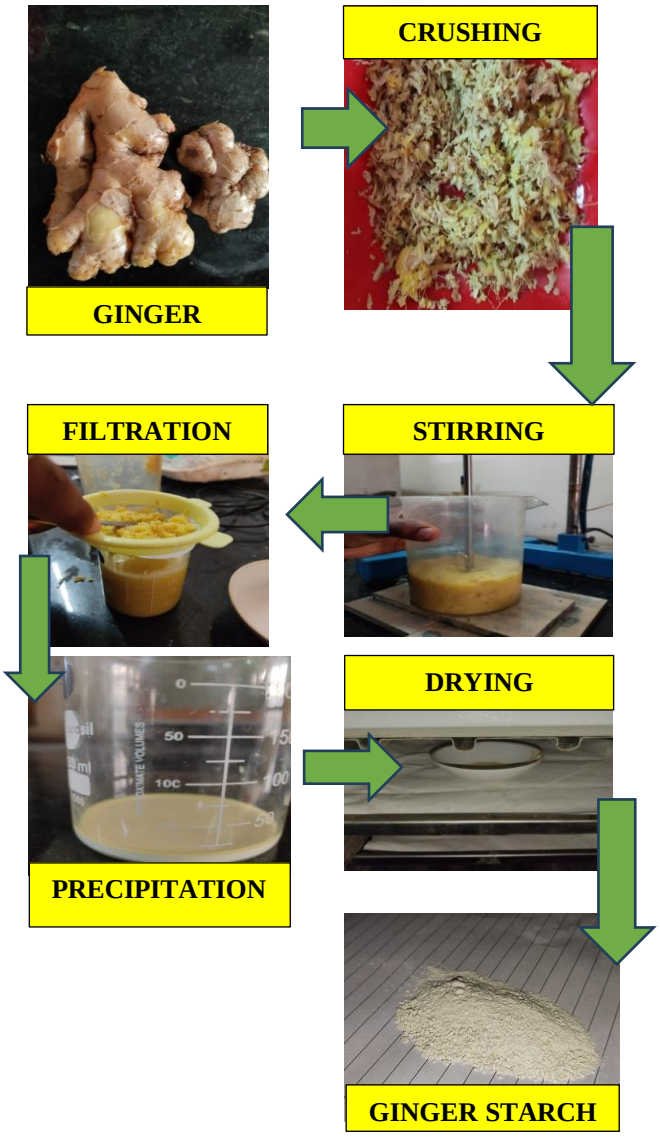

Figure1: Extraction process of ginger Starch

IV. RESULTS AND DISCUSSION

A. Yield calculation

Starch is extracted with 13% yield from ginger [8].

B. FTIR analysis

The extracted starch from ginger was characterized by using FTIR shown in the Figure 2 was done in the range of 4000 cm^{-1} to 450 cm^{-1}. According to the result, a sharp and strong absorption band with transmittance 3401.8 that represent existence of OH groups. Peak 2931.0 cm^{-1} is corresponding to the existence vibration of C-H stretching and 1651.0 cm^{-1} peak show C=O stretch. There is a band of C=C stretch at 1420.2. At 1350.4 cm^{-1} it indicates CH asymmetric band and 1083.9 cm^{-1} peak represents C-O bond stretch of polysaccharide. The characterization of extracted starch from ginger by FTIR analysis gave relevant peaks that confirming the quality of starch [9].

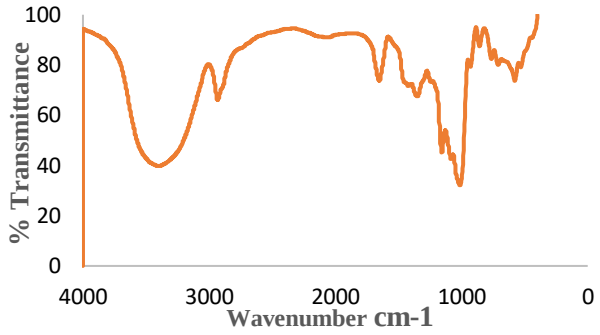

Figure 2: FTIR Spectra of Starch

C. TGA ANALYSIS

The thermogravimetric analysis was done under nitrogen atmosphere at temperature of 10°C to 600°C. The test was performed at a heating rate of 10°C/min. The thermal degradation of extracted starch shown in Figure 3, the obtained result shows that extracted starch in three stages. The thermal degradation of first weight loss at temperature range 50-100°Cand loss of 10% due to evaporation of volatile substances. Primarily water the second weight loss between 250-350°C with mass of 81% caused by decomposition of organic matter and the third weight loss at 550°C at which starch is completely degraded [10].

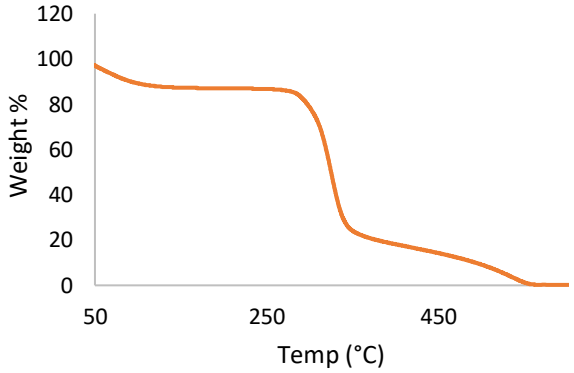

Figure 3: TGA Analysis of Starch

V. CONCLUSION

From the findings a different source of starch. It can be concluded that the extracted starch from ginger. Starch obtained from ginger had a yield of 13%. The resultant product is characterized by using FTIR techniques which displays the relevant peaks that confirms the product quality. The TGA curves for extracted starch shows its onset degradation temperature at 260°C. The study reveals that resulting starch have a good biomaterial and have potential to be employed for a variety of industrial applications.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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