IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, December 2024

A Review on Extraction of Phytochemicals from Potato Tubers

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Abstract: *Potatoes are among the leading staple crops due to nutritional value and high demand. The undersized and damaged potatoes are considered low grade and mainly dumped as a waste or used in animal feed. The study aimed to extract starch from low grade potatoes, its modification to improve the starch properties and formulation of gluten free cookies using modified starch (MS). The starch was extracted from low-grade potatoes of three varieties known as Asterix, Kruda and Mosaic, using the water steeping method. The native starch (NS) was modified using lintnerization and repetitive autoclaving. MS contains high amylose content which is associated with health benefits.*

Keywords: Potato starch, Modified starch, Water steeping, Gluten-free cookies

I. INTRODUCTION

The world's most grown staple crops encompass the potato (*Solanum tuberosum*), which belongs to the Solanaceae family. In terms of global production, the potato crop ranked third after wheat and rice. Food and Agriculture Organization (FAO) of the United Nation reported global production of potatoes over 370 million metric tons [1]. Potato achieves this major position among staple crops because of its highly nutritious properties, potential industrial and domestic usage both in processed and non-processed forms, and easy accessibility to consumers from low-income backgrounds [2]. The nutritional benefits of potatoes impart a vital role in fulfilling energy requirements at low cost in under-developed countries [3]. The potato tuber comprises of several essential amino acids, most importantly lysine, high dietary fiber and starch content, and low-fat content [4]. The high starch content makes potatoes a basic raw material for several food industries to make value-added products like chips, fries, flakes and pre-peeled potatoes [5].

Phytochemicals in Potato Tubers -

This section provides an overview of the key phytochemicals identified in the Tuber of potato

1. **Flavonoids**: These compounds are known for their antioxidant, anti-inflammatory, and anticancer properties.
2. **Tannins:** Tannins possess antimicrobial, anti-inflammatory, and wound-healing effects.
3. **Alkaloids:** Alkaloids in potato tuber are often associated with analgesic and anti-inflammatory effects.
4. **Phenolic Compounds:** Phenolic acids, such as caffeic acid, provide antioxidant activity, which is crucial for combating oxidative stress-related diseases.
5. **Saponins:** Saponins are known for their antifungal and antidiabetic properties.
6. **Terpenoids:** These compounds exhibit various biological activities, including antimicrobial and anti-inflammatory effects.

Extraction Methods of Phytochemicals-

Extraction is a critical initial step in isolating bioactive compounds from Moringa oleifera. Several techniques have been utilized, each with its advantages and limitations, depending on the target compounds and the desired yield. This various methods of extracting bioactive compounds from Ficus racemosa leaves, comparing traditional and modern techniques are as follows:

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1) **Solvent Extraction-**
   - The most common method, which involves using solvents like ethanol, methanol, hexane, and chloroform to dissolve phytochemicals.
   - Advantages: High yield of extracts, simple and inexpensive.
   - Disadvantages: Solvent residues can be toxic if not properly removed, and some phytochemicals may be lost due to degradation.
2) **Cold Extraction**
   -The different plants parts dried in an artificial environment at low temperature (50-60 °C) and dried powder then further used for extraction purpose using various solvents.
3) **Ultrasonic-Assisted Extraction (UAE)-**
   - Utilizes high-frequency sound waves to enhance solvent penetration and the release of phytochemicals from plant tissues.
   - Advantages: Faster extraction with higher yields and reduced solvent use.
   - Disadvantages: Requires ultrasonic equipment, which can be costly.
4) **Microwave-Assisted Extraction (MAE)-**
   - Uses microwave radiation to heat the solvent and plant material, enhancing extraction efficiency.
   - Advantages: Faster extraction, improved yield, and lower solvent consumption.
   - Disadvantages: Requires specialized equipment, and some phytochemicals may degrade under intense heat.
5) **Supercritical Fluid Extraction (SFE)-**
   - Employs supercritical carbon dioxide (CO□) to extract phytochemicals.
   - Advantages: High selectivity for specific compounds, no solvent residues.
   - Disadvantages: Expensive and requires high pressure and temperature conditions.
   - Disadvantages: Low extraction efficiency compared to solvent-based methods.

Biological Activities of Phytochemicals in tubers of Potato-

Thisare the pharmacological activities of the bioactive compounds extracted from Tubers of potato:

1. **Antioxidant Activity;** Antioxidant activity is widely known to scavenge free radicals, maintain redox balance and metal chelating activity, inhibit enzymatic and non-enzymatic activities, and then regulate oxidant stress.
2. **Antimicrobial Activity:** Phytochemicals in the leaves show antibacterial, antifungal, and antiviral properties, making them potential candidates for the development of natural antimicrobial agents.
3. **Anti-inflammatory and Analgesic Effects:** The anti-inflammatory property of rambutan peel extract was tested in an LPS-induced RAW 264.7 cell model. In this model, NO was overproduced and the iNOS level increased obviously.
4. **Antidiabetic Properties:** Diabetes mellitus is a global problem that has a major effect on health, the quality of life, life expectancy, and the healthcare system. One current method to treat diabetes is to inhibit carbohydrate hydrolyzing enzymes, such as α-glucosidase and α-amylase, in the digestive tract to decrease postprandial hyperglycemia by retarding the absorption of glucose.
5. **Anticancer Activity:** Certain phytochemicals, particularly flavonoids and terpenoides, have demonstrated anticancer properties in vitro and in vivo, suggesting their role in cancer prevention and therapy.

Applications of Phytochemicals from Potato tubers

The bioactive compounds derived from Tuber of potato offer immense potential in various industries, such as pharmaceuticals, neutraceuticals, and cosmetics companies.

1. **Pharmaceuticals**-The diverse medicinal properties of Potato Tuber make them suitable for the development of pharmaceutical formulations. Leaf extracts can be used in the formulation of anti-inflammatory, analgesic, and antimicrobial drugs. Furthermore, their anticancer and antidiabetic potential can be harnessed to create novel therapeutic agents.

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2. **Neutraceuticals**-Due to the high antioxidant content and therapeutic properties, Cluster Fig leaf extracts can be incorporated into dietary supplements aimed at improving overall health, enhancing immunity, and preventing chronic diseases.
3. **Cosmetics**-The antioxidant and anti-inflammatory properties of Potato Tuber extracts make them ideal for inclusion in skin care products. They can be used to develop creams, lotions, and serums that protect against skin aging, inflammation, and oxidative damage.

II. CONCLUSION

Rambutan fruit is widely accepted all over the world, and it is gradually industrialized. The intervention of multi-disciplinary research has promoted the conversion of rambutan peel waste to a healthful ingredient for industries. Rambutan peel has obviously become a good source of food functional components because of its phenolics and bioactivities. However, some challenges in the production and application of phenolics still exist, thereby limiting the rapid expansion of rambutan peel market.

III. ACKNOWLEDGEMENTS

We would like to express our social thanks to our teachers as well as our principal who gave us this opportunity to do this wonderful project also helped us in research. Guided by - Ms. PrachiN.Padwal.

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