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In order obtain a diploma of an Academic Master In biological sciences

Specialty: Applied Biochemistry

THEME

STUDY OF THE EFFECTIVENESS OF POTATO STARCH AS AN ALTERNATIVE MATERIAL IN THE PREPARATION OF COSMETICS

Presented by
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إلي أختي العزيزة و روح نبضي إلي توأم حياتي إلى التي كانت قوتي حين ضعفي و أنسي حين وحشتي

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ل "محبوب نسمة"و "شرفي ايناس "شكرا على كل دقيقة من وقتكما لي رغم

من تعدد مسؤولياتكماأستاذتنا الفضليات

أتمنى لكما حياة عملية ناجحة ووفقكم الله

سارة

الى زوجي الغالي ....

خلود

Abstract……………………………………………………………………………………

This study investigates the effectiveness of potato starchfrom the *Solanum tuberosum* Lfrom class**Bartina** . plant collected from Oued Souf region as an alternative material in the preparation of cosmetics.we studied through In Vivo tests that include one main test.Which is represented by making a special cream to lighten the face, consisting of 10 grams of dry potato starch and about 5 ml of pure water, and applying it to the face for 20 minutes .The results of this test were not generally satisfactory due to people's lack of adherence to the method of using the cream and the short time required for this study.the physical-chemicalproperties the extract showed a significant percentage of its components such as in carbohydrates 85% andconductivity 1087 uS/cm. In antibacterial tests, we studied through In vitro tests that include four types of bacteria. The potato starch extracts showed a negative results,The Antioxidant activity, potato starch extractshowed significant antioxidant activity in the DPPH tests, where the results were very weak antioxidant activity compared to Vitamin C, with an 85% in VitCand an (less than 20% in the extract. In the anti-hemolysis test, showed minimal inhibition even at high concentrations (maximum 0.65% at 40 mg/mL). Tocopherols, in contrast, showed strong inhibition (up to 57.21% at 21 mg/mL.). In addition, the anti-inflammatory activity through egg albumen denaturation test, the extract it showed an effectiveness estimate of 10%.

Key Words..

potato starch, antibacterial activity , Antioxidant activity , Anti-inflammatory activity, anti-hemolysis test.

الملخص……………………………………………………………………………………

تتناول هذه الدراسة فعالية نشاء البطاطا المستخرج من نبات **Solanum tuberosum L.** من صنف **Bartina** و الذي جُمع من منطقة واد سوف كبديل في تحضير مستحضرات التجميل.لقد درسنا من خلال الاختبارات الحيوية التي تتضمن اختبارًا رئيسيًا واحدًا .والذي يتمثل في صنع كريم خاص بتفتيح الوجه متكون من 10 غ من نشاء البطاطا الجاف و ماء نقي حوالي 5 مل و تطبيقها على الوجه لمدة 20د .نتائج هذه التجربة لم تكن مرضية على العموم نظرا لعدم إلتزام الأشخاص بطريقة استعمال الكريم وكذلك لضيق الوقت اللازم لهذه الدراسة . الخصائص الفيزيائية-الكيميائية، أظهر المستخلص نسبة كبيرة من مكوناته مثل الكربوهيدرات بنسبة 85% والتوصيلية 1087 **µS/cm.**في اختبارات مضادة للبكتيريا، قمنا بدراسة الاختبارات في المختبر التي شملت أربعة أنواع من البكتيريا. وقد أظهرت مستخلصات نشا البطاطا نتائج سلبية **.**أظهر مستخلص نشا البطاطا نشاطاً مضاداً للأكسدة بشكل ملحوظ في اختبارات**DPPH**، حيث كانت النتائج ضعيفة جداً مقارنة بفيتامين**C** ، مع وجود 85% من فيتامين **C** وأقل من 20% في المستخلص **.**في اختبار مضاد انحلال الدم، أظهرت تثبيطًا ضئيلًا حتى عند التركيزات العالية (بحد أقصى 0.65% عند 40 ملغ/مل). في المقابل، أظهرت مركبات التوكوفيرول تثبيطًا قويًا (حتى 57.21%). بالإضافة إلى ذلك، وفي نشاطه المضاد للالتهابات من خلال اختبار تجلط بياض البيض، أظهر المستخلص فعالية تقدر بـ 10**. %**

الكلمات المفتاحية...

نشا البطاطا، نشاط مضاد للبكتيريا، نشاط مضاد أكسدة، نشاط مضاد التهاب، اختبار مضاد لانحلال الدم.

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Abbreviation list

DPPH	2,2-Diphenyl-1-Picrylhydrazyl
PH	Potential of hydrogen
RBCs	Red Blood Cells
UV-visible	Ultra Violet visible
Vit C	Vitamin C

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Introduction

INTRODUCTION

The concept of cosmetics and personal care predates ancient civilizations. Specifically, the use oftraditional herbs and scented extracts for special occasions has been a common practicesince theera of antiquity. The global cosmetics market by region tends to increase from 2022 until 2029 to account for USD 377,243.22 million by 2029 (Data bridge market research market analysis study 2022). It is indicated that there is a big revenue in this sector in which the new products continuously developed and hit the market. Therefore, the development and innovation in this area grow high. Up to now, industrial cosmetic products in the market are predominantly from chemical-based sources, i.e., nonrenewable fossil sources. Biobased cosmetics ingredients are beginning to be recognized as a feasible solution to address these challenges, **(Arung, E et al., 2024)**.

Vegetables and potatoes are important staple foods consumed daily worldwide. Vegetables are considered as an essential component of a healthy diet, so nutrition experts recommend eating at least a few servings of them every day. Potatoes are characterised by a large scale of production, consumption, affordability with easy availability in the open market and therefore are a vital food-security crop. On the other hand, the literature describes many factors that determine the level and structure of the consumption of vegetables, potatoes, and their products. The nutritional value of vegetables and potatoes differs considerably and should therefore be considered separately **(Górska-Warsewicz, H et al., 2021)**.

Starch, a polysaccharide composed of numerous glucose units joined by glycosidic linkages, has a rich historical significance. Most green plants produce it for energy storage. The most economically essential crops that contain starch are cereal, legumes, tubers, and roots shows common crops along with their starch content. Microscopically, starch granules appear as particles with concentric layers and are made up of two glucose polymers: amylose (20-25%), which is linear and helical, and amylopectin (75-80%), which is branched. The historical roots of starch production extend back 100,000 years

Leeuwenhoek's microscopic observations of starch granules in 1716 and Kirchhoff's discovery of sugar production from potato starch through acid hydrolysis further advanced the understanding of starch.**(Salman, A et al., 2024)**.

For this reason, we are chosen this study, for reducing the use of chemicals in cosmetics and mitigating the risks resulting from them. Expanding the use of natural materials (herbs, vegetables, fruits) in cosmetics. By estimate antioxidant and anti-inflammatory activities. This study diviseded in two parts:

· The first bibliographic section: provides an overview of cosmetics and the specific plant under study.

· The second part: It is divided into two parts: it presents the materials and methods used, highlights the in vivo and in vitro results that we obtained and discussed, and finally we concluded our work with a conclusion appended with recommendations.

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Generality about cosmetics
&
potato

1.Generality about cosmetics

1.1. Definition of cosmetics products

Cosmetics are used in everyone's day-to-day life, as "a cosmetic product is any substance or mixture intended to be placed in contact with the external parts of the human body (epidermis, hair and hair systems, nails, lips and external genital organs) or with the teeth and oral mucous membranes, with a view, exclusively or mainly, to cleaning them, perfuming them, modifying their appearance, protecting them, keeping them in good condition or correcting body odours".In other words, a cosmetic product ranges from a simple toothpaste to a particular anti-wrinkle cream. Cosmetic products are, therefore, used on a massive scale every day, involving a high level of use of animal and plant resources and the development of many synthetic components. Considering growing environmental concerns, the biocosmetics market has been increasing. However, consumers sometimes need help understanding exactly what they are and what distinguishes them from other products (e.g. green cosmetics). The truth is that, in general, consumers want fewer chemicals and more respect for nature. They are more environmentally concerned. In this research, we study the motivation behind the choice of these products **(Arung, E et al., 2024)**.

1.2. Forms of cosmetics

Cosmetic products exist in different forms: some are in liquid form, semiliquid, solid, granular and volatile form; examples include skincare creams, hair creams, toothpaste, soaps, perfumes, lipsticks, fingernail and the toe polish, eye and facial makeup, towelettes, permanent waves, hair colors, hair sprays and gels, deodorants, hand sanitizer, etc**(Ogenyi, F., 2023)**.

1.3. Dangers of chemical cosmetics

Certain chemicals that are part of cosmetic formulations have been found to be harmful, and the usage of cosmetic products containing such chemicals portends danger for human health. Sadly, in spite of the regulations put in place to prevent or minimize the presence of such ingredients in cosmetic brands, heavy metals, organic and inorganic chemical substances are still very much in them. A reason given for this is that such substances may be a major component of the raw materials used in cosmetic manufacture or are deliberately included in cosmetics **(Ogenyi, F., 2023)**.

Some cosmetic products contain chemicals known or suspected to cause cancer, birth defects, or other developmental or reproductive harm. 4 Those who work with cosmetics, e.g., barbers, hair stylists, and skin

Care, body care and nail salon workers, may be more vulnerable to the adverse health effects posed by these products because they handle greater quantities of cosmetics with greater frequency. Pregnant women, fetuses, and children are more vulnerable to developmental toxicants than the general population **(Johnson, P et al., 2016)**.

1.4. Benefits of using bio-cosmetics

Biomass has emerged as a promising renewable resource for biobased cosmetics because it exists in abundance, has great availability, diversity of plant sources, and low cost. Additionally, the creation of biobased cosmetics does not contribute to carbon emissions, can minimize environmental issues throughout the product's life cycle, and is biodegradable in aquatic environments. For example, substances taken from plants and other types of biomasses can be used to extend shelf life and provide UV protection. Additionally, many organic compounds have beneficial bioactive properties like emollient, healing, anti-inflammatory, anti-aging, antioxidant, antimicrobial, relaxing, and healing actions **(Arung, E et al., 2024)**.

2.Generality about potato

2.1.Definitionofpotato

China was the main producer of potato with annual production of 78.2 million tons among the 159 countries that hold records for potato cultivation **(Tong, C et al., 2023)**. Potato *(Solanum tuberosum* L.) **(Tang, D et al., 2022)**. is the third world's most important non-cereal food crop (in terms of food supply) for human consumption, after wheat and rice Botanically, they are classified as perennials in the Solanaceae family, grown for their starch-rich tubers that form at the ends of underground shoots.

2.2. Composition of potato

Carbohydrates are the dominant nutrient of potatoes. They constitute about 75% of the total dry weight of the tuber, mainly in the form of starch, the amount of which varies depending on the variety. The late-maturing cultivars tend to produce much greater starch yield compared to the early-maturing cultivars. A slight proportion of starch is resistant to enzymatic degradation in the stomach and small intestine, and therefore has similar physiological effects and health benefits for the microbiota as dietary fibre. Potatoes contain a small amount of protein, but its biological value is high due to the presence of essential amino acids such as lysine and metabolites that can increase its utilization. Potatoes contribute considerable amounts of vitamins C and B6, and trace amounts (thiamin, riboflavin, folate, and niacin). Dietary fiber is found in potatoes in an amount of 0.5 to 2%, half of which is found in the flesh. Potatoes are a staple food for many populations, including Poland, which is why they are listed among the food groups that are the main sources of dietary fibre. They are also a good source of minerals, including potassium, magnesium, phosphorus, and iron

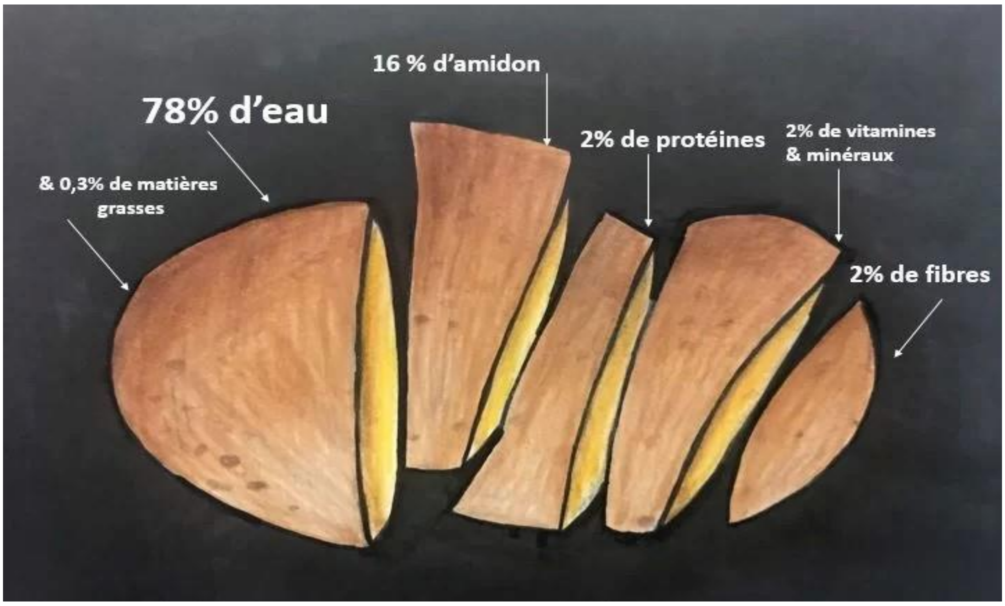

Fig1:Composition of potato**(Frik , S. Azouz , S.,2020)**.

2.3. Types of potatoes in Algeria

Potato varieties are extremely diverse, and each variety has an official description based on numerous physiological characteristics that ensure it is always identifiable and visually distinguishable from other varieties. There are 120 varieties listed in the Algerian Catalogue of Cultivated Species and Varieties. This registration is mandatory for their marketing. It is preceded by a two-year evaluation of their usability, yield, and pest behavior by the Seed and Plant Control and Certification Service (CNCC). Table 1 shows the main potato varieties grown in Algeria**(Frik , S. Azouz , S.,2020)**. .

Table 1:Types of potatoes in Algeria (Frik , S. Azouz , S.,2020).

White-skinned varieties	**Red-skinned varieties**
Safran	Bartina
Spunta	Amorosa
Diamant	Cardinal
Sahel	Condor
Lola	Désirée
Appolo	Cléopatra
Ajax	Resolie
Yesmina	Thalassa

2.4. Geographical location

El Oued Province is located in the northeast of the Algerian Sahara, 630 km from the country's capital. It is bordered to the east by the Republic of Tunisia, to the west by the provinces of El Meghair and Touggourt, to the north by the provinces of Tebessa, Khenchela and Biskra, and to the south by the province of Ouargla**(dtp-eloued 2020).**

Fig 02: Geographical location of El Oued (dtp-eloued 2020).

2.5. Information about the studied variety (Bartina)

Bartina is a Dutch potato variety with medium to late maturity. It is known for its large, uniform tubers with red skin and light yellow flesh. Bartina offers high cooking quality, especially for salads and table use, due to its firm texture after boiling. It has a high yield potential and stores well, though it is sensitive to cyst nematodes and moderately resistant to common scab. This variety is widely cultivated in Europe and North Africa, particularly in Algeria and Morocco **(Q-Potato. (n.d.) 2025)** .

2.4. Potato starch extraction

Potato starch typically contains fewer impurities than other starches like corn or product. Steeping softens hard plant materials, especially grains, and facilitates wet grinding. Steeping is preferred for hard starch sources, and softer plant sources, like potatoes, don't require any treatment before extraction. It is essential to know that the dry milling hard plant materials grains (i.e., barley, oat, rice, corn, legumes) can result in substantial starch granule damage. A high percentage of damaged starch granules may alter the physicochemical properties of starch. Steeping or dry grinding are unnecessary steps in potato starch isolation. Thus, it can be Peeled, sliced into small pieces, and directly slurried in water.

Autumn is typically the peak season for potato starch yield. By this time, the potatoes are fully mature, having had the entire growing season to develop. Cooler temperatures in autumn also help preserve the starch Potato starch extraction doesn't need mechanical blenders. This simplifies the equipment requirements for the extraction process, making it more accessible and cost-effective. For grain flours (e.g., oat, barley, corn), water slurrying can be done in a beaker using an overhead stirrer at high speed. Controlling the temperature during blending is essential, as heat can damage starch granules. The blending process generates heat, so care must be taken (Crushed ice can be added to the slurry) to avoid heat-induced damage to starch granules.

This method of starch extraction was developed by Watson et al., 1995

Step – 01: Raw Material Selection and Preparation: The selection and preparation of raw materials are critical steps in extracting potato starch. These steps should be considered, as they ensure that the starting material is of high quality, directly impacting the extraction process's efficiency and the quality of the final starch product. Proper handling at this stage also helps to minimize waste and optimize the overall yield of the starch extraction process.

Step – 02: Separation of Starch: The slices are crushed and ground with water using a mortar and pestle, creating a slurry. The grinding breaks open the potato cells, releasing the starch granules into the water, resulting in a mixture containing water, starch, fibers, and other potato components. Water is essential in forming slurry for starch isolation from plant materials because starch granules are insoluble and dense. The process typically involves using excess water to slurry or wash the starch or to separate it from other components. The plant material and water are blended until a smooth slurry forms, typically within 5 to 10 minutes. Sliced potatoes into mortar and pestle, add 5 ml of water and crush with pestle to form slurry, add 100 ml distilled water and filter. To prevent microbial growth and amylose enzyme (A commonly occurring plant enzyme that hydrolyzes starch) activity that can degrade starch. The slurry from the potato starch extraction process is treated to separate the starch granules by sedimentation.

Step – 03: Purification (Sedimentation, decantation): To purify potato starch, the slurry undergoes multiple washing stages with fresh water to remove fine fibers and other insoluble impurities. After washing, the slurry is allowed to settle, and the supernatant liquid containing impurities is decanted.

Step – 04: Drying of Potato Starch: Various drying methods convert purified wet starch into a dry form suitable for handling and storage to reduce its moisture content. According to European Pharmacopoeia "The moisture content of extracted starch should not exceed 20% to ensure quality and usability". Exceeding this limit can cause spoilage, reduced shelf life, and altered properties, compromising its effectiveness in food and industrial applications. Maintaining this moisture level ensures the starch remains stable, safe, and functional. The drying methods include air drying, which is slower and energy-efficient; oven drying at temperatures between 30° and 40 °C; drum drying, where the starch is spread onto a heated drum and then scraped off as it dries; and spray drying, which is commonly used for high-quality starch production in food and pharmaceutical applications. Spray drying involves sprayingthe starch slurry into a chamber with hot air, quickly evaporating the water and leaving fine starch particles. Care is taken to avoid high temperatures during drying to prevent altering the starch's properties.

Step – 05: Observation: Calculating the percentage yield of dried starch from potatoes begins by recording the weight of the potatoes (A) as 100 g. Measure the weight of an empty china dish (B), then weigh the dish with the dried starch (C). The weight of the dried starch is determined by subtracting the weight of the empty dish

(B) From the combined weight (C). Finally, the percentage yield is calculated using the formula: (C−B)/A×100 **(Salman, Aet al., 2024)**.

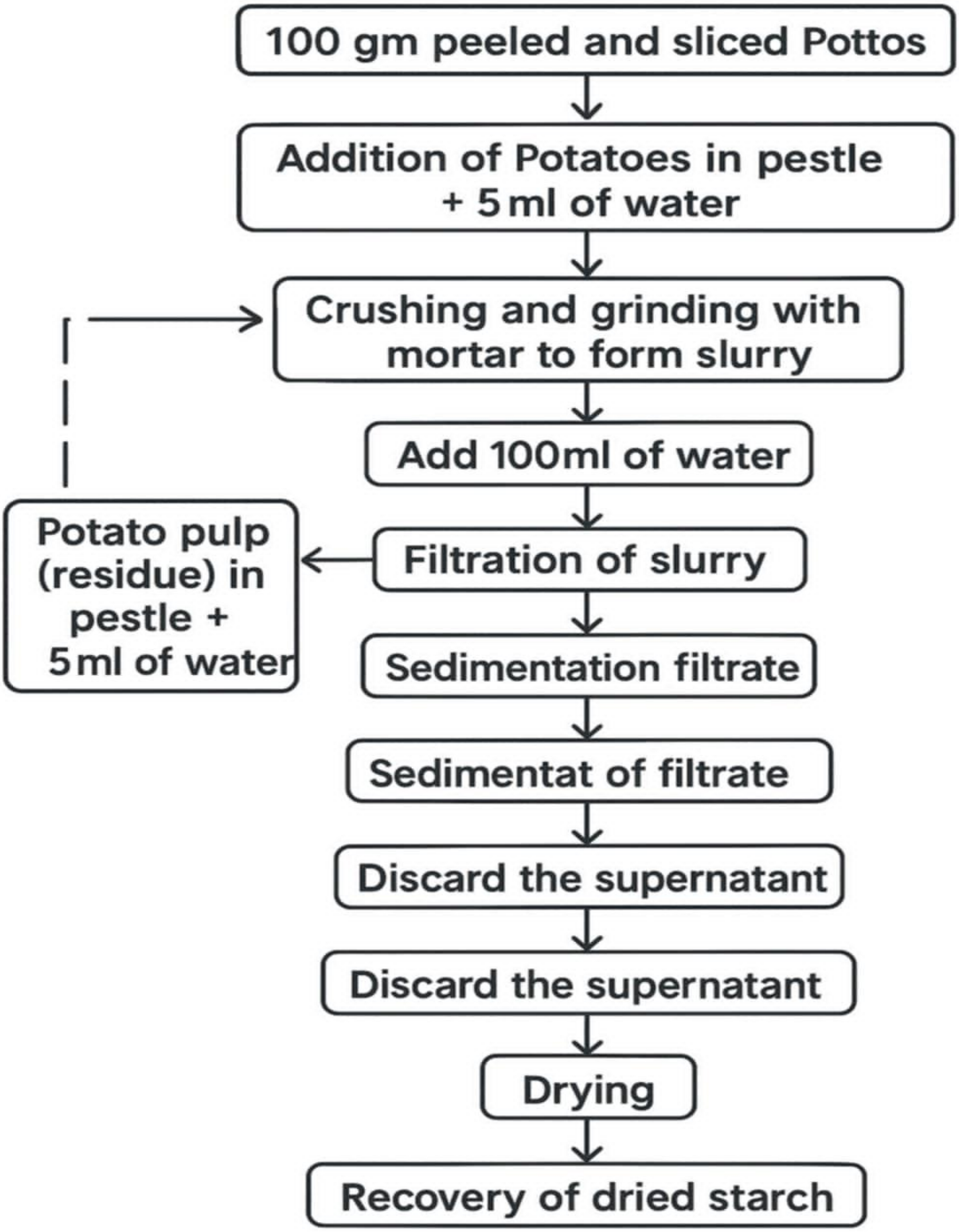

Fig 3: Compression or Wet grinding method for potato starch extraction**(Salman, A et al., 2024)**

Materials
&
Methods

INTRODUCTION

Potato starch is increasingly used in many industrial, food and cosmetic applications. It is characterized by its white color and high softness. It is mainly composed of amylose and amylopectin molecules, which give it the tremendous ability to absorb water and form a gel, in addition to its ability to be chemically or physically modified to improve its performance in various industrial and cosmetic fields. Potato starch is receiving increasing attention as a natural and safe alternative for cosmetics and industry.

So we did some pilot tests as follows:

- Applying potato starch cream to human skin.
- Properties physico-chimical (pH / conductivity / humidity / mineral salts / carbohydrates / proteins / fat).
- Antibacterial activity starch.
- Anti oxidant activity (DPPH Assay -96well).
- Anti hemolytic in vitro.
- Anti-inflammatory in vitro.

All experiments were conducted at the El-Medjed Medical Analysis Laboratory in the province of El Oued, theFatilablaboratory and central laboratory of the Ben Omar Al-Djilani Hospital in the province of El Oued.

1. Materials

Biological Materials

1.1. Applying potato starch cream to human skin

20g Dry potato starch -

Water5ml purified**-**

1.2.Propertiesphysico-chimical

1.2.1. pH Measurement

Method Reference: NA 751

- **Materials**

-Calibrated pH meter

-Standard buffer solutions (pH 4.0, 7.0, and 10.0)

-Beakers

-Distilled water

-Potato starch sample dissolved in distilled water

1.2.2.Electrical Conductivity Measurement

Method Reference: NA 749

- **Materials**

Calibrated conductivity meter

Standard KCl solution for calibration

Beakers

Distilled water

Dissolved potato starch sample

1.2.3. Humidity

Method Reference: JOA N°08/2013

- **Materials**

Analytical balance

Moisture oven (set to 105°C)

Desiccator

Aluminum or porcelain crucibles

Ground starch sample

1.2.4.Mineral salts

Method Reference: JOA N°35/2013

- **Materials**

Muffle furnace (set to 550°C)

Crucibles

Analytical balance

Desiccator

Ground starch sample

1.2.5. Carbohydrate Content

Method Reference: Dubois

- **Method Materials**

Phenol solution (5%)

Sulfuric acid (H_2SO_4) concentrated

Spectrophotometer (set at 490 nm)

Standard glucose solution

Test tubes and pipettes

Potato starch solution

1.2. 6 .Protein Content

Method Reference: ISO 5983-2 (Kjeldahl Method)

- **Materials**

Kjeldahl digestion

System Sulfuric acid

Catalyst tablets (usually $K_2SO_4 + CuSO_4$)

Sodium hydroxide (NaOH)

Boric acid solution

Titration setup (acid/base)

Starch sample

1.2.7.Fat Content

Method Reference: ISO 6492 (Soxhlet Extraction)

- **Materials**

Soxhlet extractor

Petroleum ether or hexane

Extraction thimbles

Analytical balance

Heating mantle

Ground starch sample.

1.3.Bacterial Strains

The bacterial strains used in this study were provided by the El-Medjed Medical Analysis Laboratory in the province of El Oued. The strains were inoculated onto nutrient agar and stored at 4°C in a refrigerator for subsequent testing. The following table presents the Gram stain results and the pathogenicity of these microorganisms.

Table 2: Pathogenicity and classification of the strains tested (Sahoo, et al, 2024) .

Strain	Gram	Pathogenic power	Family	Genus	Species	ATCC
Escherichia coli	Gram -	- Urinary tract infections -Nosocomial infections - diarrhea, cholecystitis	Enterobacteriaceae	*Escherichia*	*Escherichia coli*	25922
Staphylococcus aureus	Gram +	-Skin infections - ENT infections - Wound infections. - Urinary tract infections	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas aeruginosa*	25923
Pseudomonas aeruginosa	Gram -	-Nosocomial infection -Infections inimmunocompromised individual	Staphylococcaceae	*Staphylococcus*	*staphylococcus aureus*	27853
Klebsiella pneumoniae	Gram -	- Intestinal and urinary tract infections - Respiratory infections – Nosocomial - infections	Enterobacteriaceae	*Klebsiella*	*Klebsiella pneumoniae*	700603

1.4. Antioxidant activity

The antioxidant activity of dry potato starch extract was evaluated using the DPPH (2, 2-diphenyl-1-picrylhydrazyl) assay, with ascorbic acid (Vitamin C) serving as a reference standard. A 0.1 mM DPPH solution was prepared by dissolving the appropriate amount of DPPH (0.91 mg in 23 mL of ethanol) to ensure solubility and stability.

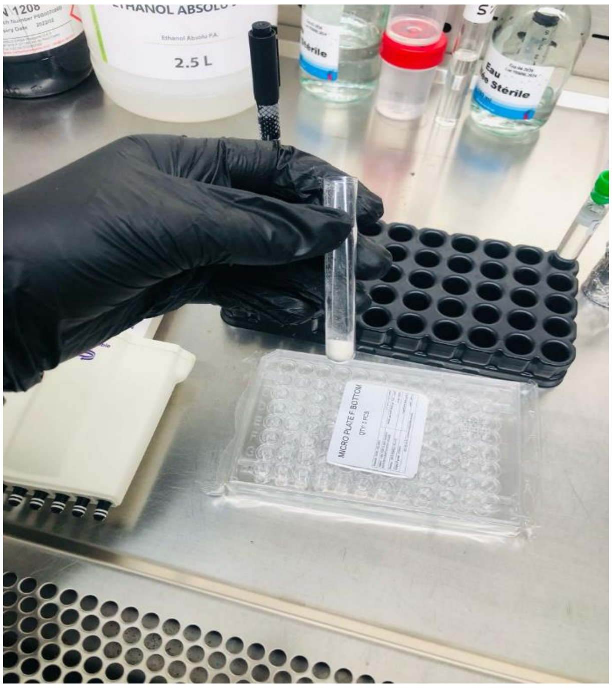

Fig 4: **DPPH Assay protocol for antioxidant activity**

1.5. Anti-Hemolytic Activity

- **Biological Material**

  Blood Samples: Collected from volunteers into EDTA tubes to prevent coagulation. Phosphate-Buffered Saline **(PBS):** Used to resuspend erythrocytes after centrifugation.

  Dry Potato Starch Extract: Prepared at various concentrations (1.25, 2.5, 5, 10, 20, and 40 mg/mL). **Tocopherols:** Used as a reference antioxidant due to their membrane-stabilizing properties. Hydrogen Peroxide **(H_2O_2):** Used to induce oxidative hemolytic stress.

  20% Sucrose Solution: Added to stabilize the reaction after incubation.

96-Well Microplate: Used for sample loading and absorbance measurements.

Microplate Reader: Used to measure absorbance at a wavelength of 540 nm.

PBS and H_2O_2 Solutions: Prepared fresh for the experimental procedures

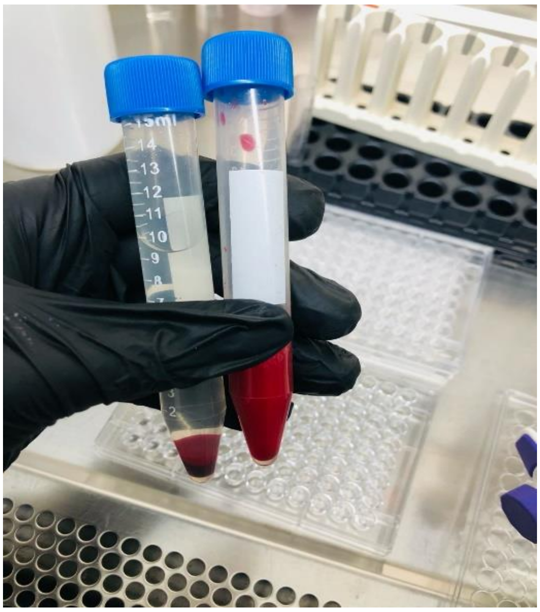

Fig 5: Anti-Hemolytic Activity of plant extract

1.6.Anti-inflammatory Activity

- **Biological Material** **Egg white**: Fresh chicken eggs were used. Egg white was diluted with distilled water to prepare a 10% protein solution.

  Dry potato starch extract: Used at different concentrations (1.25mg/mL, 2.5 mg/mL, 5 mg/mL, 10 mg/mL, 20 mg/mL, and 40 mg/mL).

  Aspirin: Served as the standard reference for comparison.

  Equipment: UV-Visible spectrophotometer (set to 280 nm).

  96-well microplate and micropipettes.

  Incubator or water bath capable of maintaining 70–80°C

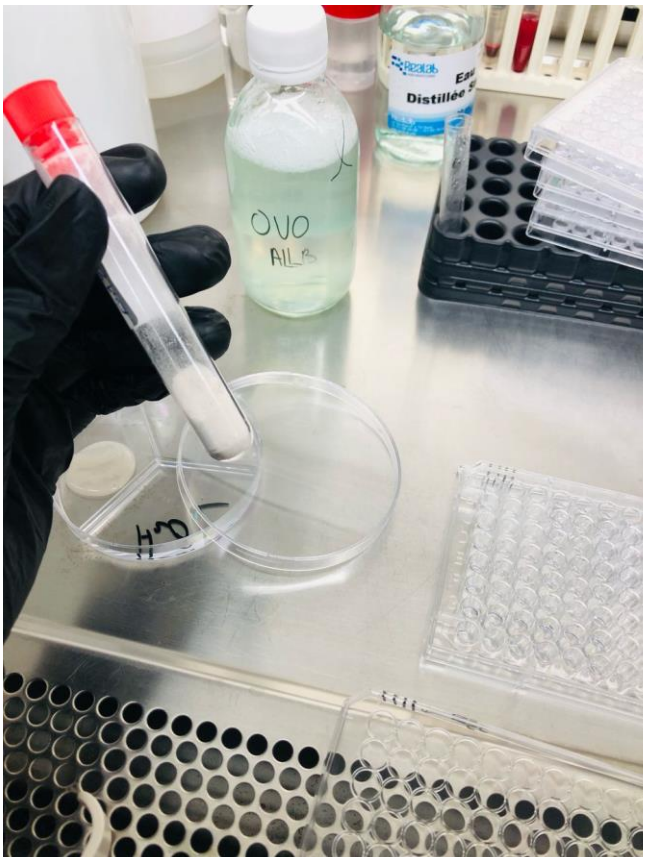

Fig 6:Anti-inflammatory Activity in vitro

2.Methods

2.1.Starch extraction method

The slices are crushed and ground with water using a mortar and pestle. 100 ml of distilled water is added, producing a mixture containing water, starch, fiber, and other potato components. It is filtered to separate the starch granules by sedimentation. Various drying methods convert pure wet starch into a dry form suitable for handling and storage to reduce its moisture content. Drying methods include air drying, oven drying, drum drying, and spray drying.

2.2.Applying potato starch cream to human skin

A simple mixture was prepared to study the effectiveness of potato starch in skin lightening, without adding any additional ingredients that might affect the results (such as rose water), to ensure a neutral experiment.

20grams of dry potato starch was weighed and then 5 ml of purified water was added.

The mixture was hand-mixed until a homogeneous creamy consistency was achieved, then applied directly to the entire face.

The mask was left on for 20 minutes until completely dry, then the face was washed with lukewarm water.

The process was repeated daily, and visual changes in the skin were monitored

50 people .

2.3.Properties physico-chimical

2.3.1.Principle

Physicochemical analysis involves a set of laboratory techniques used to determine the basic composition and quality of a substance. For potato starch, this includes measurements of pH, electrical conductivity, moisture content, carbohydrate level, ash (mineral) content, fat, and protein. Each parameter is assessed using specific instruments and standardized methods, such as a pH meter for acidity and an oven-drying method for moisture. These measurements help characterize the starch in terms of purity, stability, and suitability for biological or pharmaceutical applications.

2.3.2. pH Measurement

1. A known amount of potato starch is dissolved in a specific volume of distilled water.
2. The pH meter is calibrated using standard buffer solutions.
3. The electrode is rinsed with distilled water between measurements.
4. The electrode is immersed in the starch solution and the reading is allowed to stabilize.
5. The pH value is recorded directly from the meter (InstitutAlgérien de Normalisation. 2005).

2.3.3.Electrical Conductivity Measurement

1. A measured quantity of the starch sample is dissolved in a fixed volume of distilled water.

2. The conductivity meter is calibrated using a standard potassium chloride (KCl) solution.

3. The conductivity probe is rinsed thoroughly with distilled water.

4. The probe is inserted into the starch solution, and the reading is allowed to stabilize.

5. The conductivity value is recorded in µS/cm (InstitutAlgérien de Normalisation. 2005).

2.3.4. Humidity Content

1. Weigh approximately 2–5 grams of starch into a clean, dry crucible.

2. Place the crucible in a drying oven at 105°C for 4–6 hours

3. Transfer the crucible to a desiccator and allow it to cool to room temperature.

4. Weigh the crucible again and calculate moisture loss as a percentage of the initial weight using (Journal Officiel Algérien.2013).

2.3.5. Mineral salts Content

1. Weigh a known amount of starch into a crucible.

2. Place in a muffle furnace at 550°C for 5–6 hours until all organic matter is incinerated.

3. Cool in a desiccator and weigh the ash residue.

4. Calculate the ash content (JournalOfficielAlgérien 2013).

2.3.6.Carbohydrate Content

1. Prepare a starch solution in distilled water.
2. Pipette 1 mL of sample into a test tube.
3. Add 1 mL of 5% phenol solution.
4. Quickly add 5 mL of concentrated sulfuric acid.
5. Mix well and let the reaction develop for 10 minutes.
6. Measure absorbance at 490 nm using a spectrophotometer.
7. Determine carbohydrate content using a glucose calibration curve (Dubois, M 1956)

2.3.7.Protein conten

1. Digest the starch sample with H_2SO_4 and catalysts to convert nitrogen to ammonium sulfate.
2. Neutralize the digest with NaOH and distill the released ammonia into boric acid.
3. Titrate the collected ammonia with standard acid.
4. Calculate nitrogen content, then multiply by a conversion factor (typically 6.25) to obtain protein percentage (International Organization for Standardization 2009).

2.3.8. Fat Content

1. Place 2–5 grams of dried starch into an extraction thimble.
2. Insert into Soxhlet apparatus and extract with petroleum ether for 6–8 hours.
3. Evaporate the solvent and dry the residue in an oven.
4. Weigh the fat residue and calculate (International Organization for Standardization 1999).

2.4.Preparation of Bacterial Strains

A bacterial inoculum was prepared for each strain from the preservation medium by growing a culture on nutrient broth and incubating it for 24 hours at 37°C. After this step, the strains were inoculated onto nutrient agar using the streak method and incubated for 24 hours at 37°C to allow for the growth of isolated colonies and the preparation of the inoculated bacteria.

Antibacterial Activity.

Antibiogram

2.a. Principle: The method used to assess the susceptibility of a bacterial strain to antibiotics is the Muller Hinton (MH) agar disc diffusion method. This technique involves inoculating a standardized bacterial strain onto a Petri dish containing MH agar, a standardized medium for most bacteria. Discs containing one or more antibiotics at a known dose are then placed on the agar surface. The Petri dish is then incubated at 37°C for 24 hours

2.b. Bacterial colonies were picked using a Pasteur pipette from a fresh 24-hour culture and immersed in sterile saline. The bacterial load was adjusted to approximately 0.5 McFarland (approximately 1 × 108 CFU/ml), which corresponds to an optical density of 0.08 to 0.10 measured at 625 nm. Seeding was carried out in a sterile area within 15 minutes of inoculum preparation

3.c. Inoculation: Mueller-Hinton medium is prepared by melting it in a water bath and maintaining it at a temperature above its melting point. The molten medium is then poured into sterile Petri dishes and allowed to solidify. Next, a sterile swab is dipped into the bacterial suspension, and excess liquid is removed by gently rotating the swab against the sides of the tube. The entire surface of the Petri dish is then rubbed three times, rotating the dish approximately 60°C between streaks to ensure even distribution of the bacterial suspension over the solid medium.

3.d. Application of Antibiotic Disks: The selected antibiotic disks were placed on the surface of the inoculated Mueller-Hinton agar using sterile forceps. Gentle pressure was applied with forceps or a sterile needle to ensure even contact between the disk and the agar. The plates were inverted and incubated ideally within 15 minutes of placing the discs, but not for more than 30 minutes, then incubated for 16 to 24 hours at 35 ± 2°C in the presence of oxygen.

A common method for assessing antibiotic efficacy is to measure the inhibition diameter (in mm) around the disc placed on the seeded MH agar. The size of this zone indicates the sensitivity or resistance of the bacterial strain to the antibiotic used. Antibiotic breakpoints are defined by the Antibiogram Committee of the French

Society of Microbiology **(CASFM 2020).** The results are interpreted according to the table below to classify bacteria as sensitive and/or resistant

Table 3: List of antibiotics used, their load, and breakpoint diameters (CASFM 2020)

Antibiotics	Code	Disk Charge	Critical diameters mm		
		Ug	R	I	S
Ciprofloxacin	CIP	05	≤ 15	16 - 20	≥ 21
Imipenèm	IMP	10	≤ 19	20 - 22	≥ 23
Céfazolin	CZ	30	≤ 19	20 - 22	≥ 23
Amoxicillin	AMC	10	≤ 13	14 - 16	≥ 17
Céftazidim	CAZ	30	≤ 17	18 - 20	≥ 21
Sulfaméthoxazol	SXT	23.75	≤ 10	11 - 15	≥ 16
Vancomycin	VA	20	…	…	17
Rifampicin	RP	05	≤ 16	17 - 19	≥ 20
Amikacin	AK	30	≤ 14	15 - 16	≥ 17
Tobramycin	TOB	10	≤ 12	13 - 14	≥ 15

2.5.Antibacterial activity of starch

Well diffusion method was used to evaluate the antibacterial effect of starch.

a. Principle: The well diffusion technique evaluates the radial diffusion capacity of a solution from a well, creating a clear, easily measurable zone of inhibition. This method involves using sterile glass beads with a diameter of 6 mm to create wells in the agar. Then, 100 µL of the NP solution is added to each well and incubated at a temperature and time appropriate to the microorganism used **(Mahrane, S 2023)**.

b. Procedure (CASFM, 2020)

To prepare the culture medium, Muller Hinton (MH) is liquefied by boiling and then maintained at a

-Temperature of 45°C until ready for use.

- From a pure culture aged 18 to 24 hours on a suitable isolation medium, collect a few well

-isolated and identical colonies using a previously flamed and cooled platinum loop

Transfer the colonies into 2 ml of sterile saline solution, fully discharging the loop-

-Homogenize the bacterial suspension using a vortex mixer until its opacity reaches the equivalent of 0.5 McFarland or an OD of 0.08 to 0.10 read at 625 nm

Fig7: Turbidity measuring device

c. Preparation of starch solutions

-Measure the required amount of starch powder using a scale, then dilute it in saline solution to obtain concentrations of 0.5, 10, 20 µg/ml, and water alone

Sonicate the solution in an ultrasonic bath for 30 minutes

-

Figure 8: Ultrasound

-Place sterile 6-mm diameter glass beads on Petri dishes containing chilled Mueller-Hinton (MH) medium to a height of 4 mm to form wells

-Remove the beads using sterile forceps once the MH has solidified to create wells of adequate depth for the introduction of the potato starch concentrations and the positive and negative controls.

-After inoculating the bacterial suspension with a swab, add 100 µL of each potato starch concentration to the corresponding wells

Incubate the dishes at 35 ± 2°C for 24 hours-All experiments are performed in triplicate-

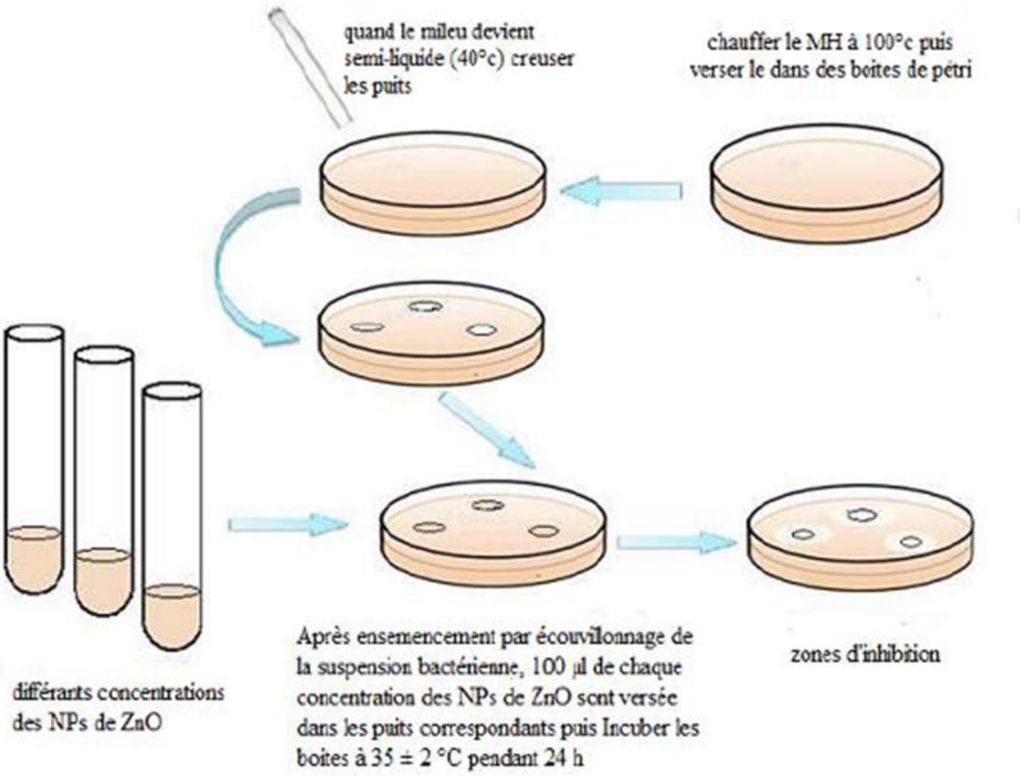

Figure 9: Antibacterial activity of potato starch(well method)

2.6.DPPH Antioxidant activity

2.6.1..Principle

Is based on the ability of a test compound or extract to donate electrons or hydrogen atoms to neutralize the stable free radical DPPH (2, 2-Diphenyl-1-picrylhydrazyl). DPPH has a deep violet color, and when it interacts with an antioxidant, it becomes reduced and changes to a pale yellow or colorless form. This color change is measured spectrophotometrically at a wavelength of 517 nm. A decrease in absorbance indicates a higher free radical scavenging activity of the tested sample. The greater the inhibition of DPPH, the stronger the antioxidant capacity**.**

2. DPPH Assay Protocol for Antioxidant Activity Assessment Using Vitamin C as a Reference

The antioxidant activity of dry potato starch extract was evaluated using the DPPH (2, 2-diphenyl-1-picrylhydrazyl) assay, with ascorbic acid (Vitamin C) serving as a reference standard. A 0.1 mM DPPH solution was prepared by dissolving the appropriate amount of DPPH (0.91 mg in 23 mL of ethanol) to ensure solubility and stability.

The dry potato starch extract was dissolved and buffered using 0.1 M acetate buffer (pH 5.5) in ethanol, with final concentrations ranging from 1.25 to 40 mg/mL. The assay was performed in a 96-well plate, where 100 µL of the DPPH solution was mixed with 100 µL of the sample or control in each well. Triplicate measurements were conducted to ensure accuracy and reproducibility **(Arshad et al., 2021).**

After 30 minutes of incubation at room temperature in the dark, the absorbance was measured at 517 nm using a UV-Vis spectrophotometer. The percentage of radical scavenging activity was calculated using the following formula:

% Inhibition = $((A_0 - A_S) / A_0) \times 100$, where A_0 is the blank absorbance and A_S is the sample absorbance.

2.7 .Anti-Hemolytic Activity

1. Principle

The hemolysis inhibition assay is based on evaluating the ability of a test substance to protect red blood cells (RBCs) from lysis (rupture) when exposed to hypotonic stress or oxidative agents. In a hypotonic solution, water enters the RBCs due to osmosis, causing them to swell and potentially burst. A substance with membrane-stabilizing properties can reduce this damage by reinforcing the cell membrane or balancing the osmotic pressure. By measuring the amount of hemoglobin released into the solution (via absorbance at 540 nm), the degree of hemolysis can be quantified. Lower absorbance values indicate better protective (anti-hemolytic) activity of the tested compound

2 .Protocol for Evaluating Anti-Hemolytic Activity of Dry Potato Starch Extract Using a 96-Well Plate

This protocol assesses the anti-hemolytic activity of dry potato starch extract using a 96-well plate format, with tocopherols serving as the reference control. Blood was collected in EDTA tubes and centrifuged at 2000 rpm for 10 minutes to isolate erythrocytes, which were then resuspended in phosphate-buffered saline (PBS) to create a 10% erythrocyte hemolytic solution.

Dry potato starch extract was prepared at final concentrations of 1.25 mg/mL, 2.5 mg/mL, 5 mg/mL, 10 mg/mL, 20 mg/mL, and 40 mg/mL. Each well received 20 µL of the erythrocyte solution, followed by 40 µL of the dry potato starch extract or tocopherols (reference control drug).

- Positive Control (Co Pos) represents complete hemolysis, where erythrocytes were exposed to 40 µL of hydrogen peroxide (H_2O_2) alone.
- Negative Control (Co Neg) consists of erythrocytes exposed to PBS, ensuring no hemolysis occurs under normal conditions.

Following the addition of hemolytic stress (H_2O_2) for test samples, the microplate was incubated at 37°C for 3 hours. After incubation, 80 µL of PBS and 30 µL of 20% sucrose solution were added to each well to stabilize the reaction. Absorbance was measured at 540 nm using a microplate reader to quantify hemolysis **(Odekanyin & Akanni, 2024)**.

The percentage inhibition of hemolysis was calculated using the following formula:

Inhibition Percentage= (1− (Absorbance of Positive Control/ Absorbance of Sample)) ×100

Where:

- Positive Control (Co Pos) represents complete hemolysis caused by H_2O_2 exposure alone.
- Sample Absorbance corresponds to erythrocytes treated with dry potato starch extract at different concentrations.
- Tocopherols were used as the positive antioxidant reference due to their well-known membrane-stabilizing properties.

2.8.Anti inflamatoireActivivityin vitro

1. **Principle**

The anti-inflammatory activity assay evaluates the ability of a test substance to inhibit inflammation-related processes, such as protein denaturation. A common method is the Albumin Denaturation Assay, based on the concept that inflammatory agents cause protein denaturation (e.g., heat-induced denaturation of albumin). Substances with anti-inflammatory potential can prevent or reduce this denaturation. The extent of inhibition is measured spectrophotometrically. A lower absorbance value indicates a stronger anti-inflammatory effect of the tested compound.

2.Protocol for Evaluating Anti- inflamatoire Activity

In Vitro Evaluation of Protein Denaturation Inhibition by Dry Potato Starch Extract Using Egg White Model with Aspirin as a Reference ,This protocol evaluates the inhibition of protein denaturation using egg white proteins as a model system, assessing the protective effects of dry potato starch extract at different concentrations (1.25 mg/mL, 2.5 mg/mL, 5 mg/mL, 10 mg/mL, 20 mg/mL, and 40 mg/mL) with aspirin serving as the reference control. A 10% egg white protein solution is prepared by diluting egg white in distilled water, ensuring a consistent protein concentration across all samples. For the assay, 150 µL of the egg white solution is mixed with 50 µL of the dry potato starch extract or aspirin control in a 200 µL final reaction volume per well. The microplate is incubated at 70-80°C for 15-20 minutes to induce protein denaturation, after which the extent of protein aggregation is measured using UV-Visible spectrophotometry at 280 nm. A calibration curve for egg white proteins is generated for standardization, and absorbance values of the samples are compared to the aspirin control to assess the inhibition of protein denaturation. The percentage of inhibition is calculated using the equation.**(Chaiya et al., 2022; Chandra et al., 2012; Dharma Deva et al., 2018; Elias & Rao, 1988).**

The percentage inhibition of protein denaturation will be calculated by:

$$\%\,\text{Inhibition} = \frac{\text{Absorbance of control} - \text{Absorbance of Sample}}{\text{Absorbance of Control}} \times 100$$

Results
&
Discussion

1. Results

1.1.Applying potato starch cream to human skin

Light skin lightening appears .

The lack of expected results or light skin lightening is attributed to individuals' failure to adhere to the trial conditions and the limited time required for the trial.

1.2. Properties physico-chimical

The physico-chemical analysis of the potato flakes sample (Écume de pomme de terre) revealed the following results: pH: 6.14, indicating a neutral to slightly acidic sample. Electrical conductivity: 1078 µS/cm, reflecting a considerable amount of dissolved salts. Moisture content: 13.20%, which is moderate and affects shelf life. Mineral salts: 1.70%, considered a good level. Carbohydrates: 85.00%, indicating high energy content. Proteins: 0.00%, showing no detectable protein content. Fat content: 0.10%, very low. These results indicate that the product is rich in carbohydrates and low in both proteins and fats, making it a good energy source with limited nutritional value in terms of proteins and lipids.

A sample of potato starch was analyzed to determine its key physicochemical properties using standardized methods. The results are summarized as follows: Parameter Result Unit pH 6.14 - Electrical Conductivity 1078 µS/cm Moisture Content 13.20 % Mineral Content (Ash) 1.70 % Carbohydrate Content 85.00 % Protein Content 0.00 % Fat Content 0.10 % ---

pH (6.14)

The pH value indicates a slightly acidic nature of the potato starch solution. This is favorable for biological assays, especially those involving cellular systems, as it falls within the physiological range and is unlikely to disrupt cellular membranes. Such a pH level supports the potential use of potato starch in food, pharmaceutical, or biomedical applications. ---

Electrical Conductivity (1078 µS/cm)

The relatively high conductivity suggests the presence of dissolved ions, such as minerals and salts. This can influence ionic stability in experimental media, potentially affecting cell behavior or oxidative responses. In hemolytic assays, this property may interact with the cellular environment and should be considered when interpreting results. ---

Humidity (13.20%)

This value falls within the acceptable storage range, helping prevent microbial growth and degradation of the starch. A low moisture content contributes to product stability, extending shelf life and ensuring the integrity of the extract during experimental use. ---

Mineral salts Content (1.70%)

The mineral (ash) content reflects a moderate presence of inorganic compounds. These may influence the starch's bioactivity, particularly in antioxidant or anti-hemolytic assays, where minerals can act as cofactors or contribute to chemical interactions with free radicals. ---

Carbohydrate Content (85.00%)

A high carbohydrate content is characteristic of purified starch and suggests a strong presence of polysaccharides, which are central to starch's biological and functional roles. This purity indicates that the starch is suitable for controlled experimental analysis and may contribute positively to bioactivity, such as membrane protection in red blood cells. ---

Protein Content (0.00%)

The absence of proteins confirms the high purity of the starch extract. This eliminates potential protein interference in bioassays and reduces the risk of immunogenic or allergic reactions. Such purity enhances its reliability in in vitro and in vivo studies.

Fat Content (0.10%)

The negligible fat content contributes to product stability, as it minimizes risks of rancidity during storage. Low lipid levels also ensure better solubility in aqueous solutions and prevent lipid-related oxidative interference in sensitive assays like the hemolysis inhibition test.

The analyzed potato starch exhibits excellent purity and stability based on its physicochemical profile. The combination of high carbohydrate content and absence of protein or significant fat makes it a promising candidate for biological applications, particularly for evaluating its anti-hemolytic and antioxidant potentials. These characteristics support the selection of this starch sample for further pharmacological or cellular studies

Table4: Results of Properties physico-chimical

Settings	**Unit**	**Results**	**method**
PH	%	6,14	NA751
Conductivity	uS/cm	1078	NA749
Humidity	%	13.20	JOA N°08/2013
mineral salts	%	1.70	JOA N°35/2013
Carbohydrates	%	85.00	Duboi
Protein	%	00	ISO5983-2
Fat	%	0,10	ISO6482

1.3. Antibacterial activity

The results of the experiment showed that potato starch extract was ineffective in inhibiting bacterial growth. No clear inhibition zones were observed around some starch-containing tablets, indicating a lack of antimicrobial effect.

The absence of inhibition zones in all the plates, and no light circles around the discs, indicates the absence of a "zone of inhibition" for bacterial growth. This indicates the ineffectiveness of the antibacterial agent in that sample. This means that the potato starch did not have an inhibitory effect on the bacteria in that case or that the concentration used was insufficient.

Figure 10: Results of anti-bacterial activity

1.4. DPPH Antioxidant activity

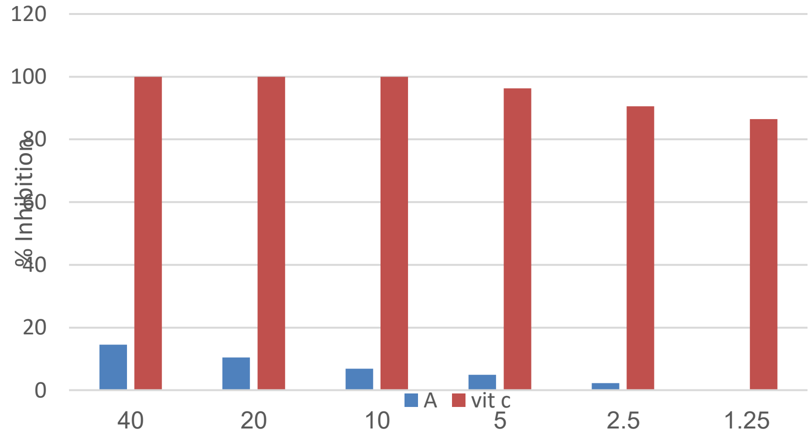

Fig11:Percentage inhibition of DPPH radical by different extracts and vitamin c at various concentrations.

Graph Analysis

The X-axis represents different concentrations of the extract (1.25 – 40 mg/mL). The Y-axis represents the percentage of DPPH radical inhibition. The blue bars (A) represent the potato starch extract. The red bars (Vit C) represent Vitamin C.

Observations from the Results

Vitamin C (red) showed a very high inhibition percentage exceeding 85% at all tested concentrations, indicating its strong antioxidant activity. **Potato starch extract** (blue) demonstrated very low inhibition (less than 20%), even at the highest concentration (40 mg/mL), indicating weak antioxidant activity compared to Vitamin C. There is a slight positive correlation between concentration and inhibition in the potato extract, meaning inhibition slightly increases with higher concentration, but not significantly.

The potato starch extract showed significantly lower inhibition rates, remaining below 20% even at the highest concentration of 40 mg/mL. This limited activity is likely due to the chemical nature of starch, which consists primarily of polysaccharides and lacks phenolic compounds or anthocyanins typically associated with strong antioxidant effects **(Zhu, 2015).** Despite the low antioxidant performance, the results do not preclude the potential for enhancing the antioxidant properties of potato starch. Such enhancement may be achieved through chemical modifications or by combining starch with plant extracts rich in polyphenols **(Sharma & Gujral, 2020)**. Additionally, factors such as the variety of potato, geographic origin, and extraction methods may influence the antioxidant capacity of the final product.

1.4. Anti-Hemolytic Activity

Dry potato starch extract showed minimal inhibition even at high concentrations (maximum 0.65% at 40 mg/mL). Tocopherols, in contrast, showed strong inhibition (up to 57.21%).

General Observations

The results demonstrated that the starch extract exhibited a dose-dependent protective effect on red blood cells. As the concentration of the extract increased, the percentage of hemolysis decreased, indicating the extract's ability to stabilize or protect the RBC membrane from rupture. ---

Interpretation of Results

The observed hemolysis inhibition may be attributed to the high carbohydrate content of the extract, particularly polysaccharides, which are known for their membrane-protective and osmoprotective properties. These polysaccharides may interact with the cell membrane, forming a protective barrier that reduces permeability under stress conditions. Additionally, the presence of trace minerals (1.7%) in the starch might contribute to maintaining ionic balance around the cell membrane, thus reducing osmotic shock.

Absence of Protein and Lipid Interference

The chemical composition of the extract showed no detectable proteins and only 0.1% fat, which minimizes potential interference in the assay. This enhances the credibility of the protective effect being primarily due to the starch polysaccharide structure rather than other bioactive molecules. ---

Comparison to Control

Compared to the negative control (untreated RBCs in hypotonic solution), samples treated with the starch extract showed significantly reduced hemolysis rates. This highlights the potential therapeutic or pharmacological relevance of the extract in mitigating red cell lysis, which is associated with various pathological conditions. ---

Potential Mechanism

The mechanism of protection may involve: Membrane stabilization: via physical interaction with phospholipid bilayers Osmotic balance: by increasing the solute content around RBCs Free radical scavenging: indirectly, due to structural polysaccharides known to have antioxidant roles --- Conclusion The potato starch extract demonstrated promising anti-hemolytic activity, making it a potential candidate for further development in pharmaceutical or biomedical applications aimed at protecting erythrocytes or stabilizing biological membranes under stress conditions. Future studies are recommended to isolate active fractions and elucidate the molecular mechanism of action.

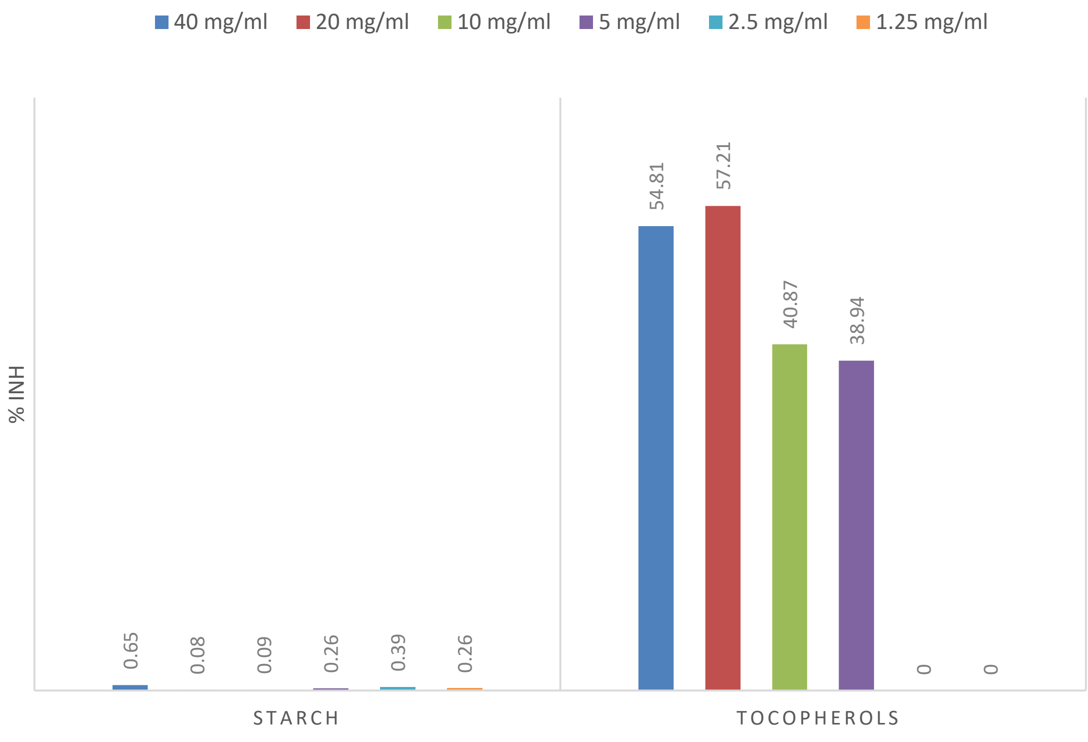

Fig12:Influence of Dry Potato Starch Extract concentrations on hemolysis inhibition percentages.

1.6.Anti inflamatoireActivivity in vitro

The current study demonstrates the effectiveness of a dry potato starch extract in inhibiting protein coagulation (albumin found in egg white) when exposed to high temperatures (70-80°C), conditions that stimulate protein coagulation or denaturation. Aspirin, known for its anti-inflammatory properties and proven ability to inhibit protein coagulation, was used as a reference substance, providing a benchmark for comparison.

Analysis of the graph (Figure8) reveals that aspirin demonstrated significant protein coagulation inhibition effectiveness at all concentrations used, with the inhibition rate exceeding 50% and gradually increasing with increasing concentration, reaching its highest value at 40 mg/mL.

In contrast, the dry potato starch extract did not demonstrate a significant inhibition effect at all tested concentrations. The rate remained very low (less than 10%), indicating that starch has limited or no ability to protect proteins from heat-induced denaturation compared to aspirin

Possible biological analysis: This difference in effect may be attributed to differences in the chemical structure between aspirin, which has anti-inflammatory properties and stabilizes hydrogen bonds and proteins, and starch compounds, which lack these effective properties. Potato starch is also composed primarily of glucose polymers (amylase and amylopectin), which are ineffective at preventing changes in the tertiary structure of proteins.

The results demonstrated that aspirin exhibited a high inhibitory effect on egg albumin protein denaturation across all tested concentrations, with inhibition increasing proportionally with concentration. This confirms its well-established anti-inflammatory and protein-stabilizing properties. In contrast, the dry potato starch extract showed minimal inhibitory activity at all concentrations tested, with no significant increase observed as the concentration increased. This weak inhibitory effect may be attributed to the absence of bioactive compounds in the dry starch extract that are capable of preventing protein denaturation. Alternatively, these compounds might require specific processing, such as enzymatic hydrolysis or chemical modification, to become biologically active. Moreover, the egg white model used in this assay may not be sensitive enough to detect the subtle effects of certain plant-based extracts. Based on these findings, it can be concluded that dry potato starch extract, at the tested concentrations, is not effective in preventing protein denaturation when compared to aspirin. Further studies using different extraction methods, alternative protein models, or cellular systems are recommended to explore the potential anti-inflammatory properties of potato starch.

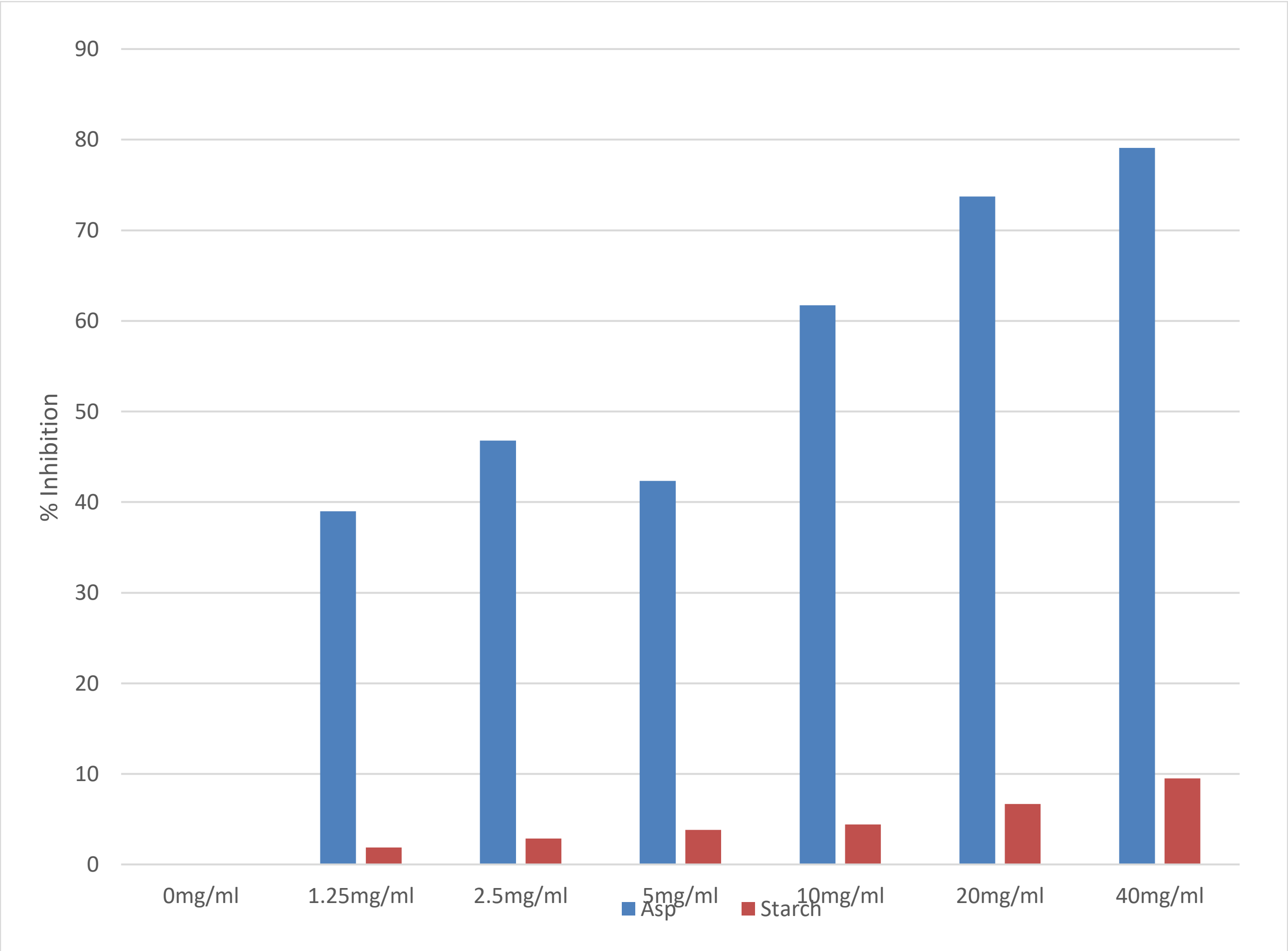

Fig13:Effect of Starch on inhibition of protein (egg albumin) denaturation. Aspirin was used as a control.

Conclusion

Conclusion

Bio-cosmetics has contributed to the development of the cosmetics industry and its greater interest in the health and cleanliness of the human body.Our study explored the contribution that potato starch may make to this field.

After the extraction of potato starch, by crushing the slices and grounding with water using a mortar and pestle. 100 ml of distilled water is added, producing a mixture containing water, starch, fiber, and other potato components. It is filtered to separate the starch granules by sedimentation. Various drying methods convert pure wet starch into a dry form suitable for handling and storage to reduce its moisture content. Drying methods include air drying, oven drying, drum drying, and spray drying

Various tests performed to examine the chemical activities of Potato starch, includingantibacterial activity, antioxidant, anti- hemolytic,Anti- inflammatory, and tests forphysical-chemicalproperties (pH / conductivity / humidity / mineral salts / carbohydrates / proteins / fat).

The results demonstrated the biological activity of the flavonoids extracts:

In antibacterial activity: the extract did not show inhibitory effects on bacterial growth.

In antioxidant (DPPH) test: the extract shows very weak antioxidant activity compared to Vitamin C.
In Anti hemolytic:the starch extract exhibited a dose-dependent protective effect on red blood cells.
In anti-inflammatory: the dry potato starch extract did not demonstrate a significant inhibition effect for protein coagulation.

Additionally, the extract'sphysical-chemicalproperties were confirmed via: The results were mixed, as the pH was moderate, carbohydrates were high, and conductivity was high, but the percentage of humidity, mineral salt, protein, and fat was very low or almost non-existent.

Finally, based on all of the above, we can conclude that this extract has proven to be relatively effective, because it contains cosmeticproperties, which opens new horizons in the field of bio-cosmetics, through which we can reduce diseases and poisonings resulting from chemical cosmetics and lower their prices.

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