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Extraction of the Sweetening Substances from the *Iris germanica White*

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Abstract

The experimental research aimed to extract some sweeteners from *Iris Germanica White* and establish the sweetening power of the extracts obtained. The extraction was done in water and alcohol, then the extracts were obtained in powder form. The soluble dry matter was determined, as well as the acidity. The acidity ranged from 1.3 to 2 g/100 g, and the pH index ranged from 5.98 to 6.22. The sweetening power of the extracts varied from 11.07 in sample 1 to 36.6 in sample 8, which reflects that the values vary inversely proportionally with the variation of invert sugar. As a result of the experiment, 8 extracts were obtained with a significant sweetening power, with a glucose level ranging between 23-40 mg/100 g glucose and 23-42.7 mg/100 g invert sugar. The importance of the experiment is major for testing the extracts for the glycemic index in the case of food products intended for diabetic diets. Another nutritional aspect is related to the cumulative digestive effect between sugar that is slowly assimilated and the antioxidant substances by the human metabolism.

Keywords: *innovation, sweeteners, Iris Germanica White*

1. Introduction

The genus *Iris* L. (family Iridaceae) comprises over 300 species distributed across the temperate regions of the Northern Hemisphere. These plants are valued for their ornamental beauty as well as for their pharmacological and cosmetic potential [1]. Among them, *Iris germanica* L., commonly known as the bearded iris, represents one of the most widely cultivated species. The white-flowered variant, *Iris germanica* L. var. *florentina* Dykes—frequently referred to as *Iris florentina*—is particularly notable for its striking white flowers and rhizomes, known as orris root**,** which have been used since antiquity in perfumery and traditional medicine [2]. Widely grown in gardens and historically used in perfumery and medicine, this iris is believed to be a hybrid or cultivar rather than a true wild species. It is typically characterized by large, fragrant white blooms with a subtle bluish or pale lavender tint, sword-like grey-green foliage, and a robust, rhizomatous growth habit. Despite its long-standing presence in horticulture and traditional use, the precise botanical identity of *Iris florentina* remains uncertain. Some botanists have classified it as a variant or hybrid of *Iris germanica*, while others have proposed it as a distinct species, occasionally associating it with *Iris albicans* Lange [2].

Phytochemical investigations have revealed a wide array of secondary metabolites in Iris florentina rhizomes, including flavonoids, xanthones, isoflavones, and phenolic acids [1]. Recent studies identified new isoflavone glucosides with strong antioxidant and cytoprotective potential [3]. Comparative

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analyses of different extraction techniques—such as hydrodistillation and headspace solid-phase microextraction (HS-SPME)—highlight significant variations in the volatile compound profiles [2].

Multiple studies have confirmed the biological and dermatological potential of Iris florentina extracts. Yim et al. (2025) reported dual modulatory effects on melanogenesis, indicating potential applications in skin tone regulation and anti-hyperpigmentation treatments [1]. Kim et al. (2023) demonstrated that exosomes derived from Iris germanica rhizomes exhibit antioxidant and anti-aging effects on human epidermal keratinocytes, reducing oxidative-stress-induced cellular senescence [4].

Furthermore, exosome-based treatments derived from *Iris germanica* have shown promising effects on hair regeneration, improving mitochondrial function in dermal papilla cells and counteracting oxidative stress [5]. These findings position *Iris germanica* rhizome extracts as valuable bioactive ingredients for cosmetic and regenerative formulations.

Although *Iris germanica* is primarily used in perfumery and cosmetics, recent studies have explored its potential applications in the food and beverage industry. The orris root powder is used as a flavoring agent and natural fixative in certain traditional European liqueurs, wines, and confectionery products due to its delicate violet-like aroma [2].

Moreover, phenolic extracts from *Iris florentina* have demonstrated antioxidant activity that could be harnessed for the preservation of lipid-rich foods. Their inclusion in functional foods may contribute to oxidative stability and health-promoting properties. Ongoing research aims to evaluate toxicological safety, sensory thresholds, and microencapsulation techniques for potential industrial-scale use of Iris extracts as natural flavor enhancers and nutraceutical additives [6].

In recent years, growing attention has been directed toward the identification and extraction of natural sweetening and antioxidant compounds from non-traditional plant sources. Iris germanica white rhizomes are of particular interest due to their unique combination of glycosidic compounds and phenolic antioxidants [1,4].

Preliminary phytochemical analyses have revealed that *Iris florentina* rhizomes contain isoflavone and xanthone glycosides that may impart a mild sweet taste profile [1]. The sweetening potential is attributed to glycosidic derivatives of irigenin and iridin, compounds structurally related to known natural sweeteners from other Iridaceae members [1].

Extraction of these compounds typically involves ethanolic or hydroalcoholic maceration, followed by liquid–liquid partitioning and chromatographic fractionation. Optimal yields are obtained at solvent polarities between 50–70% ethanol, temperatures of 40–60 °C, and extraction times of 2–4 hours. Modern green-extraction technologies, such as ultrasound-assisted extraction (UAE) and supercritical CO_2 extraction, have shown improved recovery rates and lower degradation of thermo-labile compounds.

The sweet fractions can be analyzed via HPLC-DAD, LC-MS, and GC-MS, allowing for quantification of glycosides and their corresponding aglycones [2]. Organoleptic studies have indicated that these extracts present a delicate floral sweetness with low caloric value, suggesting their suitability for functional food applications [6].

Recent hypotheses propose a synergistic relationship between sweet glycosides and antioxidant phenolics in *Iris germanica*. The glycosidic structure may contribute to enhanced solubility and stability of phenolic antioxidants in aqueous systems [7]. This dual property is of interest for functional food and nutraceutical development, as it allows the creation of naturally sweetened formulations with added antioxidant benefits. Furthermore, the absence of caloric sugars and the presence of stable phenolic glycosides make *Iris germanica* extracts potentially valuable as natural sugar substitutes in diabetic-friendly or low-glycemic products [8].

This paper aim to study the physical-chemical properties and the sweetening power of the *Iris*

germanica white extract in order to be used as natural ingredient in hypoglucidic food products.

Figure 1. *Iris Germanica White* [9]

2. Materials and method

2.1. Samples

The material used in this experiment was *Iris Germanica White* flowers, harvested from the North-East Region of Romania, Iasy County, Ciurea area. The flowers were separated from the stem and bulb, weighed, and hot water and ethyl alcohol were added as a solvent in a ratio of 1:2.

Thus, 8 solid-liquid samples were established to perform the extraction of the sweetening solution.

Table 1. The samples preparation

Sample	Extraction	Dilution ratio
1	3 g: 9 ml solvent	1:3
2	4 g: 16 ml solvent	1:4
3	5 g: 30 ml solvent	1:5
4	6.5: 39 ml solvent	1:6
5	7.5 g: 52.5 ml solvent	1:7
6	9 g to 72 ml solvent	1:8
7	9.5 g to 85.5 ml solvent	1:9
8	10.5 g: 105 ml solvent	1:10

2.2. Methods

The extraction was carried out for 24 h at 18-20ºC, after which filtration was performed, resulting in a greenish yellow liquid. The extract solutions were analysed physic and chemically, determining acidity, pH, reducing sugar, glucose, invert sugar, soluble dry matter, and antioxidant substances. Experimental determinations were performed by efficient separation, for calculating the yield.

2.3. Determination of acidity.

The total acidity was determinated using 25 ml filtered extract with dilution to 250 ml and filtration. 50 ml of the filtrate was passed into a 100 ml Erlenmeyer beaker, adding 2 drops of phenolphthalein and titrated with NaOH 0,1 n until pale pink, which persists for 1 minute [10].

2.4.Determination of pH index of the samples to be analysed was determined with the pH Testo meter [10].

2.5.Determination of powder extract

Subsequently, the extracts were dried in an oven according to the method [10]. 5 ml sample introduced into glass capsules with lids were dried by infrared drying at 100ºC ±3ºC until constant mass, for 3 to 4 hours. Cooling of the powder samples obtained from the extracts was done in a desiccator, subsequently weighing the capsules with lids on an analytical balance. The moisture content of the sweetener powder was 0.5-1%, the variation in humidity being very small.

The powder extract was determined using the formula:

$W\% = (m_1-m_2)\ x100/(m_1-m_0)$, % percentage of moisture of the sample to be analysed,

Where: m1 is the initial mass of the sample, m2 is the final mass of the sample after drying and m_0 is the mass of the empty capsule [10]

2.6. Determination of glucose and invert sugar

Purified aqueous extract of the test sample was filtered and sucrose was hydrolysed (inverted) to reducing sugars, which reduced cupric Cu^{2+} ions in alkaline boiling solution to cuprous Cu^{+} oxide. The surplus of Cu^{2+} was determinate by iodometry using $Na_2S_2O_3$.

Reagents: Fehling I, II, starch colloidal solution indicator, H_2SO_4 25%, KI 10%, $Na_2S_2O_3$ 0,1n.

Procedure: 10 ml of sample was put in flask with 10 ml Fehling I and 10 ml Fehling II which were boiled 2 minutes. After the cooling it was put 10 ml H_2SO_4, 20 ml KI 10% and 1ml starch indicator. It was titrated the samples with V1 $Na_2S_2O_3$, ml. In the same procedure was prepared the sample with 10 ml water, resulting the V2 $Na_2S_2O_3$, ml.

Calculating the result: Difference between the V1-V2 = V ml which corresponding to the values of glucose and invert sugar from the table **[**10].

2.7. The determination of soluble dry matter was done refractometrically [10].

3. Results and discussions

The trend of the obtained liquid or dry extracts, as well as the extraction yield, indicates an increasing dynamic and a linear variation in the extraction yield between 11.05-30% (Figure 2). The confidence level of the obtained results was very high $R^2 = 0.9367$ for

both the liquid extracts and R^2 = 0.7245 for the extraction yields.

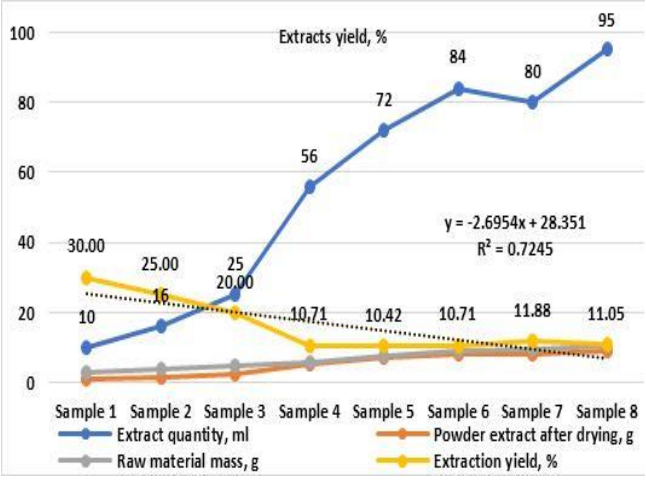

Figure 2. Dynamics of the extraction yield from the *Iris Germanica White*

The glucose index in the case of the experimentally obtained extracts from sample 1 to sample 8 ranged from 23 to 40 mg/100 g, and the invert sugar ranged from 23.2 to 42.7 mg/100 g. From a statistical point of view, the variation of the experimental results is linear with a very important confidence level R^2 = 0.9464 for glucose and R^2 = 0.966 for invert sugar. (Figure 3).

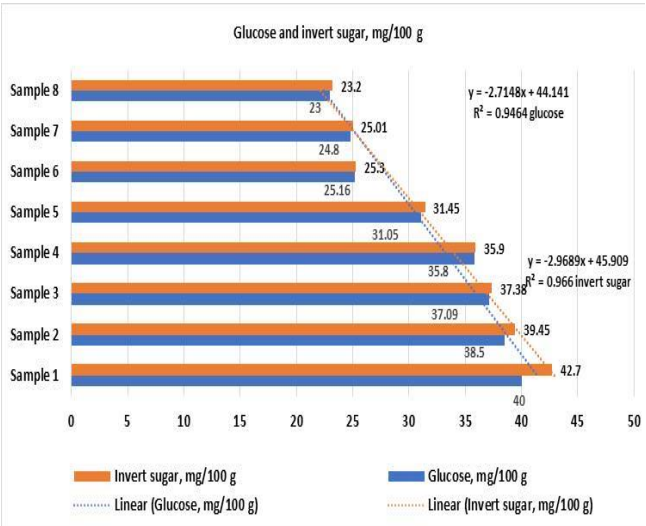

Figure 3. Evolution of the glucose and the invert sugar in the extracts of *Iris Germanica White*

The acidity ranged from 1.3 to 2 g/100 g, and the pH index ranged from 5.98 to 6.22. The confidence level of the results obtained is above average R^2 = 0.7769 for acidity and R^2 = 0.5855 for the pH index. (Figure 4).

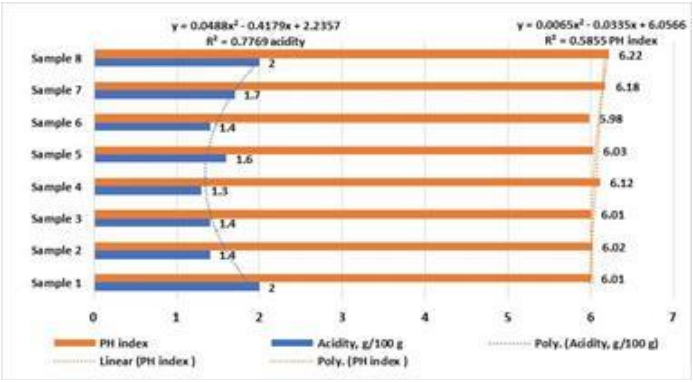

Figure 4. Dynamics of acidity and pH index of the extracts

The sweetening power of the extracts varied from 11.7 in sample 1 to 36.6 in sample 8, which reflects that the values vary inversely proportionally with the variation of invert sugar 42.7 mg/100 g invert sugar in sample 1 and 23.2 mg/100 g invert sugar in sample 8. Invert sugar formed from glucose and fructose will have a higher sweetening power than sucrose due to the fructose molecules. The polynomial variation of the obtained results indicates a confidence level above the average level R^2 = 0.8348. (Figure 5).

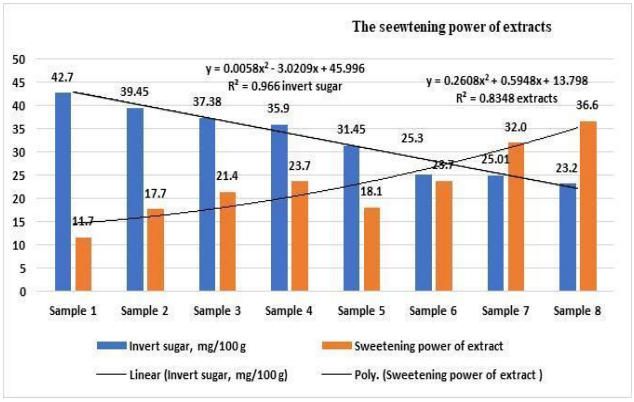

Figure 5. Evolution of the sweetening power of the extracts

The degree of sweetness of the extracts obtained was 1:3, 1:4, 1:5, 1:6, 1:7, 1:8, 1:9, 1:10, and for the sweetener powder, the sweetening power increases significantly by removing water by drying the extracts from 11 times to 36 times. Compared to the sweetening power of glucose in the control samples with dilutions of 1:3, 1:4, 1:5, 1:6, 1:7, :8, 1:9, 1:10, the degree of sweetness of the extracts from Iris *Germanica White* is much lower, approximately 7-8 times. As a result, the extracts or powder can be used for sweetening by adding a larger liquid extract and a medium-dose powder.

The evolution of the sweetening power of the extracts compared to the sweetening power of glucose or fructose is much lower because the soluble dry matter concentration of the extracts was 0.5% in sample 1 to 0.85% in sample 8, i.e. the total sugar in the *Iris Germanica White* extracts (Figure 6). The linear variation of the results obtained indicates a confidence level above the average level $R^2 = 0.8094$.

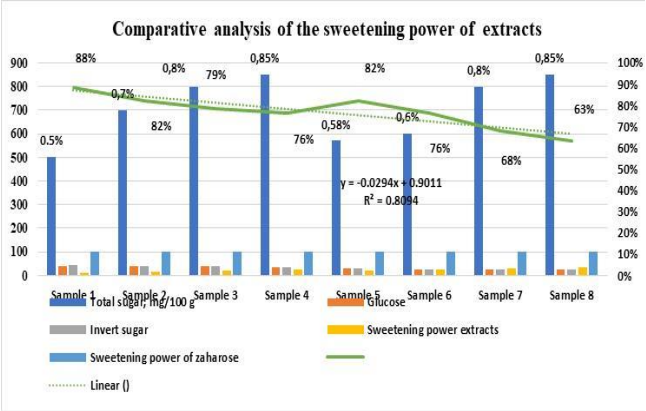

Figure 6. Evolution of the sweetening power of extracts compared with the sweetening power of the glucose and fructose

Conclusions

The results of this study highlight the potential of iris as a natural sweetener in the food industry. Specifically, the following conclusions can be drawn:

1.The hydroalcoholic extract of Iris Germanica W. had a weakly acidic character and a pH index in the acidic range. This means tan important significance for obtaining foods, juices, beer, wine with moderate acidity

2. The extracts obtained had a variation of the glucose content 23-40 mg/100 g, and a variation of the invert sugar between 23-42.7 mg /100 g. This means that the power of the sweetening are generated from both glucose and inverted sugar.

3.The extraction yield obtained from liquids is quite low. Therefore, by concentrating the extracts and removing the water, the powders obtained had a higher sweetening power.

4. Acidity and pH index have influenced the conversion of sucrose into invert sugar, which significantly affects the sweetening power of the extracts due to the fructose molecules that have a higher sweetening power than glucose molecules.

5. In addition, the sweetening power of the extracts obtained is lower than the sweetening power of sucrose, but technologically it can be solved by increasing the amount of liquid extract added in the manufacturing recipes or using powder with a high fructose concentration.

6. The antioxidant and antimicrobial effects stimulate the preservation of the juices against the fermentation of sucrose, glucose and fructose and as good alternatives to synthetic additives, being an natural sweetening with cumulative effects – sweetening, antioxidant and antimicrobial.

Iris germanica L. var. florentina Dykes represents a multifaceted species with ornamental, pharmacological, cosmetic, and emerging food-related applications. Its rhizomes are a rich source of aromatic and bioactive compounds with antioxidant, anti-inflammatory, and anti-aging potential. Future research should focus on standardizing extraction methods, exploring safe dosage levels for food uses, and clarifying molecular mechanisms of bioactivity to fully realize the potential of this species in sustainable and health-oriented industries.

Conflicts of interest / Competing interests: No conflict of interest

Ethics approval: No ethic situation.

Availability of data and material: All relevant data have been included within the manuscript.

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