

**DEVELOPMENT OF A FUNCTIONAL BEVERAGE FORMULATION
BASED ON BUTTERFLY PEA EXTRACT AND EVALUATION OF ITS
ORGANOLEPTIC AND PHYSICOCHEMICAL PARAMETERS**

*S.N.Obloberdiyev¹, G.Sh.Korabekova², F.Sh.G'ulomova³,
M.J.Bekmurodova³, Sh.E.Ulashova³, Z.A.Madusmonova³*

*¹Acting Associate Professor, Tashkent Institute of Chemical
Technology, Yangiyer Branch, Yangiyer, Uzbekistan*

*²Master's student, Tashkent Institute of Chemical Technology,
Yangiyer Branch, Yangiyer, Uzbekistan*

*³Bachelor's student, Tashkent Institute of Chemical Technology,
Yangiyer Branch, Yangiyer, Uzbekistan*

Abstract. this study focuses on the development of a functional beverage formulation based on butterfly pea (*clitoria ternatea* l.) extract and the evaluation of its organoleptic and physicochemical parameters. the beverage was prepared using butterfly pea extract, drinking water, sugar, citric acid, and ascorbic acid. the obtained product was assessed by taste, aroma, color, appearance, ph, titratable acidity, and color stability. the results showed that butterfly pea extract can be used as a natural colorant and functional ingredient in beverage production. the developed beverage had an attractive color, pleasant taste, acceptable acidity, and good sensory properties.

Keywords: butterfly pea extract, functional beverage, *Clitoria ternatea*, natural colorant, organoleptic properties, physicochemical parameters, pH, acidity.

Annotatsiya. Ushbu tadqiqotda butterfly pea (*Clitoria ternatea* L.) ekstrakti asosida funksional ichimlik formulatsiyasini ishlab chiqish hamda uning organoleptik va fizik-kimyoviy ko'rsatkichlarini baholash o'rganildi. Ichimlik tarkibi butterfly pea ekstrakti, ichimlik suvi, shakar, limon kislotasi va askorbin kislotasi asosida tayyorlandi.

Tayyor mahsulotning ta'mi, hidi, rangi, tashqi ko'rinishi, pH ko'rsatkichi, titrlanadigan kislotaligi va rang barqarorligi baholandi. Natijalar butterfly pea ekstraktidan ichimlik ishlab chiqarishda tabiiy rang beruvchi va funksional komponent sifatida foydalanish mumkinligini ko'rsatdi. Ishlab chiqilgan ichimlik jozibador rang, yoqimli ta'm, maqbul kislotalik va yaxshi organoleptik xossalarga ega bo'ldi.

Kalit so'zlar: butterfly pea ekstrakti, funksional ichimlik, *Clitoria ternatea*, tabiiy rang beruvchi, organoleptik xossalari, fizik-kimyoviy ko'rsatkichlar, pH, kislotalik.

Аннотация: В данном исследовании изучена разработка рецептуры функционального напитка на основе экстракта butterfly pea (*Clitoria ternatea* L.) и оценка его органолептических и физико-химических показателей. Напиток был приготовлен на основе экстракта butterfly pea, питьевой воды, сахара, лимонной кислоты и аскорбиновой кислоты. Готовый продукт оценивали по вкусу, аромату, цвету, внешнему виду, показателю pH, титруемой кислотности и стабильности окраски. Результаты показали, что экстракт butterfly pea может использоваться в производстве напитков как натуральный краситель и функциональный компонент. Разработанный напиток отличался привлекательным цветом, приятным вкусом, приемлемой кислотностью и хорошими органолептическими свойствами.

Ключевые слова: экстракт butterfly pea, функциональный напиток, *Clitoria ternatea*, натуральный краситель, органолептические свойства, физико-химические показатели, pH, кислотность.

INTRODUCTION

The development of functional beverages based on natural plant extracts is an important direction in the modern food industry. Butterfly pea (*Clitoria ternatea* L.) extract is of particular interest due to its natural color, anthocyanin content, and pH-sensitive color-changing properties.

The main problem is the wide use of synthetic colorants in beverages and the need to replace them with safer natural ingredients. Previous studies have mainly focused on the antioxidant activity and color-changing behavior of butterfly pea extract. However, the formulation of a functional beverage and the evaluation of its organoleptic and physicochemical parameters require further study.

The aim of this research is to develop a functional beverage formulation based on butterfly pea extract and evaluate its taste, aroma, color, pH, acidity, and color stability. The novelty of the study is the use of butterfly pea extract as both a natural colorant and a functional component in an innovative beverage formulation.

MATERIALS AND METHODS

The object of the study was a functional beverage prepared using butterfly pea (*Clitoria ternatea* L.) extract. Drinking water, butterfly pea extract, sugar, citric acid, and ascorbic acid were used as the main raw materials and additives.

The beverage samples were prepared under laboratory conditions. First, butterfly pea extract was dissolved in drinking water and mixed until a uniform solution was obtained. Then sugar was added to improve taste. Citric acid and ascorbic acid were introduced to regulate acidity, increase functional value, and provide a color-changing

effect. The mixture was stirred for 5–10 minutes at room temperature until all components were completely dissolved.

Several beverage samples with different ratios of extract and acids were prepared. The organoleptic properties of the samples were evaluated by color, taste, aroma, appearance, and overall acceptability. Physicochemical parameters such as pH, titratable acidity, and color stability were also determined.

The analysis was carried out using a pH meter, laboratory scales, measuring cylinders, glass beakers, pipettes, and titration equipment. The best formulation was selected based on acceptable taste, attractive color, stable appearance, and optimal acidity.

RESULTS

As a result of the experiment, several functional beverage samples based on butterfly pea extract were prepared. The samples differed in color intensity, acidity, taste, and overall acceptability. The beverage had a bright blue color before acid addition and changed to purple after adding citric acid and ascorbic acid.

Table 1.

Organoleptic and physicochemical parameters of beverage samples

Sample	Color	Taste	pH	Titratable acidity, %	Overall quality
Sample 1	Light blue	Weak taste	4.8	0.20	Satisfactory
Sample 2	Bright purple	Pleasant, balanced	4.2	0.32	Good
Sample 3	Dark purple	Sour taste	3.6	0.45	Acceptable

The best result was observed in **Sample 2**, which had a pleasant taste, attractive purple color, acceptable acidity, and stable appearance. Sample 1 had low acidity and weak color intensity, while Sample 3 had a more sour taste due to the higher amount of acid.

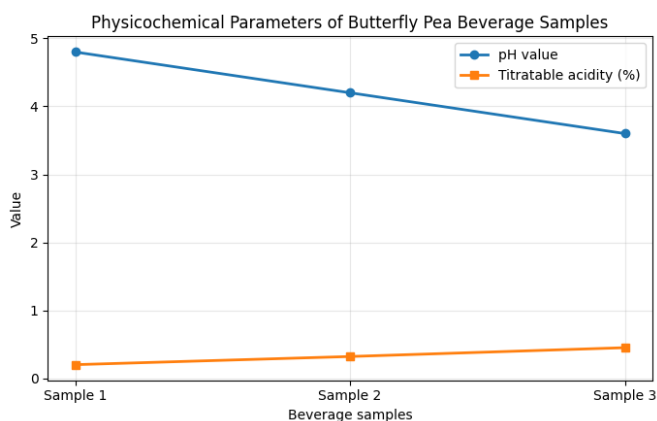


Figure 1. Changes in pH and titratable acidity of functional beverage samples based on butterfly pea extract.

As shown in Figure 1, the pH value decreased from Sample 1 to Sample 3, while titratable acidity increased. Sample 2 showed the most balanced result, with acceptable acidity and good sensory properties. Therefore, this sample was selected as the optimal formulation.

The obtained results showed that butterfly pea extract can be successfully used as a natural colorant and functional ingredient in beverage production. The pH value directly influenced the color change of the beverage, confirming the pH-sensitive properties of anthocyanins found in butterfly pea extract.

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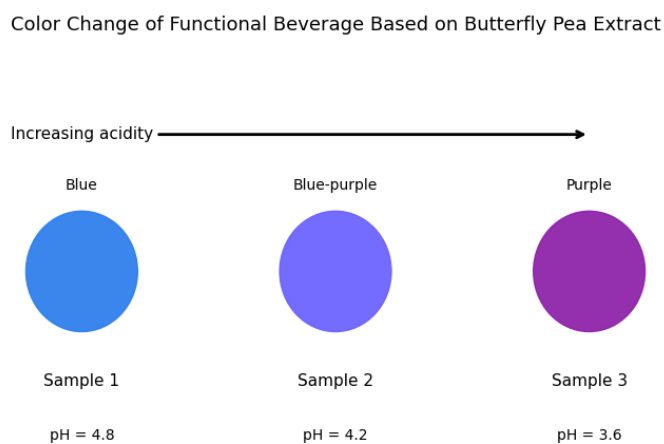


Figure 1. Color change of the functional beverage based on butterfly pea extract depending on acidity.

DISCUSSION

The obtained results show that butterfly pea extract can be effectively used in the formulation of a functional beverage. The color change from blue to purple was mainly caused by the reaction of anthocyanins with citric acid and ascorbic acid, which reduced the pH of the beverage.

Sample 2 showed the best balance between color, taste, and acidity. This indicates that the optimal amount of acid improves not only the visual appearance but also the sensory quality of the beverage. In Sample 1, the color and taste were weak because of low acidity, while Sample 3 had a sour taste due to excessive acid addition.

These results are consistent with previous studies showing that butterfly pea anthocyanins are sensitive to pH changes and can act as natural colorants in food and beverage systems. The main advantage of the developed beverage is its natural composition, attractive color-changing effect, and potential functional value. However, color stability during long-term storage may be limited and requires further investigation.

The developed formulation can be practically applied in the production of innovative functional beverages, especially as a natural alternative to synthetic colorants.

CONCLUSION

The study showed that butterfly pea (*Clitoria ternatea* L.) extract can be used as a natural and functional ingredient in beverage production. The prepared beverage had an attractive blue-purple color, pleasant taste, acceptable acidity, and stable appearance. Among the tested samples, Sample 2 showed the best organoleptic and physicochemical properties. The color change of the beverage was mainly related to the pH-sensitive anthocyanins present in butterfly pea extract. Further studies should focus on long-term storage stability and consumer acceptability of the developed product.

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