JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Anthocyanin Extract from Rose Petal as an Acid-Base indicator

Kavita Patel, Amisha Yadav, Shagufta Naaz

Department of Chemistry O.P. Jindal University Punjipathra Raigarh (C.G.)

Abstract

The goal of the study is to create an acid-base indicator using rose petal extract. Anthocyanin, a blue, violet, or red flavonoid pigment found in roses, is acidity (pH) sensitive. The information suggests that the rose may be a natural signal. A material whose color can be altered to indicate an acidic or basic solution is called an acid-base indicator. An indicator's job is to show if a solution's characteristics are basic or acidic. The color of the acid-base indicator changes according on the PH level. The process for extracting anthocyanin from rose petals involves first preparing 20 grams of petals, then 200 milliliters of distilled water, and last immersing the petals in the water inside a 250 milliliter beaker. The mixture is then brought to a boil for fifteen minutes. The rose petal's anthocyanin is removed after 15 minutes, and it is then used as a naturally occurring, more cost-effective, long-lasting acid-base indicator. Plant-based color compounds have numerous uses in the food, nutraceutical, and cosmetic industries. With the identification of putative important regulatory genes, the biosynthetic pathway for anthocyanins has been well-established, allowing for the manipulation of their synthesis by biotechnological methods. Anthocyanins have been produced under controlled settings using a variety of biotechnological systems, such as in vitro plant cell or tissue cultures and microorganisms; nonetheless, a wide range of parameters affect their creation. A practical technique for obtaining anthocyanins from roses.A methanolic solution of 3% citric acid was shown to be a more convenient way of extracting anthocyanins from rose blossoms (Rosa rosa), with a higher anthocyanin yield than a methanolic solution of 0.1% hydrochloric acid. It has been demonstrated that the extract's hue changes from dark pink to mehdi green when its pH is adjusted from 2 to 9.

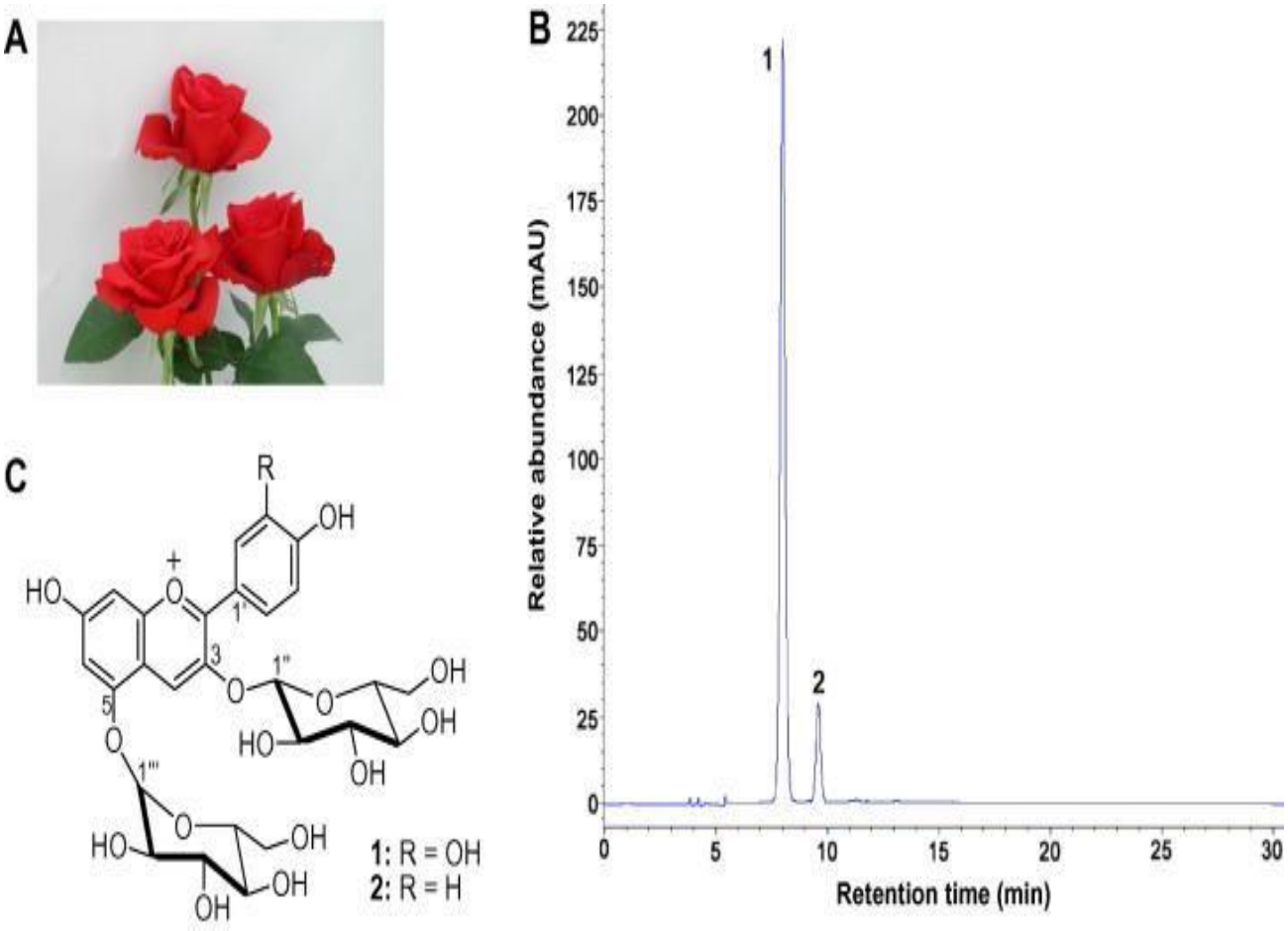
Keywords: Anthocyanin, Acid – Base indicator, glycocyanation, Sugar molecules, acyl group

Introduction:

Chemicals known as acid-base indicators are used to determine the acidity, neutrality, or alkalinity of an aqueous solution. Since alkalinity and acidity are related to pH, they are also referred to as pH indicators. Every pH indicator has a color shift based on whether it accepts or donates protons. Plant pigments can function as acid-base indicators. A pH indicator is simply a weak acid with differently colored acid and conjugate base forms. As a result, pH indicators are themselves acids or bases. Many flowers, fruits, and vegetables contain chemical substances that change color of solution at different pH values.The plant pigment called anthocyanin, which gives poppies their red color, cornflowers their blue color, and red cabbage their purple color, is arguably the most easily accessible acid/base indicator. The goal of the project is to create anthocyanin, a naturally occurring acid base indicator. which is more resilient, cost-effective, and less polluting. The following is a list of researchers who have employed anthocyanin as an acid-base indicator: Common flowers such as Hibiscus rosa-sinensis, Ipomoea fistulosa, and Clitoria turnetea have different anthocyanin pigments in the form of purple-red, violet, and blue colors, respectively. These pigments can be economically used as markers of acidity or alkaliity. When acid is present, the acetone extracts of the pigments become red and exhibit maximum absorption at 500 nm (for H. rosa-sinensis) or 525 nm (for I. fistulosa and C. turnetea). Depending on the flowers utilized, the extracts turn green when treated with alkali and have a higher absorbance in the 575–625 nm depending upon the flowers used. A potential chemicalindicator from pheasant's eye.

The pure pigments' spectroscopic data show that altering the aqueous medium's ambient pH caused a shift in the colors' wavelength maxima. Wavelength maxima changed from 421 nm (yellow) to 552 nm (green) between pH 5 and 7, and then they changed back to 421 nm (yellow) at pH 12.1 to 13.0. In vitro pigment extension demonstrated greater stability compared to in vivo. Plant pigments as markers of acid-base - an experiment using red cabbage anthocyanin pigment extracts [1].The solution was combined with different acid and base strengths while the pH range and color were being watched. Hueseyin (2006) was the one who patented the red cabbage litmus paper [2].Using this procedure, red litmus paper is made by soaking up the pink juice of red cabbage, which may have been prepared by adding additional acids or citric acid. Blue litmus paper is made by soaking up the blue liquid of red cabbage to copy paper. Red cabbage's pH-changing anthocyanin pigments serve as a signal. As natural acid-base indicators, some plant blooms can be useful, as Soltan et al. (2002) [3] have shown. They have used the blossoms of the following plants: Hibiscus subdariffa, Bombax ceiba L., Poinciana regia, and Celosia cristate Linn. These blooms are used as pH indicators because they contain anthocyanin pigments, whose color depends on pH.

.



Structure of anthocynine

Anthocyanins are pigments that belong to the flavonoid group, specifically derived from anthocyanidins (the aglycone form) linked to sugar molecules. These compounds are responsible for the red, purple, and blue colours in many plants. Below is a detailed breakdownof the structure of anthocyanins.

Basic Structure

The basic structure of an anthocyanin consists of three main parts:

1. **Anthocyanidin Backbone (Aglycone)**
2. **Sugar Molecules (Glycosides)**
3. **Acyl Groups (optional)**

1. Anthocyanidin Backbone

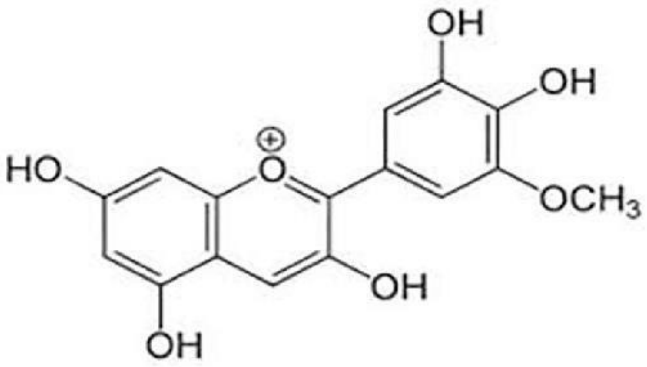
The core structure of anthocyanin is the anthocyanidin, which is a flavylium ion (a 2-phenylbenzopyrylium cation). The anthocyanidin consists of three rings labeled A, B, and C.

Common Anthocyanidins:

1. **Cyanidin**: 3,5,7,3',4'-Pentahydroxyflavylium
2. **Delphinidin**: 3,5,7,3',4',5'-Hexahydroxyflavylium
3. **Pelargonidin**: 3,5,7,4'-Tetrahydroxyflavylium
4. **Peonidin**: 3,5,7,3',4'-Pentahydroxy-4'-methoxyflavylium
5. **Malvidin**: 3,5,7,3',4',5'-Hexahydroxy-3',5'-dimethoxyflavylium
6. **Petunidin**: 3,5,7,3',4',5'-Hexahydroxy-3'-methoxyflavylium

2. Glycosylation (Attachment of Sugar Molecules)

Anthocyanidins are typically glycosylated at the C3 position, sometimes at the C5 position. Glycosylation enhances the water solubility and stability of the anthocyanins.



Structure of anthocyanin

Role of Anthocynin in plants

Anthocyanins play several important roles in plants, contributing to their survival, reproduction, and overall fitness. These water-soluble pigments are part of the flavonoid groupand are responsible for the red, purple, and blue colors observed in many flowers, fruits, and leaves. Here are the key roles of anthocyanins in plants[4-6]

1. Attraction of Pollinators and Seed Dispersers:

- **Flower Coloration:** Anthocyanins contribute to the vibrant colors of flowers, which attract pollinators such as bees, butterflies, and birds. The visual appeal of anthocyanin-rich petals enhances the chances of pollination, thereby aiding in plant reproduction[7].
- **Fruit Coloration:** The colors of fruits, often due to anthocyanins, attract animals and birds that help in seed dispersal. Brightly colored fruits are more likely to be eaten, andthe seeds are dispersed through the animals' droppings, facilitating plant propagation.

2. Protection Against Environmental Stresses:

- **UV Radiation Protection:** Anthocyanins absorb UV light, protecting plant tissues from harmful UV radiation. This helps in reducing the risk of DNA damage and other cellular injuries caused by UV exposure.
- **Cold Tolerance:** Anthocyanins can accumulate in plant tissues during cold stress, contributing to the protection of cells against freezing damage. They help stabilize cellular membranes and protect plants from cold-induced oxidative stress.
- **Drought and Salt Stress:** These pigments play a role in mitigating the effects of drought and salt stress by modulating the plant's osmotic balance and reducing water loss. They also help in scavenging reactive oxygen species (ROS) generated during these stress conditions.

3. Interaction with Other Pigmen

- **Color Modulation:** Anthocyanins interact with other pigments, such as chlorophyll and carotenoids, to create a wide range of colors[8] This interaction can enhance the visualappeal of flowers and fruits, aiding in the ecological functions mentioned above.
- **Adaptive Advantage:** The ability to produce diverse colors through anthocyanin and other pigment interactions can provide adaptive advantages in different environments,helping plants to attract specific pollinators or deter particular herbivores.

4. Defense Against Herbivores and Pathogens:

- **Antioxidant Activity:** Anthocyanin have strong antioxidant properties, which help in neutralizing reactive oxygen species produced during pathogen attacks or herbivore feeding. This reduces oxidative damage and enhances the plant's defense mechanisms.
- **Deterrence of Herbivores:** The presence of anthocyanin in leaves and stems can deter herbivores due to their bitter taste and potential toxicity. This makes the plant less palatable and reduces the likelihood of being eaten [9]
- **Pathogen Resistance:** Anthocyanins can inhibit the growth of certain pathogens, including bacteria and fungi, by acting as antimicrobial agents. This enhances the plant's resistance to infections and diseases.

5. Physiological Roles:

- **Photosynthesis Regulation:** In some plants, anthocyanins help in regulating photosynthesis by absorbing excess light that can damage the photosynthetic machinery. This is particularly important in high-light environments where excessive light can lead to photoinhibition.
- **Leaf Senescence and Seasonal Changes:** The accumulation of anthocyanins inleaves during autumn contributes to the red and purple colors seen in many deciduous trees. This process is part of leaf senescence and may help in protecting leaves during the final stages of their life cycle, ensuring efficient nutrient recovery before leaf drop.

ROSE Anthocynin as natural acid base indicater

Enthocynine extracted from rose serve

as natural indicater which is less polluted, more economical and more durable**.** Using anthocyanin extract from rose petals as an acid-base indicator is an effective and visually appealing method for demonstrating pH changes. This natural indicator can be prepared andtested using simple laboratory techniques.

Scientific Background

Anthocyanin are water-soluble pigments found in the vacuoles of plant cells, responsible for the red, purple, and blue colour observed in many flowers, fruits, and leaves. These pigments change colour depending on the pH of their environment:

- **Acidic Conditions (pH < 7):** Typically red to pink
- **Neutral Conditions (pH ~ 7):** Typically purple
- **Basic Conditions (pH > 7):** Typically blue to greenish-yellows

Material And Methods

Chemical:

Hydrocloric acide, acidic acid, ammonia,distiled water.

Rose flower leaves were collected and they were kept in cold (20c) and dark storage untilprocessed.

Anthocynine extraction

step-1=20 grams of rose petals were prepared Step-

2=next 200ml of distilled water prepared.

Step-3=Then ,the rose petal were submerged in the water inside a 250ml Biker.Step-

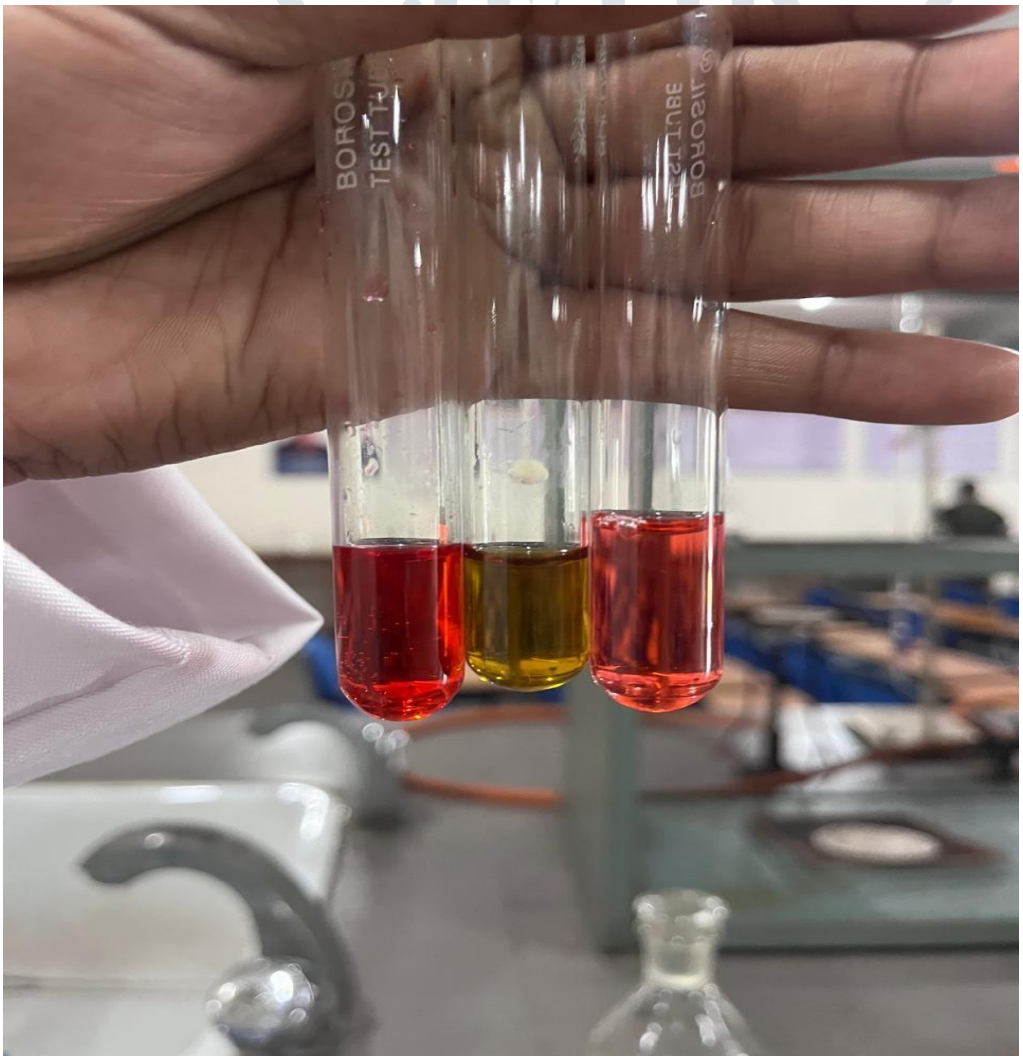
4=The mixture is boiled for 15 minutes

Step-5=After boiling,the Extract is cooled for 10 minutes,then the extract is poured into a new250 ml beaker.

Step-6=After extraction anthocynine is applied to each compound using a dropper

=>

Rose petal	Extracted Anthocynin



Observation Table 01

S.No.	Chemical	Colour
1	Cl	ed colour
2	cetic acid	ight orange

3	mmonia	live green

1.Anthocynin turns HCL dark red colour

2Anthocynin turn acetic acid lightest range

3.Anthocynin turn ammonia olive green

APPLICATION OF ROSE PETAL

Rose petals have various applications, including:
1. Use in Cooking: Rose petals are added to food to enhance flavor, scent, and presentation. They work well in salads, desserts, teas, jams, and syrups when used fresh or dried.

2. Aromatherapy and Perfumery: Because of their pleasant, flowery aroma, rose petals are a common element in aromatherapy and perfumery. They are utilized in the production of fragrances for personal care items, rose water, and essential oils.

3. Medical Uses: Due to its possible anti-inflammatory, antioxidant, and calming effects, rose petals have been utilized in traditional medicine. They are frequently found in teas, cosmetics products, and herbal medicines.[10–12]

4.Creative Purposes: Rose petals are used as decorations for religious ceremonies, weddings, and other special occasions. They can be put to bathtubs for a posh experience, placed on tables, or used to create garlands.

5. Crafts and Do-It-Yourself Projects: Dried rose petals can be used for a variety of crafts and do-it-yourself projects, such as pressed flower art, potpourri, sachets, and homemade candles.

6. Symbolic Meanings: Love, passion, beauty, and spirituality are all connected to roses and rose petals. To express these feelings, they are frequently employed in rites, ceremonies, and festivities. Of course, here are a few more uses for rose petals:

7. Skincare: Because rose petals are moisturizing, calming, and anti-inflammatory, they are used in skincare products. They are present in facial.

8. Hair Care: Rose petals are infused into hair care products such as shampoos, conditioners,and oils to promote scalp health, stimulate hair growth, and add shine and fragrance to the hair.

9.Herbal Remedies: Rose petals are used in herbal remedies for various ailments, including digestive issues, menstrual cramps, and respiratory problems. They can be consumed as tea orincorporated into herbal preparations.

10.Natural Dyes: Rose petals can be used as a natural dye to color fabrics, yarns, and other materials. Depending on the method of extraction and treatment, rose petals can yield a rangeof shades from pale pink to deep red.

11. FloralWater: Rose water, a byproduct of the steam distillation process used to extractrose essential oil, is used in cooking, skincare, and aromatherapy. It adds a delicate floralflavor and fragrance to dishes and products.

12. Herbal Infusions: Rose petals are often steeped in hot water to make herbal infusions or teas, which are consumed for their aromatic, calming, and therapeutic properties. Rose tea isenjoyed for its subtle floral taste and potential health benefits.

13. The concomitant presence of the six most common anthocyanidins suggested that R. alaternus berries, besides being a good pigment source, could also be a useful tool for anthocyanin identification[13-14].

These additional applications highlight the versatility of rose petals in various industries,from beauty and wellness to culinary and textile.

Conclusion:

Chemicals called acid-base indicators are used to assess if an aqueous solution is neutral, alkaline, or acidic. The color of each PH indicator varies according on whether it is donated or not.Rose anthocyanin is a naturally occurring, cost-effective, and long-lasting indicator. Additionally, it serves a number of crucial functions in plants, including attracting pollinators, shielding them from environmental stress, and providing defense against infections and herbivores [15–16].The process for removing anthocyanin from rose petals involves first preparing 20 grams of rose petals. The rose petals are then immersed within the mixture, which is then brought to a boil for 15 minutes. During this time, the rose petals' anthocyanin is extracted, which can then be used as a naturally occurring acid-base indicator.As a result, pH indicators are bases or acids in and of themselves. Based on its chemical alterations, rose anthocyanin was chosen as a natural color to represent particular pH values. Rose flower extract is recommended in this work as a pH indicator in the form of either solutions. The 883 Padma S. Vankar et al. (2010) EJEAF Che, 9.(5). [875-884] From the acidified methanolic extracts of the rose flower, pH indicator solutions were made.[17] Acid-base titrations are a basic chemical subject that can be taught using indicator solutions that change color due to variations in pH. Rosa rosa methanolic extract was acidified and utilized as novel indicators in quantitative measurement of HCl and NaOH solution standardization. Impact of employing such organic using such natural extracts as indicators gave quantitative results as compared with conventional indicators with good agreement.

REFERENCES :

1. M. Forster, Journal of Chemical Education, 55(2) (1978) 107.
2. E. M. Hueseyin, Turk. Pat. Appl. (2006), TR 2004001355 A2 20060123.
3. M.E. Soltan, S.M. Sirry, Journal of the Chinese Chemical Society, 49 (1) (2002) 63.
4. https://www.researchgate.net/publication/266880732_Rose_anthocyanins_as_acid_base_indicators
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10758878/#:~:text=The%20hierarchical%20structures%20of%20rose,to%20the%20popular%20material%20graphene.
6. https://www.researchgate.net/publication/266880732_Rose_anthocyanins_as_acid_base_indicators
7. https://www.mdpi.com/2223-7747/12/13/2558
8. http://dspace.bsu.edu.ru/bitstream/123456789/17258/1/Tokhtar_Rose%20Flower%20Petal s.pdf
9. https://www.jpsr.pharmainfo.in/Documents/Volumes/ispst2018/jpsr112018con11.pdf
10. R. Willstätter, A. E. Everst, Justus Liebigs Ann. Chem., 401 (1913) 189
11. I. Jansons, Natural pH Indicators: What are they and how do they work?, Chapter 8: Acids and Bases, Nelson Science (2001) 10.
12. O. Phanstiel , Journal of Chemical Education, 62 (1985) 322.
13. L.R. Summerlin, Chemistry of Common Substances, Silver Burdett, New York, 1986.
14. http://antoine.frostburg.edu/chem/senese/101/features/water2wine.shtml
15. B. Bose, National Academy Science Letters, 6(8) (9183) 249.
16. M.K. Hammouri, K.I. Ereifej, M.M. Ajlouni, R.A. Shibli, G.N. Al-Karaki,. International Journal of Chemistry 10(2) (2000) 151.
17. L. Longo, and G. Vasapollo, Food Chemistry, 94(2) (2006) 226.