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ORIGINAL ARTICLE

Detection And Quantification of High Levels of Sucrose Content in Marketed Pomegranate (*Punica Granatum*) Juice By Using FT-IR Spectroscopy

Vinod Kumar Kondreddy[1], Harish Naidu Talluru[1], Ankanna[1], Sanjeeva Kumar Avvari[2*]

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Abstract

Aim of the study was to Detect and Quantify High levels of Sucrose content in marketed Pomegranate (Punica granatum) juice by using FT-IR Spectroscopy. The pomegranate fruits were squeezed manually and centrifuged (Make Sorvall, USA, and Model Super T21) at 5000 rpm for 5 min and filtered with muslin cloth to get the clear juice followed by previously weighed sucrose with usage of de-ionised water. Sucrose solutions were prepared by simple stirring, with various concentrations, which represents the sucrose content. Firstly FT-IR (OPASS software) instrument was calibrated by using standard protocol. Compare the obtained spectrum with reference spectrum for wave numbers of 1583 cm-1 to 1589 cm-1, then the % T should be greater than 12% and 2858 cm-1 to 2870 cm-1, the % T should be greater than 18%. After calibration of the FT-IR measure the samples with the scan speed of per sample were 0.2 cm-1. Fourier transformed infrared transmittance spectra were obtained for all samples at room temperature 24±1ºC in the wave number ranging from 4000 cm-1 to 550 cm-1, five scans were performed for each sample and average spectrum was saved for further analysis. ATR-FTIR spectral data was used to predict the adulteration of pomegranate juice by added sucrose. The excess consumption of sucrose present in pomegranate fruit is always associated with obesity, type 2 diabetes, cardiovascular disease, tooth decay, certain cancers, and non-alcoholic fatty liver diseases. It should be regulated by food control authorities, especially fruit drinks marketed to children.

Keyword: *Punica granatum*, ATR-FTIR, Sucrose content and food safety

Introduction

The Pomegranate, botanical name is Punica granatum belong to the family Lythraceae. It is a fruit bearing small tree or deciduous shrub; it grows 5 to 8 meters height. Widespread in central Asia, the Caucasus, south-west Asia and the Mediterranean. By drinking of pomegranate juice increases metabolic rate, boosts immune system, increases haemoglobin content, maintains healthy cholesterol level, controls blood sucrose level, controls blood pressure, anti-aging benefits, skin rejuvenation and for treatment acne. It contains high levels of anti-oxidants greater than other food juices, green tea, and red wine etc. (Sanigorski and Bell, 2006). The pomegranate is an exotic fruit that has been mentioned in literature as old as the Bible, but the juice of the pomegranate is more widely consumed than the fruit itself. Pomegranate juice contains a negligible amount of vitamin C, 0.2 mg in a 1 cup

***Corresponding author: Sanjeeva Kumar Avvari**
Email: avvarisanjeev@gmail.com

[1]Department of Pharmaceutical Analysis, Raghavendra Institute of Pharmaceutical Education and Research (Autonomous), Chiyyedu Post, Ananthapuramu, Andhra Pradesh, India -515721

[2]Amity Institute of Pharmacy, Amity Unıversity Bengaluru, Opp. to Bengaluru Rural DC Office, NH - 648, Devanahalli - Doddaballapura Road, Bengaluru, Karnataka - 562 110

serving, which isn't even 1 percent of the recommended daily value. But it does contain other vitamins and minerals that are beneficial to overall health, according to the USDA National Nutrient Database. The vitamin with the highest content in pomegranate juice is K. Best known for its ability to promote the proper clotting of blood, vitamin K is essential to health, as without it people could bleed to death. A 1-cup serving of bottled pomegranate juice contains 25.9 micrograms of vitamin K, or 32 percent of the recommended daily intake. (Committee on nutrition, 2001). Pomegranate juice contains several B vitamins, the highest of which is folate. Also known as vitamin B9, folate plays a role in several vital bodily functions such as the production and maintenance of healthy DNA and the production of new blood cells. (Vikas et al., 2001). The NIH Office of Dietary Supplements states that folate is especially important to have in your body during times of rapid cell growth, such as pregnancy and the early childhood growing years. A 1-cup serving of pomegranate juice contains 59.8 micrograms of folate, or 15 percent of the RDI (Alexiou and Franck, 2008). Pomegranate juice contains a trace amount of vitamin E in a 1-cup serving, with 0.9 mg or 5 percent of the RDI. The Linus Pauling Institute reports that the primary role of vitamin E is its action as an antioxidant vitamin. Antioxidants protect your cells from damage caused by free radicals, which are unstable molecules produced during oxidation (Järvinen et al., 2005). These free radicals can lead to cellular and DNA damage which may lead to serious chronic diseases, including cancer. The pomegranate juice provides good health apart from this interfere with some prescribed drugs like anti-lipidamics (to treat high cholesterol levels), anti-hypertensive's (to treat high blood pressure). If pomegranate juice taken with rosuvastatin causes kidney failure.

But consumption of fruit juice containing high levels of sucrose causes severe health problems in children's and adults. Especially most of children facing obesity as a major problem.

Materials & Methods

Material Collection

High graded pomegranate fruits and sucrose were collected from the local supermarket. Three commercial pomegranate fruit juices were purchased based on their brand value.

The purchased items were preserved in refrigerator (24^0C) for further use.

Sample preparation

The pomegranate fruits were squeezed manually and centrifuged (Make Sorvall, USA, and Model Super T21) at 5000 rpm for 5 min and filtered with muslin cloth to get the clear juice. Followed by previously weighed sucrose with usage of deionised water sucrose solutions are prepared by simple stirring, with the concentration 5% w/w, 10% w/w, 15% w/w, 20% w/w, 25% w/w, 30% w/w, which represents the sucrose content present in commercial branded pomegranate fruit juice. These prepared samples were kept at room temperature for stabilization (Jha and Gunasekaran, 2010)

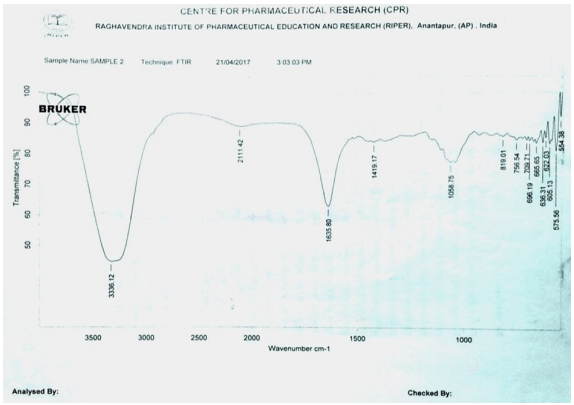
Procedure

Firstly FT-IR (OPASS software) instrument was calibrated by using polystyrene film, because it contains all functional groups executed in entire IR region. Polystyrene film was made by the polymer of styrene. It's having highly durability and stabled at any temperature. Put the reference polystyrene film in (0.05 mm thick) the sample holder and scan. Compared the obtained spectrum with reference spectrum for wave numbers of 1583cm-1 to 1589 cm-1, then the % T should be greater than 12% and 2858 cm-1 to 2870 cm-1, the % T should be greater than 18%. After calibration of the FT-IR measure the samples with the scan speed of per sample were 0.2 cm-1. Fourier transformed infrared transmittance spectra were obtained for all samples at room temperature 24±1ºC in the wave number ranging from 4000Cm-1 to 550Cm-1, five scans were performed for each sample and average spectrum was saved for further analysis.

Qualitative and Quantitative analysis

By the observing the obtaining spectrum for each sample the wave number ranging from the 1034 Cm -1-1064 Cm-1, and the functional groups were detected exclusively for sucrose. We quantified the sucrose content by plotting the linearity graph between concentration vs % transmittance of standard

sample with added sucrose. The linearity plot gives regression (R2) value 0.9937. By substituting the % transmittance values of commercial branded fruit juice in regression equation sucrose concentration were calculated (Daniel Kelly and Gerard downey, 2005; leopold and leopold, 2011).



Results and Discussion

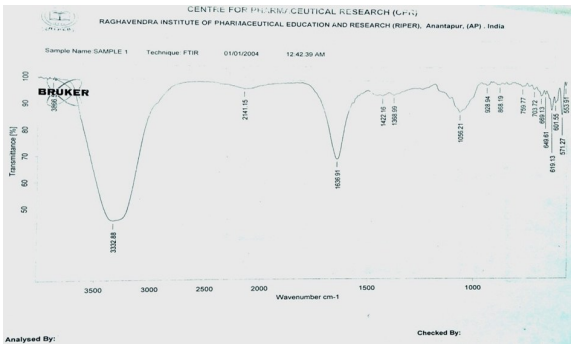


Fig.1: FT-IR spectra for brand -1 (commercial) fruit juice.

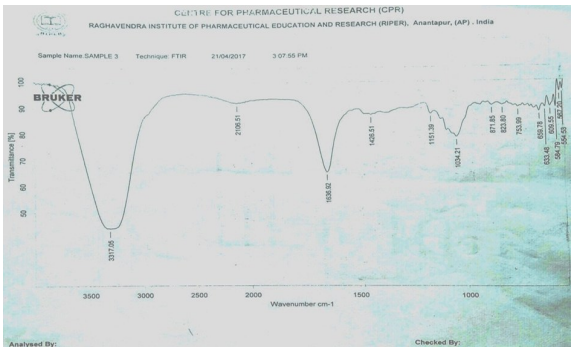


Fig. 2: FT-IR spectra for brand -2 (commercial) fruit juice

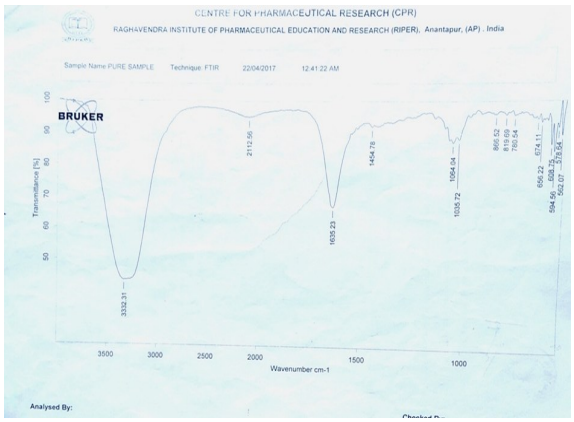


Fig. 4: FT-IR spectra for pure pomegranate sample

Table 1: Linearity studies

S. No.	Concentration of sucrose solution per 100ml	% Transmittance
1	5%	92
2	10%	89
3	15%	87
4	20%	85
5	25%	82
6	30%	79

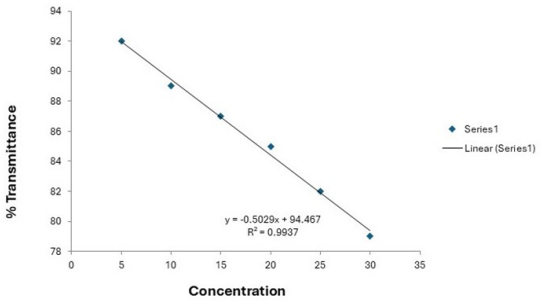


Fig. 5: Linearity plot for concentration *vs* % transmittance

Table 2: sucrose content in marketed pomegranate juice

S. No.	Fruit juice (marketed)	% sucrose content as per label (gr./100 ml)	Detected and quantified amount (gr./100 ml)
1	Brand-1	10	14.84
2	Brand-2	12	30.75
3	Brand-3	10	26.77

Conclusion

TR-FTIR spectral data can be used to predict the adulteration of pomegranate juice by added sucrose. It is a simple technique for identification and quantification purpose. By the excess consumption sucrose present in pomegranate fruit always associated with obesity, type 2 diabetes, cardiovascular disease, tooth decay, certain cancers, and non-alcoholic fatty liver diseases. It should be regulated by food control authorities, especially fruit drinks marketed to the children's.

List of abbreviations

FT-IR : Fourier Transform Infrared Spectroscopy

Disclosure

Ethics approval and consent to participate

Not Applicable

Consent for publication

Not Applicable

Availability of data and materials

Data are available upon reasonable request.

Competing interests

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Authors' contributions

All authors are equally contributed to this work.

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