ISSN : 0974 - 7451 Volume 8 Issue 3

Trade Science Inc.

Environmental Science
An Indian Journal

Current Research Paper

ESAIJ, 8(3), 2013 [103-105]

Determination of heavy metal content of grape juice concentrate

Ali Mohamadi Sani
Department of Food Science & Technology, Quchan Branch, Islamic Azad University, Quchan, (IRAN)
E-mail : mohamadisani@yahoo.com; msani@iauq.ac.ir

ABSTRACT

Grape juice concentrate (GJC) is evaporated, concentrated and shelf-life extended form of grape syrup. In the traditional production, a certain white soil is used as the clarifier material in the production of GJC which may deliver some heavy metals to the final product. So this study aimed to determine some heavy metals in GJC samples produced by traditional method. For this purpose twenty GJC samples were supplied from local supermarkets of 9 cities in Khorasan province in Iran. Heavy metals including Arsenic, Lead, Mercury, Cadmium, Tin, Calcium, Magnesium and Iron were determined by ASS method. The average content of the mentioned metals detected as follows: Arsenic 8.2 ppb, Lead 36.6 ppb, Mercury 1.4 ppb, Cadmium 0.37 ppb, Tin 4.9 ppm, Calcium 817 ppm; Magnesium 1704 ppm and Iron 60ppm. These results show that GJC is nutritious because of the Mg and Fe content, but a risk of heavy metal poisoning also exist.

KEYWORDS

Grape juice concentrate;
Traditional products;
Heavy metals;
Food safety.

INTRODUCTION

Grape juice concentrate (GJC) is evaporated, concentrated and shelf-life extended form of grape syrup or the other berries and fruit juices. Since ancient times, evaporated grape syrup has been traditionally produced in most Iranian regions by using varieties of grapes. The color of the GJC changes from dark brown to white depending on the processing conditions, concentration, types of bleaching agents, heat and mixing rate. GJC contains important daily value of nutrition, caloric value and aroma compounds. Since GJC contains high amounts of sugar, minerals and organic acids, it is an important food product in human nutrition[1]. GJC is easily assimilated because it mostly consists of carbohydrate in the form of monosaccharides like glucose and fructose. Furthermore, GJC supplies approximately 1226 kJ/100 g of energy and also contains important organic acids and mineral matters[2,3]. GJC is a rich source of chemical elements essential to human body, such as copper, zinc and iron. Iron contained in GJC may be useful in the treatment of anemia patients[2,3]. Clarification ways of GJC are similar to those of clarification of grape juice. In fruit juice industry, clarification is a unified process that comprises the elimination of undesired color and flavor; turbidity; bitterness and gassy[4]. In the process of clarification, clarifiers are utilized which are combined with charged particles of fruit juice such as protein, pectin and phenolic materials and are consequently separated from the environment. Usual clarifiers in fruit juice industry are bentonit, gelatin and silicasol[5], but in traditional production, a certain white

soil called GJCS is used as the clarifier material in the production of GJC. In addition to depositing suspending material, the soil neutralizes the acidity of the grape juice[6] but this soil might deliver some heavy metals to the final product. So the aim of this study was to determine some heavy metals in GJC samples produced by traditional method.

MATERIALS AND METHODS

The GJC samples (20) were supplied from local supermarkets of 9 cities in Khorasan province according to TABLE 1. In this study the GJC samples had been prepared using a certain white soil called grape juice concentrate soil as the clarifier material. Heavy metals including Arsenic (As), Lead (Pb), Mercury (Hg), Cadmium (Cd), Tin (Sn), Calcium (Ca), Magnesium (Mg) and Iron (Fe) were determined by ASS method.

Preparation of GJC Samples for Atomic Absorption Spectroscopy (AAS)

After mixing the samples very well to obtain homogenity, 10g of the samples weighed in a borosilicate glass beaker and the dry ashing method advised by Jorhem (1993) was applie[7]. Later, ash was diluted to 10 ml with 10% of nitric acid (Merck).

Preparation of standards of trace elements

Five standards were set for the calibration of the AAS to determine trace elements. These concentrations were different from metal to another one. The calibration curve of well prepared standard and an accurate Atomic Absorption Spectrophotometer should present as a linear curve.

Apparatus

An Analytik Jena, ContrAA 700 AAS (Jena, Germany) equipped with a GFAAS was used in the experiments. Aspect CS Version 1.5.1 software was used. The operating parameters for working this element were set as recommended by the manufacturer.

Statistical analysis

The data of metals concentrations were analysed by Excell 2007 and results presented as X±SD.

RESULTS AND DISCUSSION

Metals concentrations in GJC samples

Grape contains valuable minerals such as calcium (840–866 ppm) and iron (50–100 ppm). The high iron content makes it a recommended treat for anemia[8]. So we expect that grape juice concentrate to be rich of these minerals. In the production of GJC, the grape juice is concentrated about 5-6 times and we expect the nutritious metals to be increased in GJC as the same rate, but the results in TABLE 1 shows that the average content of calcium and iron was 817 and 60 ppm respectively which is equal to the grape samples. However GJC composition deviates due to grape type and production conditions (such as equipments, filter aid,

TABLE 1: Heavy metals content of GJC samples

Region	No. of samples	As (ppb)	Pb (ppb)	Hg (ppb)	Cd (ppb)	Sn (ppm)	Ca (ppm)	Mg (ppm)	Fe (ppm)
Mashad	4	7.5	0	1.2	2	40	910	2082	5
Kashmar	2	0.1	31.9	0.9	0	<0.2	210	1175	5
Torbat-e-heydarie	2	10.1	0	2.1	0	2.7	390	1890	78
Qaaen	2	9.9	0	0.1	0	<0.2	2540	2398	34
Birjand	2	3.1	218	0	1.3	<0.2	740	1292	30
Bojnourd	2	23	0.1	0.9	0	<0.2	630	1058	18
Gonabad	2	20	0	2.2	0	<0.2	500	2250	331
Qouchan	2	0.1	1	1.6	0	<0.2	390	1270	11
Sabzewar	2	0	78	3.3	0	<0.2	1040	1925	28
Average	-	8.2	36.6	1.4	0.37	4.9	817	1704	60
SD	-	8.6	73	1.1	0.75	13.2	698	507	104
Maximum	-	23	218	3.3	2	40	2540	2398	331

Stated values represent the average of two replicate assays

clarifying agent and environmental conditions). We think that in the clarification stage, some elements are also removed in the precipitate. Also the average content of the other metals were as follows: Arsenic 8.2 ppb, Lead 36.6 ppb, Mercury 1.4 ppb, Cadmium 0.37 ppb, Tin 4.9 ppm and Magnesium 1704 ppm. But no limit has been defined for these pollutants in GJC in Iranian standard organization. The national standard no 12968, on fruit juices has limited the heavy metals as described in TABLE 2. According to this standard, only lead has a limit concentration equal to 0.05 ppm and the Pb content of GJC samples is 36.6 ppb which is lower than this standard. The other heavy metals, except for tin, are lower than 50 ppb. Tin is a heavy metal which imparts to the food goods specially when the container or processing vessels are tin coated.

TABLE 2 : Acceptable dosage for heavy metals in fruit juices according to Iranian national standard

Heavy metal	Accepted limit (ppm)
Arsenic	--
Lead	0.05
Cadmium	--
Mercury	--
Tin	--

According to the other studies pekmez (local name of GJC in Turkey) contained: Calcium: 51-206 mg/100g; Sodium: 25-83 mg/100g; Manganese: 11-68 mg/100g; Phosphorus: 81-95 mg/100g; Magnesium: 140 mg/100g; Iron: 2.6-16 mg/100g; Cupper: 0.3-0.9 mg/100g and Zinc: 0.2-0.7 mg/100g[3, 9]. One of the main intervening agents on the qualitative properties of GJC is the type of clarifying agent used. Clarification is a unified process that comprises the elimination of undesired color, aroma and flavor; turbidity; bitterness and gassy[4]. In the process of clarification, clarifiers are utilized which are combined with charged particles of fruit juice such as protein, pectin and phenolic materials and are consequently separated from the environment. When soil is used as the clarifying agent, in addition to depositing suspending material, the soil neutralizes the acidity of the grape juice[4].

CONCLUSION

This traditional product is a rich source of chemical elements essential to human body including Iron, Magnesium and Calcium, but some heavy metals also were available in concentrations below 50 ppb except for tin (4.9ppm). If the clarifying agent could be replaced by non-pollutant agents, this food risk will not be existed any more.

REFERENCES

[1] H.Yogurtçu, F.Kamisli; J.Food Eng., **77**, 1064 **(2005)**.
[2] M.I.Aksu, S.Nas; Gida, **21**, 83 **(1996)**.
[3] N.S.Ustun, Ý.Tosun; Gida, **22**, 417 **(1997)**.
[4] K.H.Piruzifard; Clarification of fruit juices. Uuniversity of Jahad, Urmia, **(1999)**.
[5] P.A.Ciullo; Industrial minerals and their uses, A Handbook & Formulary, Noyes Publications, New Jersey, **(1996)**.
[6] Sh.Zomorodi; Storing, processing and quality control of grapes, Agriculture Research and Education Organization, Urmia, **(2005)**.
[7] L.Jorhem; AOAC Int., **76**, 798 **(1993)**.
[8] Ö.Inan, Y.Özdemir; Speciation of Iron in Pekmez, Adnan Menderes University, 4th AACD Congress, 29 Sept-3 Oct.2004, Kusadasý-Aydin/ Turkey Proceedings Book 042.DOC, **(2004)**.
[9] E.Arslan, M.E.Yener, A.Esin; J. Food Eng., **69**, 167 **(2005)**.