Aspartame Determination in Soft Drinks

Ritu¹, Mamta Sharma², Shelly³ and Minakshi Sharma⁴

Department of Zoology, Maharshi Dayanand University, Rohtak, Haryana, India.
sminakshi.2007@rediffmail.com

ABSTRACT

Aspartame is an artificial sweetener used as a substitute for sugar in many soft drinks, beverages and some foods. It is a combination of phenylalanine, aspartic acid and methanol. It has a caloric value of 17 KJ per gram like other protein substance. An Acceptable Daily Intake (ADI) of aspartame is 40-50 mg/kg body weight/day; it helps the diabetics to improve their quality of life. Higher conc. leads to various side effects such as physical weakness, decrease in night vision, insomnia, mental depression, anxiety, feeling aggressive, diarrhea and weight loss etc. So the determination of aspartame in soft drinks and fruit juice is important from biological point of view. Though there are many technique for its estimation but present work will focused on its estimation in the fruit juices by colorimetric method which is easy, cheap and can be done in any lab. Colorimetric method shows best absorbance at 406 nm. These values are compared with standard curve and find out corresponding concentration. Sofit soya milk sample showed highest aspartame value and Delmonte peach showed least value.

Keywords: Aspartame, Artificial Sweetener, Soft Drinks, Colorimetric Method, Ninhydrin, Acetonitrile, Sofit Soya Milk, Delmonite Peach.

1. INTRODUCTION

Aspartame (N-L-X-aspartyl-L-phenylalanine methodic ester) is a low calorie artificial sweetener and composed of aspartic acid, phenylalanine and methanol (R.G. Ranney, 1976). It has a caloric value of 17 KJ per gram like other protein substance. An Acceptable Daily Intake (ADI) of aspartame is 40-50 mg/kg body weight/day was established by US Food and Drug Administration (FDA, 1984). It has also some beneficial effects, as helps the diabetics improve their quality of life and is tooth friendly. Higher level of aspartame leads to various side effects such as physical weakness, decrease in night vision, insomnia, mental depression, anxiety, feeling aggressive, diarrhea and weight loss etc. (John, 2011).

Phenylalanine can be neurotoxic and can affect the synthesis of inhibitory monoamine neurotransmitters; this neurotoxicity of methanol in primates has also been well documented (A.M. Potts, 1955). Elevations in concentrations of phenylalanine and aspartic acid in plasma and could result in increased transport of these amino acids into brain, altering the brain’s neurochemical composition (R.A.Coulombe, 1986).

Aspartame can be synthesized from its constituent amino acids, L-phenylalanine and L-aspartate. Like many other peptides, aspartame may hydrolyze (break down) into its constituent amino acids under conditions of elevated temperature or high pH. This makes aspartame undesirable as a baking sweetener, and prone to degradation in products hosting a high pH, as required for a long shelf life. The stability of aspartame under heating can be improved to some extent by encasing it in fats or in maltodextrin. The stability when dissolved in water depends markedly on pH. At room temperature, it is most stable at pH 4.3, where its half-life is nearly 300 days. At pH 7, however, its half-life is only a few days. Most soft-drinks have a pH between 3 and 5, where aspartame is reasonably stable. In products that may require a longer shelf life, such as syrups for fountain beverages, aspartame is sometimes blended with a more stable sweetener, such as saccharin. Aspartame’s major decomposition products are its cyclic dipeptide (in a 2,5-diketopiperazine, or DKP, form), the de-esterified dipeptide (aspartyl-phenylalanine), and its constituent components, phenylalanine, aspartic acid (Stegink and LewisD,1987) and methanol (Lin, SY and Cheng, YD, 2000). At 180 °C, aspartame undergoes decomposition to form a diketopiperazine derivative (Male K.B et.al: 1993). In products such as powdered beverages, the amine in aspartame can undergo a Maillard reaction with the...
aldehyde groups present in certain aroma compounds. The ensuing loss of both flavor and sweetness can be prevented by protecting the aldehyde as an acetal. Descriptive analyses of solutions containing aspartame report a sweet aftertaste as well as bitter and off-flavor aftertastes (Odaci et al. 2004). The safety of aspartame has been studied extensively since its discovery with research that includes animal studies, clinical and epidemiological research, and postmarketing surveillance, with aspartame being one of the most rigorously tested food ingredients to date (Mitchell, Helen 2006). Because of number of metabolic disorder associated with aspartame metabolism. Its estimation in soft drink, fruit juices and beverages become quite important. Though there are many technique for its estimation but the present work will focused on its estimation in the fruit juices by colorimetric method which is easy, cheap and can be done in any lab.

2. MATERIAL AND METHOD

Ninhydrin solution- 1.0 g of ninhydrin was dissolved in 50 ml of 95% ethanol and 10 ml of glacial acetic acid. Acetonitrile phosphate buffer -10 volume of acetonitrile plus 90 volume of 6.8g/Sol. of potassium dihydrogen phosphate and were previously adjusted to pH 3.7 with phosphoric acid. 10 sample of soft drinks.

3. PROCEDURE

a. Qualitative Analysis

1 ml sample were dissolved in water and add 0.5 ml acetonitrile phosphate buffer (3.7 pH). Keep it for 5 Minute and add 1 ml ninhydrin solution. Warmed it in hot air oven for 7 minute. Aspartame gave pink colour. Limit of detection of this method was 7.5 microgram.

b. Quantitative Analysis Colorimetric Method

Test with simple sugar samples, 1g of sample was dissolved with 40 ml distilled water and diluted to 100 ml with absolute ethanol. 1.0 ml of acetate buffer was mixed with 1.0 ml sample solution and 2.0 ml ninhydrin solution. The mixture was heat in boiling water bath for 8 minutes after that the mixture was dilute to 10.0 ml with absolute ethanol. The absorbance of sample solution was measured at 406nm.

4. RESULT AND DISCUSSION

Ninhydrin solution is a indicator that determines the presence of aspartame content in soft drinks. This is a sensetive method and use for low amount sugar detection, up to 7.5 microgram. Reaction of aspartame with ninhydrin gives pink colour. In the colorimetric method, aspartame reaction gives purple colour. Dark purple colour shows the presence of more aspartame content. Colorimetric method can be used for detection of large amount of aspartame. We took 10 sample and find out their absorbance values and their mean value. These values are compared with standard curve and find out corresponding concentration. The result showed that Coca cola showed
highest aspartame con. and Mountain dew showed least aspartame con. The results is shown in table 1.

Fig: 2 Standard Curve Of Aspartame

5. CONCLUSION
Aspartame is an artificial, non-saccharide sweetener used as a sugar substitute in some foods and beverages. In the European Union, it is Modified as E951. Aspartame is a methyl ester of the aspartic acid/phenylalanine dipeptide. It was first sold under the brand name NutraSweet; It was first synthesized in 1965 and the patent expired in 1992. Headaches are the most common symptom reported by consumers while one small review noted aspartame is likely one of many dietary triggers of migraines, in a list that includes "cheese, chocolate, citrus fruits, hot dogs, monosodium glutamate, aspartame, fatty foods, ice cream, caffeine withdrawal, and alcoholic drinks, especially red wine and beer,"(Millichap et al.2003) other reviews have noted conflicting studies about headaches(Sun-Edelstein et al.2009) and still more reviews lack any evidence and references to support this claim(Butchko et al.2002).

Since the caloric contribution of aspartame is negligible, it has been used as a means for weight loss through its role as a sugar substitute, with reviews finding that aspartame may aid in weight loss as part of a multidisciplinary weight loss program. On its own, aspartame is not known by medical literature to cause weight gain or weight loss although researchers have theorized that aspartame contributes to hunger or increases appetite psychologically,(Yang and Qing. 2010) broad reviews and regulators conclude that aspartame has no appreciable effect on appetite(Magnuson et al .2007). Because of number of metabolic disorder associated with aspartame metabolism. Its estimation in soft drink, fruit juices and beverages become quite important. Though there are many technique for its estimation but the present work will focused on its estimation in the fruit juices by colorimetric method which is easy, cheap and can be done in any lab. Colorimetric method shows best absorbance at 406 nm. We took 10 sample and find out the absorbance values and their mean value. These values are compared with standard curve and find out corresponding concentration. The result showed that Coca cola showed highest aspartame con. and Mountain dew shows least aspartame con.

REFERENCES


