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Full Length Research Paper

Anticarcinogenic effect of turmeric on processed food products containing acrylamide

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In present scenario Acrylamide concentration in processed food products have become a very serious health issue. The World Health Organization (WHO) and The Scientific Committee for Food (SCF) of the European Union also confirmed this concern. In laboratory scale, it was found that Acrylamide causes tumors in animals. It is even present in processed food free of microbes indicating the absence of microbial role in Acrylamide formation. This study was aimed to demonstrate the anti-carcinogenic effect of Acrylamide in the processed food products available in open market. In order to determine the acrylamide concentration in three processed food brands GC-MS technique was employed. Turmeric was found to bring about the anti-carcinogenic effect and lower down the acrylamide concentration in Aloo Paratha. No profound concentration of acrylamide was found in other two processed food products taken in for study. The processed food is found to be a Health hazard to the consumer and discretion of usage could minimize its impact.

Key words: Processed food, GC-MS, acrylamide, anti-carcinogen, turmeric.

INTRODUCTION

In the year 2002, the Swedish National Food administration published their comments and data on acrylamide concentration in the processed food (SNFA, 2002). In laboratory scale acrylamide causes tumors in animals. The report of World Health Organization (WHO) (WHOPR, 2002) and the Scientific Committee for Food (SCF) of the European Union (OSCF, 2002) revealed that the concentration of acrylamide in most of the processed food was high like potato chips, fried chips, crisp bread, roast potatoes, breakfast cereals etc. So, it was confirmed that it has become a serious problem in respect to the public health. High concentration of acrylamide in the body usually has serious impact on the health and causes various health problem issues and the acrylamide was found to be very prone to cancer (Castle and Clarke 2002). The approach which was used for the analysis of acrylamide concentration was the GC-MS which gave the proper qualitative and quantitative analysis.

Turmeric contains protein (6.3%), fat (5.1%), minerals (3.5%), carbohydrates (69.4%) and moisture (13.1%). The essential oil (5.8%) obtained by steam distillation of rhizomes has *a*-phellandrene (1%), sabinene (0.6%), cineol (1%), borneol (0.5%), zingiberene (25%) and sesquiterpines 5(53%). Curcumin (diferuloylmethane) (3–4%) is responsible for the yellow colour, and comprises curcumin I (94%), curcumin II (6%) and curcumin III (0.3%) (Ishita et al., 2004). It has also been suggested that compounds, which possess antioxidant activity, can inhibit mutation and cancer because they can scavenge free radical or induce antioxidative enzyme (Hochstein and Atallah, 1988).

GC-MS has been credited with qualitative and quantitative analysis of various components, biological and non-biological (Ono and Tateo, 2003). Biological components when analysed with GC-MS require flow rates which are in separate ranges depending on the underneath composition (Nemoto et al., 2002) . Non-biological components are not that specific when it comes to flow rate. The flow rate plays an important role in the time taken for GC-MS analysis to finish. Higher flow rate

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Figure 1. Sample after defatting.

ensures faster completion of analysis process and slower flow rate makes the process slower.

The impact of the turmeric acting as an anti- carcinogen is a recent question of contention as far as processed foods are concerned. Past studies have not been able to present a clear answer or device a mechanism in this regard.

Selection of solvent system and the nature of the solvents play an important role in GC-MS analysis of biological components (Eden and Per, 2002). When the biological species being analysed is a processed food item, obviously the emphasis on the nature of solvent and the solvent system selection becomes more important. Polar solvents and non-polar solvents have a marked difference when it comes to Biological components analysis by GC-MS. Usually used solvents are acetonitrile, water, methanol, ethanol, acetone etc…

MATERIALS AND METHODS

The main materials for this study were Aloo Paratha (Al-kabeer), Paneer Butter Masala (MTR) and Bhujiya (Haldirams). All these samples were procured from super market and bakery situated inside SRM University, Chennai.

Sample preparation

As a first step, all the samples were allowed to swell by adding water in an amount normally corresponding to 3 times the weight of the sample (more for exceptionally dry samples). Taking into consideration homogeneity and availability of the sample, often 25 g of sample and 75 ml of water were combined in a 150 ml beaker glass. 500 g/kg of one internal standard i.e. D3-acrylamide (internal standard, IS) was added, i.e. 1 l per 1 g of sample of a 500 mg/l acetonitrile solution. After mixing the homogenate was allowed to swell during 30 min at 70°C in a water bath. The beaker glass was covered by aluminium foil to prevent evaporation of water. 10 g of the homogenate was weighed into a 100 ml centrifuge glass with a screw cap and thoroughly mixed with 40 ml of 1-propanol. When the solids form lumps, mixing was supported by a blender. 10 ml (8.4 g) of the supernatant (possibly after centrifugation of some 12 ml of turbid supernatant) was transferred to a 25 ml pointed flask. Few droplets (about 200 mg) of a vegetable oil were added and the water/propanol removed in a rotary evaporator at about 50 Torr and 60 to 70°C in the water bath. Evaporation was stopped as soon as no liquid was left. The residue from the evaporation, consisting of fat/added oil and often much salt, was extracted with acetonitrile and defatted with hexane (Figure 1). 3 ml acetonitrile and 20 ml hexane were added and mixed with the sample with the help of an ultrasonic bath. The acetonitrile (lower) phase was transferred into a 10 ml reagent glass with screw cap by means of a Pasteur pipette, losing acetonitrile rather than carrying along hexane. The acetonitrile phase was

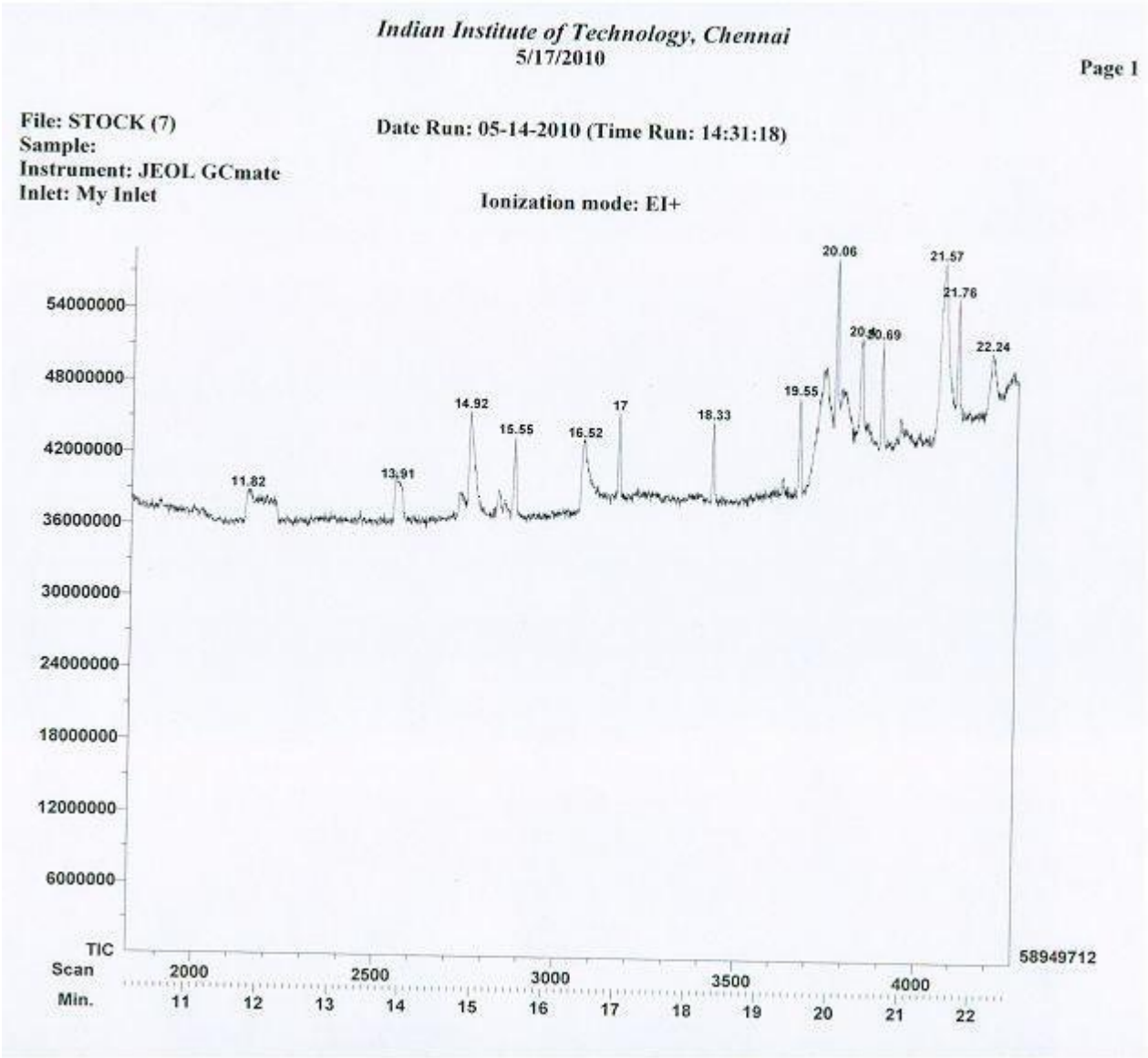

Figure 2. GC-MS analysis of standard acrylamide solution.

extracted by another 5 ml hexane, now transferring 1.5 ml of the acetonitrile phase (assumed to be half) into a 1.5 ml autosampler vial. Butyramide solution (internal standard, IS) was added. For the common 25 g sample swollen with 75 ml water this meant 5 l of a 25 mg/l solution in acetonitrile (Peter and Hugo, 2002).

The samples were sterilized by moist heat sterilization. Then it was tested for common microbes such as *Escherichia coli, staphylococcus aureus* and *Enterococcus* which have the high chance of being present in the processed foods taken up for study.

GC-MS data analysis

GC-MS instrument used was JEOL GC mate-II – Mass Spectrometer. It was tested in HP5 column using Helium gas at a temperature range of 80 to 280°C .The rate of temperature was 10°C/min.

RESULTS AND DISCUSSION

The acrylamide concentration was analysed using GC-MS and estimation was done after ensuring that the samples were microbes free. The no of peaks observed in stock solution were 14. The highest peak was observed to be at 20.06 and the lowest at 11.82 (Figure 1).

GC-MS analysis of Aloo Paratha was done and the number of peaks obtained in the case which did not contain turmeric was 9 with 4 peaks identical to standard acrylamide solution (Figure 2). The number of peaks observed in the case of sample which was added with turmeric was found to be 11 with only a single peak identical to standard acrylamide solution (Figures 3a and b).

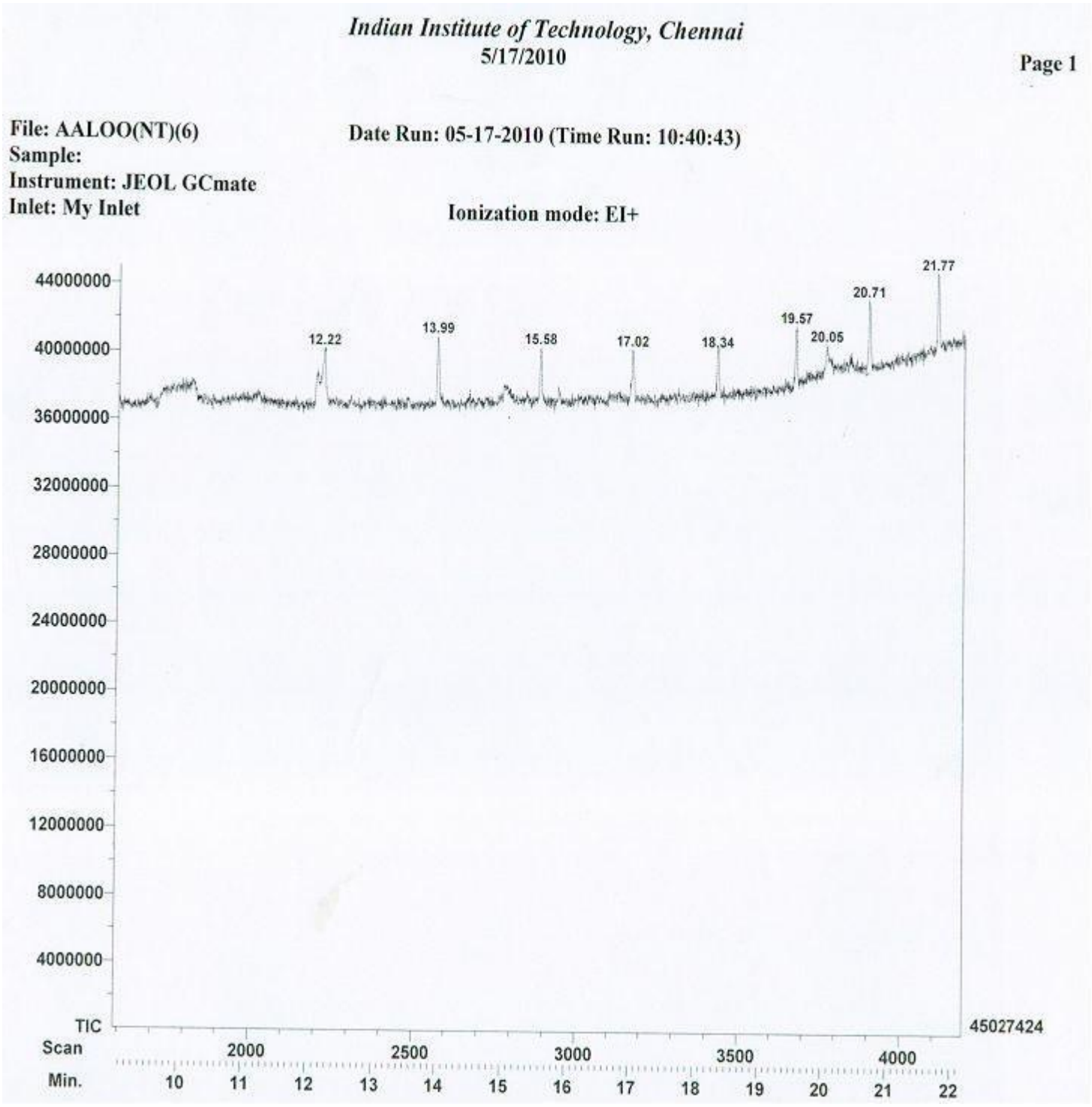

Figure 3a. GC-MS analysis of Aloo paratha without turmeric.

In analysis of Bhujiya without turmeric number of peaks obtained were 11. The highest was observed at 24.02 and the lowest at 23.12 (Figures 4a and b). None of the peaks were identical to the acrylamide stock solution and in the sample containg turmeric number of peaks was observed to be 8. The highest was at 24.02 and the lowest at 12.27.

In the GC -MS analysis of Paneer Butter Masala containing no turmeric (Figures 5a and b) it was observed that number of peaks obtained were 11. The highest

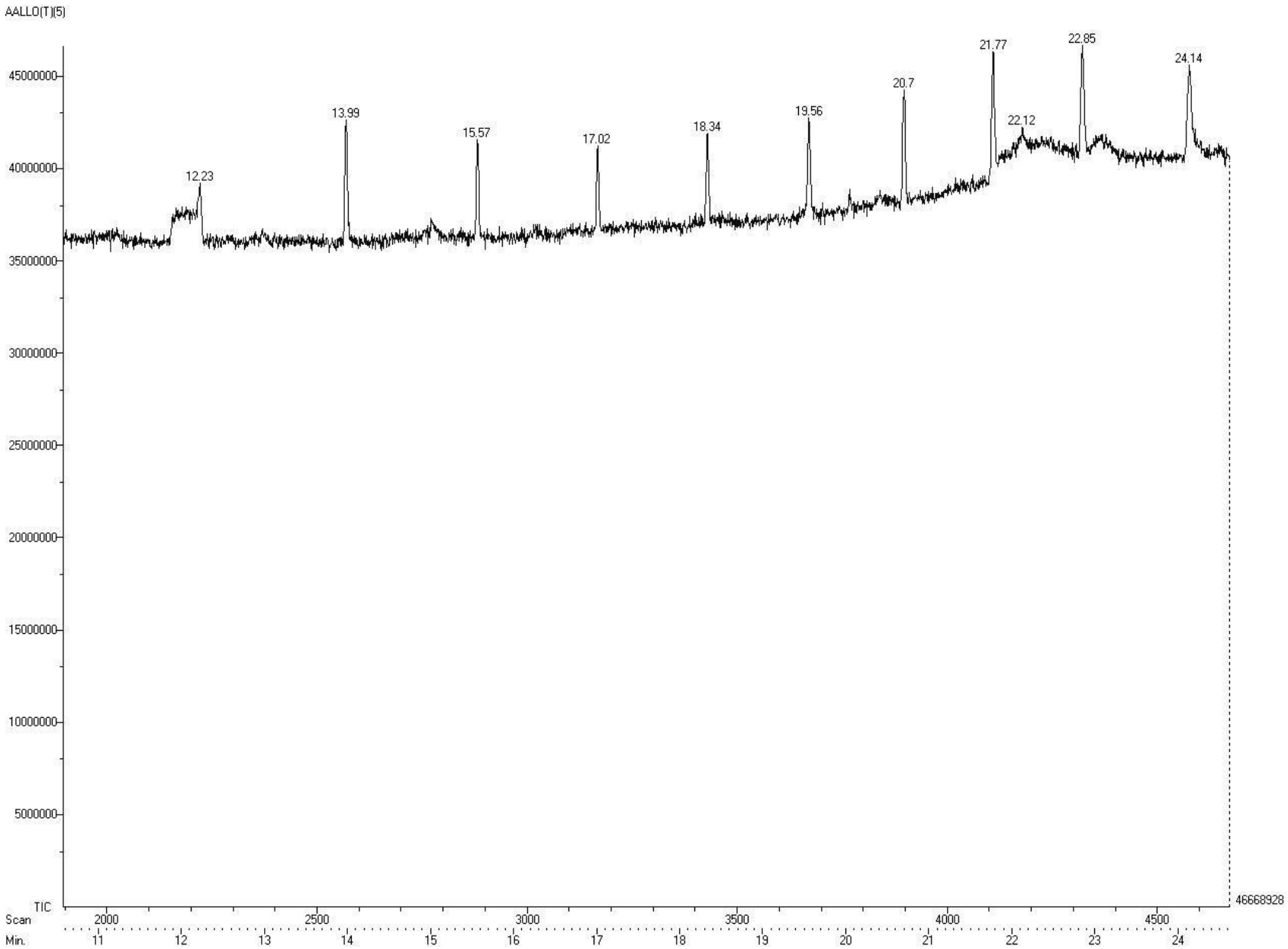

Figure 3b. GC-MS analysis of Aloo paratha with turmeric.

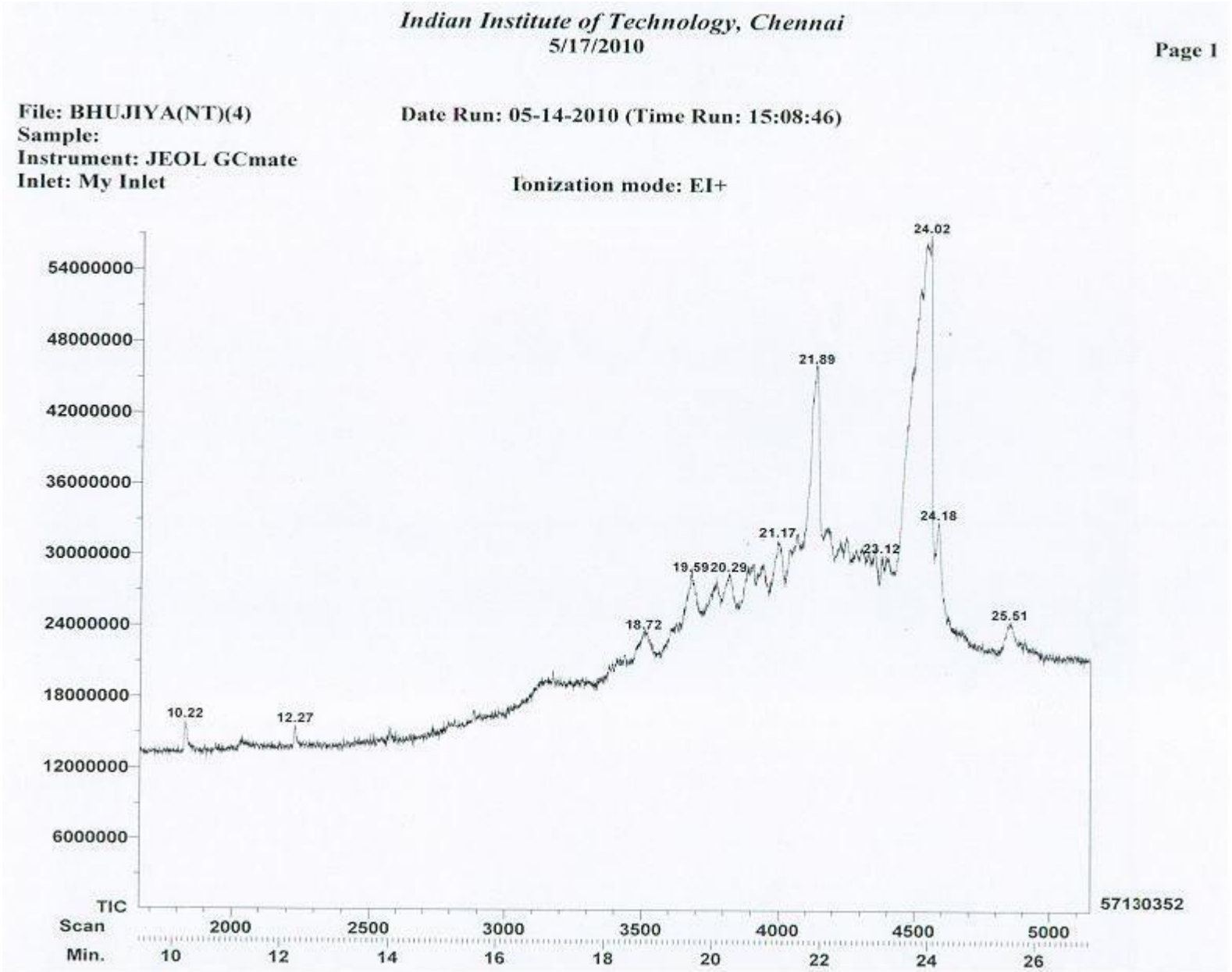

Figure 4a. GC-MS analysis of Bhujiya without turmeric.

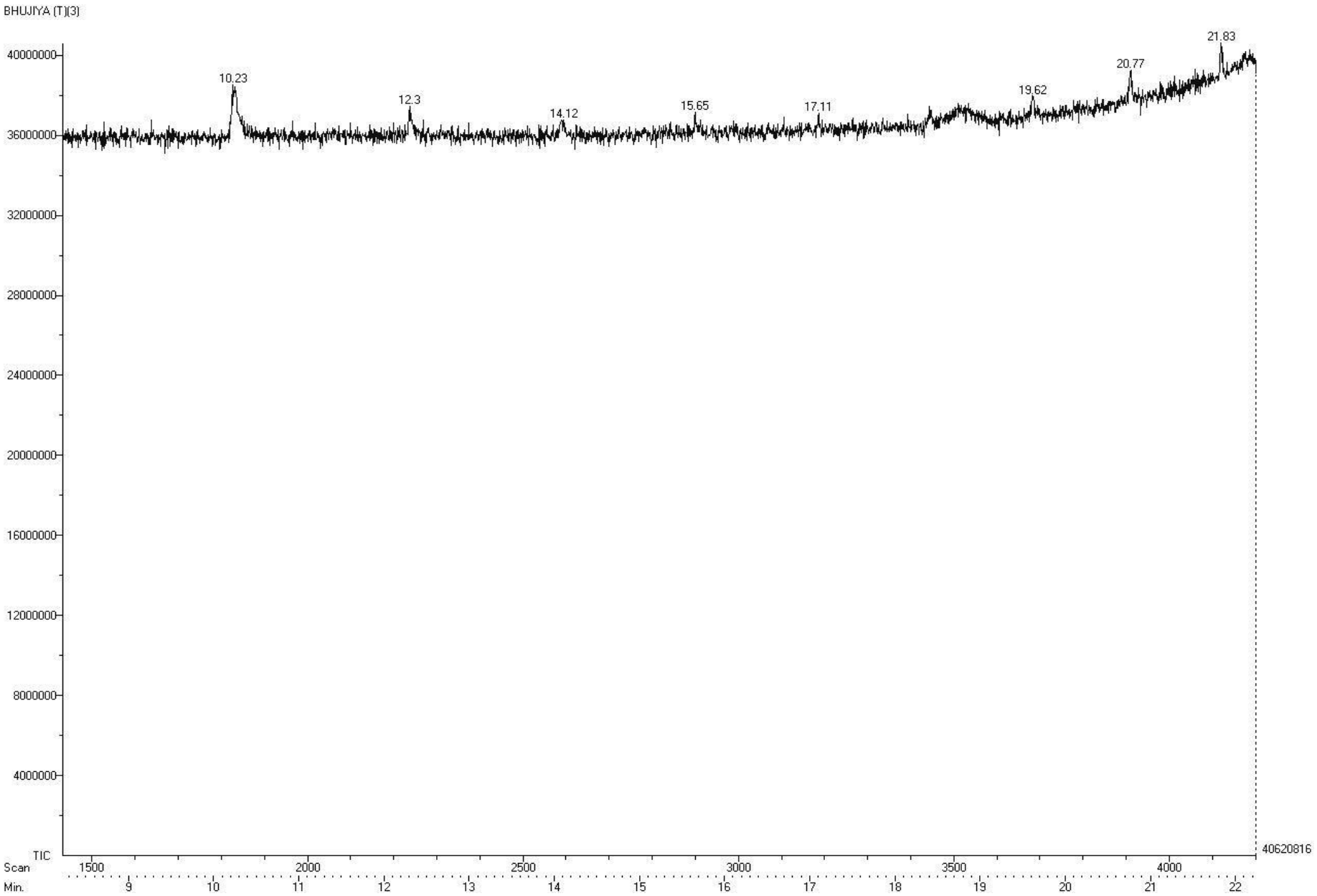

Figure 4b. GC-MS analysis of Bhujiya with turmeric.

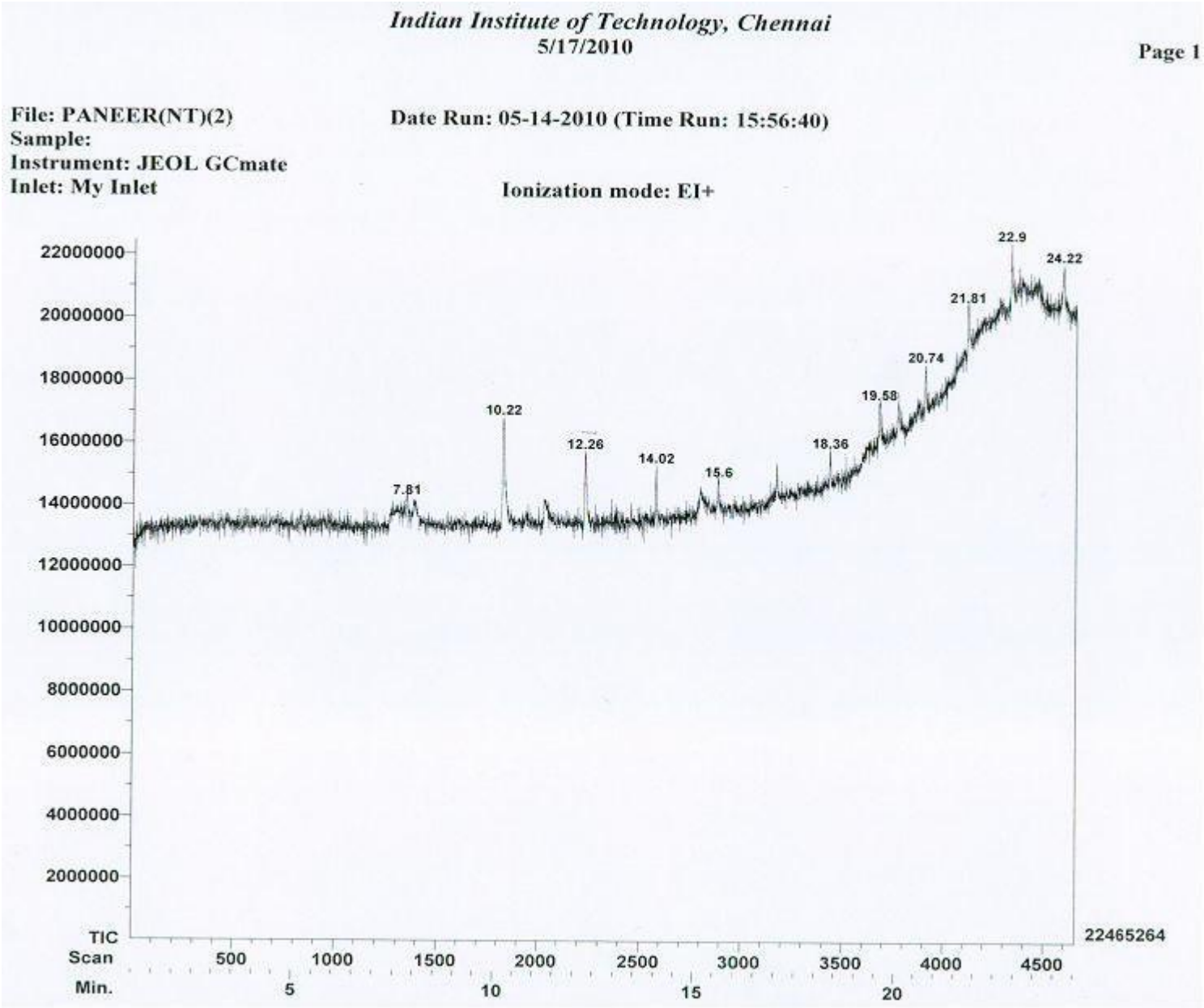

Figure 5a. GC-MS analysis of Paneer without turmeric.

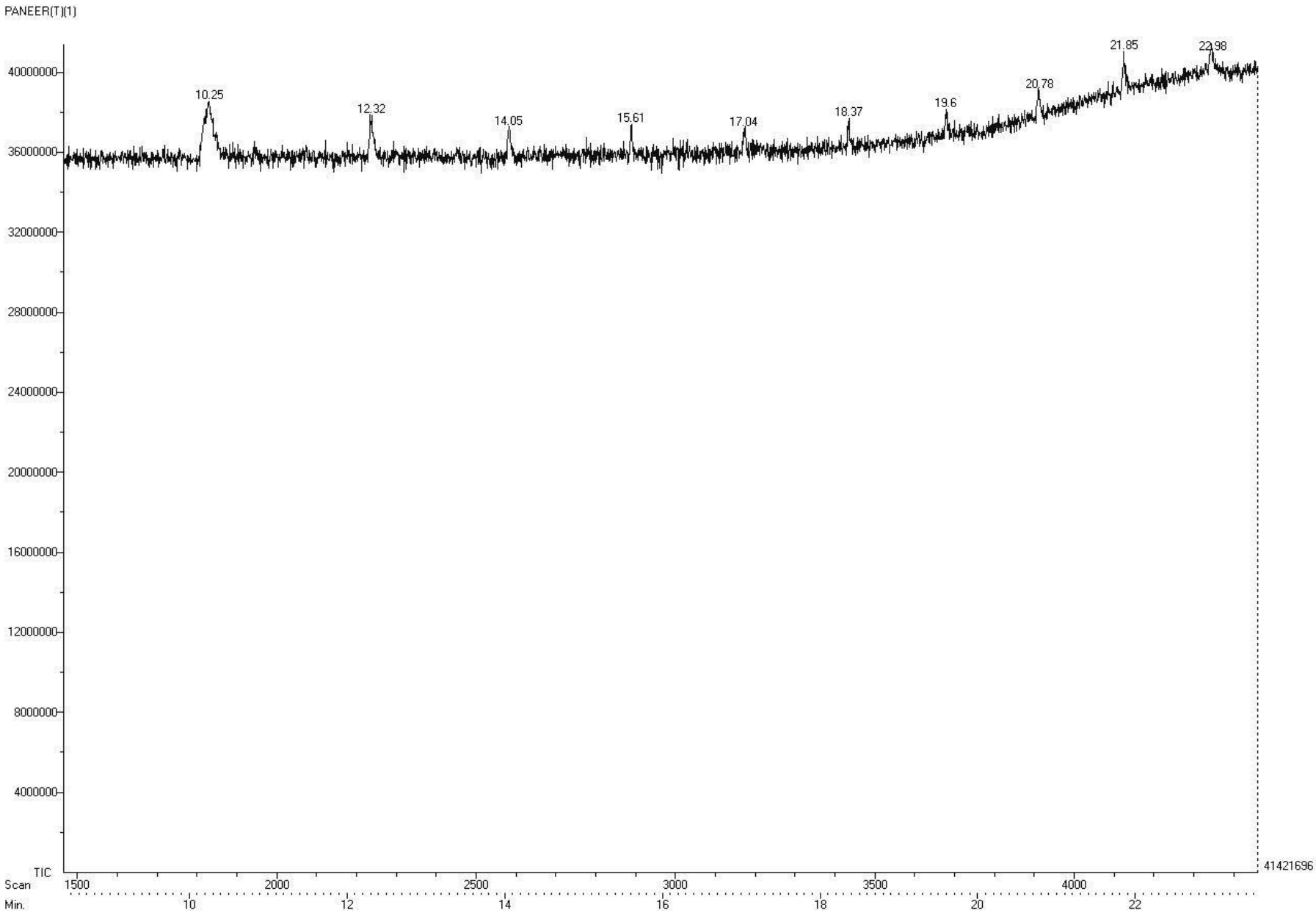

Figure 5b. GC-MS analysis of Paneer with turmeric

was observed at 10.22 and the lowest at 7.51. In the sample containing turmeric number of peaks obtained were 10. The highest was found to be at 10.25 and the lowest at 19.26. In both the cases no reading matched with the acrylamide stock solution.

Acrylamide is carcinogenic and processed foods available at super markets seem to be having considerable amount of it. In certain processed food acrylamide was present and its concentration was found to be reduced by the action of turmeric. The processed food items sans acrylamide will be extremely beneficial in the health aspects of public by and large.

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