Research Article

Morphological and Proximate Analysis of Apple Pulp Powder

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Abstract

Vinegar is a liquid that may be consumed by humans and is made by fermenting starch and sugar. It is very important since it can be used to marinade meats, pickle vegetables, and other foods, as well as strengthen our immune system. Vinegar is typically made by an alcoholic fermentation process in which yeasts transform the simple sugars in the raw material into alcohol. Scanning electron microscopy (SEM) JSM 6490) is a very useful instrument to visualize morphological structure of the food. Apple Pulp was analyzed by using high resolution SEM. Figure 2 shows the results of Apple Pulp at X1000; it clearly shows a very smooth surface. When observed on X2000 magnification it depicts the uneven geometry of particles which due to the amorphous nature of the sample. The vinegar produced from different locally grown fruits and industrial produced vinegar was evaluated to determine their proximate and elemental composition. The proximate parameters analysed includes moisture content, total solids, crude protein, crude fat, crude fibre, carbohydrates and ash content. The Moisture content of Apple Pulp is 67%, Crude Protein 0.03gm, Crude Fat 0.02gm, Crude Fibre 2.8gm, Ash content 0.11% and Carbohydrate 13.8gm.

INTRODUCTION

Vinegar is a liquid that may be consumed by humans and is made by fermenting starch and sugar. It is very important since it can be used to marinade meats, pickle vegetables, and other foods, as well as strengthen our immune system. Vinegar can be produced in a variety of ways utilizing a variety of raw materials, with the essential requirement being a reliable, affordable source of alcohol [1-3]. Wine (white, red, and sherry wine), fruit, cider, pure ethanol, musts, malted barley, and other ingredients are used as raw materials to make vinegar. The main flavouring and antibacterial component of vinegar is acetic acid. Acetic acid bacteria, a class of obligate aerobic gramme negative bacteria, may convert ethanol to acetic acid [4-6]. Vinegar is typically made by an alcoholic fermentation process in which yeasts transform the simple sugars in the raw material into alcohol. Apple cider vinegar, sometimes referred to as cider vinegar, is light to medium in hue. Apple cider vinegar is made from apple juice that has been crushed and fermented. Like apple juice, it is likely to contain pectin, vitamins B1, B2, and B6, biotin, folic acid, niacin pantothenic acid, and vitamin C. Apple cider vinegar has been used traditionally for many years to treat a number of diseases, including hyperlipidemia, which is known to be a risk factor for atherosclerosis. Early atherosclerosis identification, diagnosis, and treatment can prevent the negative effects of cardiovascular disease. Following a cardiologist's recommendation, the people agreed to take apple cider vinegar. At the start of the study, blood samples were collected to measure the levels of cholesterol, triglycerides, low density lipoprotein (LDL), and high density lipoprotein (HDL). The tests were repeated two, four, and eight weeks after drinking vinegar. The results were analyzed using repeated measurement analysis. It is suggested as a simple treatment for apple cider vinegar use over an eight-week period since it caused significant decreases in hazardous blood lipids. The aim of the current study was to examine the effects of drinking apple cider vinegar on decreasing blood cholesterol levels. Apple cider vinegar, a traditional condiment, is created from apple juice or fruit utilizing a two-step process that involves the aerobic oxidation of acetic acid and the anaerobic conversion of sugar to ethanol. In the current study, efforts were made to standardize and manufacture seasoned (flavoured) apple cider vinegar using different proportions of honey, healing herbs, and spices. To enhance the flavour of something in order to make it more tasty, nutritious, and palatable [7]. Vinegar is characterized as "a liquid fit for human consumption and produced from a suitable material of agricultural origin containing starch or sugar or both" and contains acetic acid to some extent. It's a typical acidic condiment created from rice, malt, apples, wine, and a number of other components. Fundamentally, making vinegar involves two steps: the anaerobic fermentation of fermentable carbohydrates into ethanol by yeasts, usually Saccharomyces species, and the aerobic oxidation of ethanol to acetic acid by bacteria, usually Acetobacter species. Since the beginning of civilization, people have used vinegar as a food preservative, a condiment, and the

base for simple human and animal medicine [8]. It is widely used to pickle fruits and vegetables, to make mayonnaise, salad dressings, mustard, and other food condiments, as well as a flavouring ingredient in meals. Additionally, natural apple cider vinegar, commonly referred to as cider vinegar, is brewing vinegar made from recently picked apples that have been grown organically and left to mature in wooden barrels. Today, however, the production of cider vinegar largely uses apple fruits, juice, and apple juice concentrate in submerged cultures. It is advised to use cider vinegar as a typical folk remedy to treat a variety of ailments, such as obesity, overweightness, arthritis, asthma, coughs, diarrhea, and colitis. Eczema is one of several illnesses [9]. Compared to other brewed vinegars, cider vinegar is more frequently employed as a flavour and food preservative. "Seasoned vinegar," sometimes known as "flavoured vinegar," is a type of brewed vinegar that is created by extracting spices and herbs for its powerful flavour, aroma, and antioxidant effects.

Flavoured vinegar has been manufactured and traded as a product for more than 5000 years. The Babylonians produced and sold vinegars scented with fruit and honey up until the sixth century. But up until now, relatively little research in this area has been conducted in India. Since it contains higher amounts of ascorbic acid (25.86 mg/100g) and total phenols (123.4 mg/100g), the developed seasoned vinegar has positive effects on health. Consequently, the fact that this medicine is readily available on the market at reasonable prices would surely benefit those who are concerned about their health. Apples and their byproducts, which include both alcoholic and non-alcoholic drinks, are being diverted to the pharmaceutical, canning, and beverage industries since they are an easily adaptable culture and have an overabundance of output in some parts of the world. The final fermentation, known as the acetic fermentation, is when the remaining alcohol is further oxidised to acetic acid by AAB (Gullo and Giudici 2008).Vinegar can also be made using the fermented juices of many other fruits besides grapes.
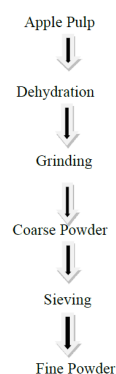
MATERIAL AND METHODS

Material: Apple fruit was purchased from the local market of luck now.

Methodology

Apple Pulp Powder Preparation

Flow chart of Pulp Powder Preparation

Apple Pulp
↓
Dehydration
↓
Grinding
↓
Coarse Powder
↓
Sieving
↓
Fine Powder

Morphological Analysis of Apple Pulp

Scanning Electron Microscopy of Samples: After the preparation and processing of Apple Pulp Powder (Figure 1), surface analysis and chemical composition can be done by using SEM and EDX. Scanning electron microscopy (SEM) is a powerful tool for surface analysis of food products at X500 and X1000 magnification. In this study, the morphology and element composition of Product were analyzed using SEM: Along with SEM, EDX is used which is a micro analytical technique used to determine local elements in a sample are as follows in result and discussion section. Scanning electron microscopy (SEM) JSM 6490) is a very useful instrument to visualize morphological structure of the food. Apple Pulp was analyzed by using high resolution SEM [10]. The samples were first made into a powder. After drying, protect the sample from relative humidity. And keep the sample Eppendorf micro centrifuge tubes, then 2- 4 mg of dried sample were taken and coated by using the sputter coater of JOEL, both of the samples were examined at 10KV. Image were taken in representative parts of the tested sample and observed at a high magnification. The SEM and EDX analysis can be done in USIC department of the Babasaheb Bhimrao Ambedkar University, Lucknow Uttar Pradesh (Figure 2,3).

Proximate Analysis

Sample Collection and Treatment: Fresh samples of star

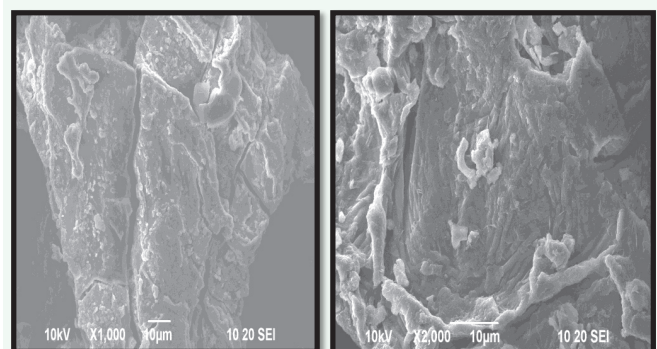**Figure 1** Preparation of Apple Pulp Powder.

Figure 2 SEM image of Apple Pulp at X1000 and X2000 level magnification.

apple fruits (Chrysophyllum albidun) were bought in market of Lucknow. The pulp was removed and kept separately. The hard outer shell of the Pulp was removed by cracking with a small pestle. The pulp was oven dried at the temperature of 60oC for 24 hours. The dried samples were then ground with a manual grinder into powder and sieve to get very fine powder. It was then stored separately in an air tight plastic container pending chemical analysis.

Proximate Composition: Moisture content, ash content, crude protein and crude fat were determined in accordance with Association of Analytical Chemist (AOAC, 1990), while crude fibre was determined using (AOAC, 1995) [11]. Carbohydrate content was determined as the difference obtained after subtracting the values in percentage of crude protein, lipid ash, and fibre from the total dry matter.

The result of the proximate composition of Apple Pulp are presented in Table 1 and illustrated in Figure 4.

RESULT AND DISCUSSION

Morphological Analysis

The scanning electron microscopy image shown in fig.2 the unique surface characterises of Apple Pulp. The SEM creates images by raster scanning over it with a high-energy beam of electrons of any sample surface. The incident electron will

Figure 3 EDX of Apple Pulp.

Figure 4 Proximate composition of Apple Pulp.

Table 1: Element composition

Element	Weight %	Atomic%
C K	53.42	62.05
O K	41.59	36.27
Na K	0.81	0.47
Mg K	0.44	0.25
Cl K	0.19	0.08
K K	1.82	0.65
Ca K	0.32	0.11
Pt M	1.41	0.10
Totals	100.00	
Nutrients	Pulp	
Moisture	67%	
Crude Protein	0.03gm	
Crude Fat	0.02gm	
Crude Fibre	2.8gm	
Ash	0.11%	
Carbohydrate	13.8gm	

interaction with the atoms of the sample in turn which emits the photons from the analysis of emitted photos signals the sample information about surface topography, composition and other properties like electrical and mechanical etc. Figure 2 it shows the morphological behaviour of Apple Pulp at different magnifications. The aim of SEM analysis was to obtain the exact morphology of Apple Pulp samples and to compare them. Figure 2 shows the results of Apple Pulp at X1000; it clearly shows a very smooth surface. When observed on X2000 magnification it depicts the uneven geometry of particles which due to the amorphous nature of the sample. When observed at X1000 magnification it shows a less smooth surface [12]. On the other hand Apple Pulp powder when analysed under SEM at X2000 magnification shows a larger particles size than Pulp however there is no clear geometrical shape of the particles. This is an important observation, as surface morphology affects various physical characterizations, including the angle of repose, coefficient of friction, and porosity. This is the first report that provides a microscopic comparison of the surface morphology of ancient seed grains, which would be helpful to advance research related to Apple Pulp.
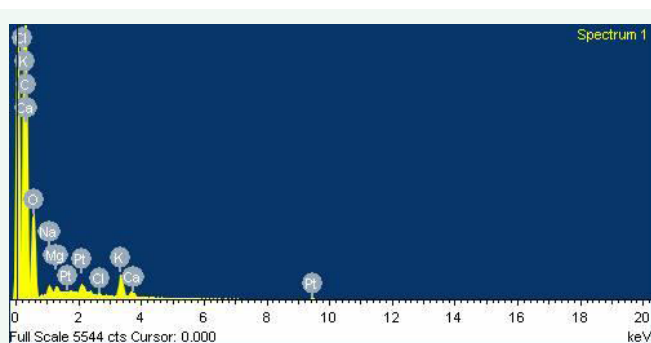
SEM -EDX Analysis

Along with SEM, EDX is used which is a micro analytical technique used to determine local elements in a sample. SEM-EDX analysis was used to determine mineral distribution in Pulp powder. The aim of EDX in present study was to identify minerals in the prepared samples and to compare the mineral composition of Apple Pulp. The result showed that sample contains eight elements i.e Cl, K, C, Ca, O, Na, Mg, Pt. The Element present in highest percentage is carbon i.e. 52.34% and the least amount is Cl i.e.0.19% [13].

Proximate Composition

Moisture contents: Moisture contents have a great value in the preservation of food materials (Eka, 1984). Moisture contents of the apple pulp were 67%. These clearly shows that
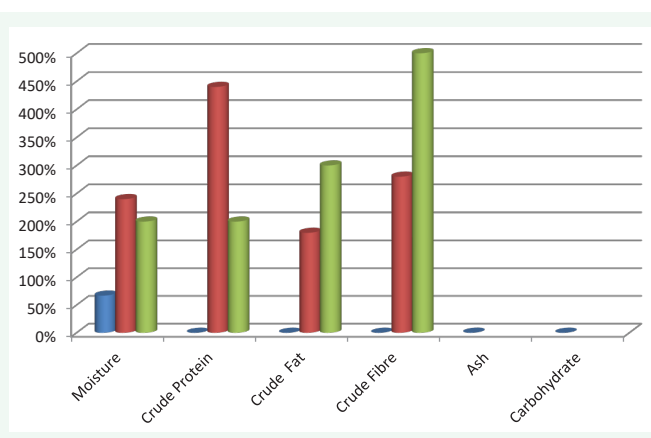
pulp contain much moisture. Moisture content is one of the most important and most widely used parameter in food processing; hence star apple seed can easily be processed and preserved easily since it contains less moisture. The percentage moisture content was calculated by the following formula:

$$\% \ moisture = \frac{W_1 - W_2}{W_1} \text{x } 100$$

Where,

W_1 = *Weight of sample before drying*

W_2 = *Weight of sample after drying*

Crude Protein: Crude protein contents of apple pulp were 0.03gm. Food and Nutrition Board of Nigeria (1972) recommended 56kg of protein per day in the diet of adult men weighing 70kg and 40kg for women weighing 56kg of body weight. The percentage Crude Protein was calculated by the following formula:

$$N\% = \frac{(\text{ml of sample} - \text{ml of blank})\text{x normality of HCl x 14.007 x 100}}{Weight \ of \ sample \ (mg)}$$

Thus, protein content will be estimated by conversion of nitrogen percentage to protein (James, 1995).

Protein % = N% x Conversion factor (6.25)

Where conversion factor = 100/N (N% in fruit products

Crude Fat: Fat contents of the star apple pulp were 0.02gm. The value of pulp and peel is higher than the fat content of other fruits reported by Oyenuga (1960). Fat provide an excellent source of energy, enhance transport of fat soluble vitamins, insulate and protect internal tissues and contribute to vital cell process. However, it is strongly believed that excess of saturated fatty acids are responsible for a tendency to coronary thrombosis and aortic atheroma in men also high level of poly unsaturated fatty acids is important in lowering blood cholesterol level (Loyd et al., 1997). Crude fat was determined by the following formula:

$$\% \ Crude \ Fat = \frac{W_3 - W_2}{W_1} \text{x } 100$$

Where,

W_1 = *weight of sample*

Crude Fibre: This theoretically referred to material that is indigestible in organisms. The values of 2.8gm were obtained for the apple pulp. However the physiological role of fibre is to maintain an intestinal tract [13]. Also client with low fibre have been associated with diseases of the colon like piles, appendicitis and cancer [14]. However, low fibre contents are also known to reduce the rate of glucose and fat absorption (Mottram, et al., 1979). Hence the low fibre contents in the apple pulp are advantageous in absorption of glucose and fat. The Crude Fibre was calculated by the following formula:

$$\% \ Crude \ Fibre = \frac{\text{loss in weighted (g) after ignition}}{\text{weight of the original sample(g)}} \text{x } 100$$

$$= \frac{W_1 - W_2}{W} \text{x } 100$$

Ash Contents: Ash content indicates the amount of inorganic matter and oxides present in the sample. It is the determinant factor of the mineral constituents in the sample. Ash content as presented in Table 1 was 0.11% for Pulp. The percentage Ash content was calculated by the following formula:

$$Calculation: \% \ Ash = = \frac{Weight \ after \ Ashing \ (W_3) \ - \ Tare \ Weight \ of \ Crucible \ (W1)}{Original \ Sample \ Weight \ (W2) \ x \ Dry \ Matter \ Coefficient} \text{x } 100$$

Carbohydrate: The carbohydrate contents of the apple were found to be 13.8gm. The major metabolic role of the carbohydrate in the diets is for energy production [15]. There are different types of carbohydrate, but in food only total carbohydrate is considered and it is what is left when protein, fat, moisture and ash of the foodstuff have been removed. The percentage carbohydrate content was calculated by the following formula:

% Carbohydrate = 100-(% Protein + % Moisture + % fat +% Ash).

CONCLUSION

The results from the Morphological Analysis showed that sample contains eight elements i.e Cl, K, C, Ca, O, Na, Mg, Pt. The Element present in highest percentage is carbon i.e. 52.34% and the least amount is Cl i.e.0.19%. Fig.2 shows the results of Apple Pulp at X1000; it clearly shows a very smooth surface. When observed on X2000 magnification it depicts the uneven geometry of particles which due to the amorphous nature of the sample. When observed at X1000 magnification it shows a less smooth surface. On the other hand Apple Pulp powder when analysed under SEM at X2000 magnification shows a larger particles size than Pulp however there is no clear geometrical shape of the particles. The results from the proximate composition showed that Apple pulp and seed have greater amount of carbohydrate contents. The proximate parameters analysed includes moisture content, total solids, crude protein, crude fat, crude fibre, carbohydrates and ash content. The Moisture content of Apple Pulp is 67%, Crude Protein 0.03gm, Crude Fat 0.02gm, Crude Fibre 2.8gm, Ash content 0.11% and Carbohydrate 13.8gm. Hence each these samples (peal, pulp and seed) can act as a source of the mineral supplement in food and allied industries.

ACKNOWLEDGEMENT

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