

Apple Pomace: By product Utilisation

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ABSTRACT

Apple juice industries utilise almost 75% of the fruit for product preparation while the remaining 25% is left as the by product known as Pomace. India alone produces about 11 million tons per annum of Pomace out of which only 10,000 tons is utilised as a by product. Pomace is generally discarded without any use causing environmental degradation. Its potential is not recognised yet; it is an extremely rich source of many nutrients like carbohydrates, crude fibre and minerals. Pectin, which is a very important raw material for a fruit industry can also be extracted in abundance from the same. This paper reviews various ways to utilise this apple industry by product so that the potential of the same is exploited to the maximum extent.

Keywords: Apple Pomace, Waste Utilisation, Apple Processing

Introduction: Apple (*Malus domestica* Borkh) is the most preferred fruit by many people all around the world, mainly grown in the temperate regions of the world (Kaushal and Joshi 1995, Kaushal et al. 2002, Agrahari and Khurdiya 2003). India currently is the ninth largest producer of apples in the world and contributes 1/3rd of the total apple production (anon 2004). apple is the fourth major fruit crop out of which 71% of apples are freshly consumed and 20% of the same are processed and out of which 65 % is utilised in apple juice concentrate (AJC). Many other products are also manufactured by apples like apple cider, wine, apple purees and jams, RTS apple juice, vermouth, and dried apple products. (Downing 1989, Joshi et al. 1991, Joshi 1997, Kaushal et al. 2002).

Apple production is the backbone of the rural economy of many states like Jammu and Kashmir, Himachal Pradesh, north eastern and Himalayan states and Uttaranchal (Agrahari and Khurdiya 2003). Though mainly this fruit is used as a whole fruit, a portion of it is used in the value added production of products like concentrates (Kaushal and Joshi 1995).the general process of production of concentrates utilises 75% of the fruit while rest is left as Pomace (25%) (Wang and Thomas 1989, Shah and Masoodi 1994, Kaushal et al. 2002).

In a large apple processing plant there are two types of waste; One, the belt rejected that are those whole fruits which are bruised and spoiled and can't be used as a commercially fit product and Second, Pomace that is obtained after the apple processing as a waste product.

Poor environmental conditions are because of the improper waste disposal of these by products. this is characterised by the dumping of the belt rejected apples along with the apple Pomace, since apple Pomace has a high fermentation potential, contains large amount of water and is wet in nature, creating high chemical oxygen demand (COD) of 250-300 g/kg and a high Bio chemical oxygen demand because of its biodegradability (Kaushal et al. 2002) Its safe disposal is mandatory for reducing pollution load in and around the processing area.

For a safe disposal and a pollution free environment it is important that some extra labour and technological costs are involved to dispose it off in a suitable manner. Exploitation of the potential that Pomace has as a waste food resource is one of the best method to dispose it off (Shah and Masoodi 1994)

The Traditional use of apple Pomace was cattle feed and a very small percentage of the same was utilised for other purposes because of its quick spoilage (Bates and Roberts 2001)

Therefore keeping in view the extreme potential of the apple Pomace, this paper reviews the possibilities of its utilisation to the maximum.

Nutritive value of apple Pomace: Apple Pomace has 85% of (wb) moisture content and is the main by product of cider and juice processing (Sun et al. 2007). The proximate nutritive value of Pomace is described in Table 1.

Table 1: Nutritive value of apple Pomace

S. No	Nutrient	Value	Reference
1	Carbohydrates	9.5-22 %	(Sun et al.2007)
2	Proteins	4.0%	(Vasil'ev et al. 1976).
3	Dry matter	26.4 %	(Vasil'ev et al. 1976).

4	Sugars	3.6%	(Vasil'ev et al. 1976).
5	Cellulose	6.8%	(Vasil'ev et al. 1976).
6	Ash	0.38%	(Vasil'ev et al. 1976).
7	Calcium	8.7mg/100g	(Vasil'ev et al. 1976).
8	Acid	0.42%	(Vasil'ev et al. 1976).

Fuel Purposes: the energy budget can be regulated and made more economical by using dry apple Pomace for steam generation in boilers used for processing within the industry. (Fischer 1984). Sargent et al. (1986) suggested that the fossil fuel and waste disposal costs could highly be reduced if the combustion of the apple Pomace is In-plant

Food Products: Large number of edible products could be prepared by apple Pomace like Pomace jam and sauce (Kaushal and Joshi 1995, Joshi et al. 1996), citric acid (Sharma and Joshi 2001, Kaushal et al. 2002). Production of Pomace papad which is high in value and low in volume can also be prepared. (Kaushal et al. 2002). A technology developed as per Rotova (1983) made the production of Pomace powder possible which involved moulding, drying crushing and fractionation of apple press cakes. A lot of confectionary recipes had this powder as one of the raw material with special reference to Ukrainian confectionery that was almost 2000 tons used of the same in their recipes. Replacing soy meals by this apple Pomace powder in variety of blended toffees was also found to be successful with no effect on quality of the toffees (Eingor et al. 1984)

Walter et al. (1985) studies revealed that production of non nutritive bulk to low fibre fabricated foods could be produced using apple Pomace by treating the Pomace to mild alkaline degradation process that results in an a-cellulosic fraction which is approximately 26 % of the dry untreated matter. Studies by Wang and Thomas (1989) revealed the use of apple Pomace in bakery products directly. they used drum dried Pomace extracted from a single pass metallic membrane ultra filtration process in the bakery products as an alternative to sugar and dietary fibre, a sensory study revealed that bran muffins replaced with powdered apple Pomace were more acceptable that the control bran muffins which used plain bran wheat .also substitution of oats by apple Pomace in moon cookies as a filling were more desirable that original moon cookies.

Preparation of cookies by using Pomace powder in dough was done by Kaushal and Joshi (1995)

they added different percentages of Pomace (10-50%) and studied the same which revealed that the cookies containing 30% of the powder were best in their sensory attributes.

Apple Pomace could also be preserved as a pulp using potassium Meta bisulphite (1.0g/kg /pulp) that had a shelf life of over one year at 20 degree Celsius. Preparation of beverages by this pulp is highly acceptable. Conversion of Pomace to pulp by autoclaving resulting in homogenous pulp was studied by Shah and Masoodi (1994)

Production of Pomace sauce and the study of its sensory and quality attributes were done by Joshi et al. (1996). They took apples at three maturity stages of August (T1), September (T2) and October (T3) and studied the level of sugar in per kg of pulp in each case. Results depicted that sugars both reducing and non reducing, brix/acid ratio, starch, proteins and crude fibre all increased but there was a significant decrease in ascorbic acid from stage one to three. The apple Pomace sauce of T2 stage was found to be the best amongst all the three stages with respect to sensory and quality attributes. The study of quality attributes after six months revealed TSS, titrable acidity ,sugars (reducing and total), and standard plate counts increased whereas non-reducing sugars, pectin, crude fiber, starch, and ascorbic acid content decreased in the due course of time. The changes encountered during storage were same for any other sauce and not specifically for Pomace, the product was found to be acceptable for 6 months at room temperature

Addition of Pomace as a press aid to raspberries, strawberries, grapes and blueberries revealed that juice yield by pressing with Pomace was comparable to that of hull and paper. In this study the Pomace was dried at 70 degree Celsius and milled to be used as a press aid. Pomace as a press aid resulted in a more flavourful juice that the one pressed with hull. (Bates and Roberts (2001))

Pectin extraction:

Extraction of pectin from Pomace is the oldest use of this by product (Sharma et al. 1985).A multistep counter current method was used to extract pectin from apple Pomace and this was suggested to be done without mixing the batches of raw materials in optimum processing conditions to

yield a pectin rich extracts. Even from a low pectin Pomace high yield of pectin was extracted using double extraction however this resulted in the loss of gelling properties of pectin. *Gentschen (1988)*. Extraction of pectin using various solvents was studied by *Ihl et al. (1992)* in which extraction was done from crude extract by ethanol or with 2–4% AlCl₃. Pectin yield was 1.11% with 2% AlCl₃, 2.38% with 3% AlCl₃, 7.2% with ethanol, and 2.8% with 4% AlCl₃. Esterification was highest in case of 4% AlCl₃. This extraction resulted in very high gel strength but had a high aluminium residue to its disadvantage. However the pectin precipitation with ethanol is mostly recommended.

The method of extraction of pectin under acid conditions was patented by *Ezhov et al. (1993)* in which the pressings were divided in two phases, that of solid and liquid. Both pectin yield and microbial attacks were reported to be enhanced by increasing the extraction using equimolar amounts of NH₄OH

Conclusion:

The apple Pomace which is generally considered to be a waste material in the industries has got a huge potential which if utilised can convert this waste to gold. The economic feasibility of the Pomace conversion to various products may not be feasible on a small scale but if implied on a larger scale the economics may definitely be improved.

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