Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 02, Issue: 01 (JAN-FEB, 2022)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Waste Management: Urgent Need for Food Sustainability

(*Pratibha, Surbhi Prithiani and Harshita Mali)

Department of Horticulture, R.C.A, MPUAT, Udaipur

* prolaniyaskr23@gmail.com

Food processing is an important sector in agriculture, the scope of which has increased manifold that can help to prevent wastage of perishable commodities to a great extent. But, at the same time, the food processing industries generate a large quantity and variety of food products, provide employment to a large number of people and uplift their economic status. The production, processing and preparation of food, all results in generation of huge quantity of waste material causing health hazards due to environmental pollution. The waste material may be in the form of leaf/ straw, waste during harvesting, food preparation waste, after processing waste, unused material as waste, food processing operation waste, *etc*. The huge wastage of the food material is due to lack of control on such agri-economy practices. So, the disposal of waste material has become a challenge to the processors, as different agencies are pressurizing for an environment friendly treatment of waste material. The utilization of waste for the production of value added products is very important in the management of food processing waste.

Different types of food industries wastes are:

- Fermentation industry waste,
- Fruit and vegetable industry waste
- Sugar and starch industry waste,
- Dairy industry waste,
- Meat processing industry waste,
- Coffee industry waste and
- Palm oil industry waste,
- Fish processing industry waste. So, there is a great need to find out options which have positive values of food waste.

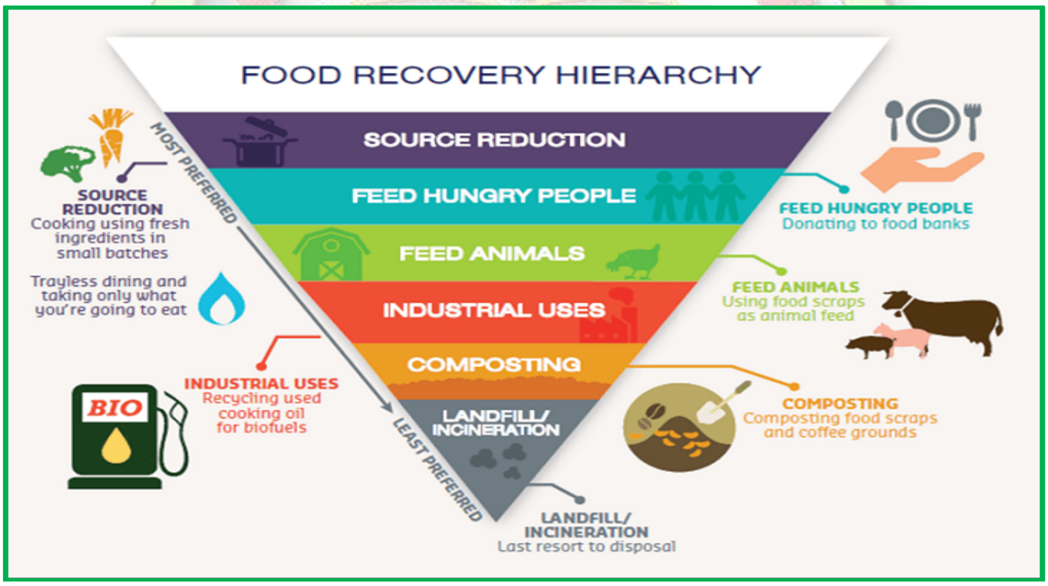
Table: Type of waste generated (%) from various fruit and vegetable processing industries

Commodity	Per cent waste (weight basis)	Nature of waste
Apple	20-30	Pomace
Apricot	8-25	Stones
Banana	-	Peel
Bean, green	5-20	Strings, stem
Beet	7-4	Peel
Cabbage	5-25	Outer leaves
Carrot	18-52	Peel, top portion, pomace
Grape fruit /citrus	55-60	Peel, rag and seed
Grapes	-	Stem, skin and seeds
Guava	-	Peel and core and seeds
Lime	60	Peels, seeds, rag and pulp
Mango	40-60	Peel (12-15), pulp (5-10), stones (15-20)
Orange	50	Peel, rag and seed
Peach	11-4	Stones
Pear	2-46	Peel, pomace
Peas	6-79	Shell
Pineapple	30-60	Peel, core and coarse solids
Potatoes	10-15	Peel, starch, fibre.
Sweet potato	15	Peel
Tomato	20-30	Skin, core and seeds

The proper waste management can be done by either application of suitable waste treatment or waste utilization technology. It is apparent from the earlier studies that waste from fruit and vegetable processing industries is a rich source of several constituents and has a great potential for preparation of value added products. Therefore, the adoption of right approach/strategy would be of utmost importance for waste management.

Waste Management Strategies

1. Selection of techniques which generate no or less quantity of waste e.g. enzyme technology for juice extraction.
2. Recover maximum useful materials (oil from apricot stones, pectin / fibre from apple pomace, lactose from whey).
3. Use the waste as substrate for production of valuable substances e.g. use of spent mushroom substrate for crop production, SSF of waste for mushroom, vitamins, single cell protein and pigment production.
4. Conversion of waste material into useful products (ethanol from fruit waste, citric acid from pomace, enzyme from wheat bran, animal feed from waste).
5. The waste material of fruit & vegetable origin should get first preference for production of food/feed related substances, followed by biogas.
6. Waste water treatment should meet the requirement of pollution control agencies.



Waste Utilization

Value Added Products from Processing Waste

Adding value to agricultural by-product makes it more desirable and enhances their economic value. Crop residue or agro by-products usually represent relatively high amounts of cellulosic material that could be returned to the soil for its future enrichment in carbon and nutrients or could be made available for further conversion to biofuels, bioenergy and other products. Such agricultural by-products can play an important role in triggering the transition of sustainable energy.

1. ***Mango:*** The industrial processing of mangoes end up with a considerable proportion of stones and peels which are discarded and end up in wastes. The stone content of mangoes

ranges from 9-23% with an average of 15%. Major waste like mango seed kernel is a good source of carbohydrate and can replace around 20% of corn for growing and egg laying chicken rations. Drying of mango kernels and peel can make high class energy food for animal feed. Mango peels, apple pomace which are also available in plenty from processing factories have also been shown to be a good source of pectin. Likewise, starch may also be available from mango seed kernels.

2. ***Grapes:*** Waste from wineries, breweries and distilleries after fermentation can also be used for feeding livestock. Animal feed can also be obtained from grape pomace and wine lees after growing microbes on them. The waste from brewery and distilleries also support the production of SCP. Natural colours are also obtained from blue grapes skin. Citric acid by fermenting brewery waste with *Aspergillus niger* has been produced. Citric acid on commercial scale can be produced by Solid State Fermentation (SSF) with *Aspergillus niger* on substrate of grape pomace can be used for citric acid production.

3. ***Banana:*** It is widely used for feeding dairy and beef cattle. Growing yeast on it and using it for animal feed is further helpful. Ripe banana peels (constituting about 22-30%) are sun dried for use as poultry feed. Banana pseudo stem gives about 5% edible starch.

4. ***Pineapple:*** Pineapple bran has a great demand as a cattle feed in the Hawaii Island. Cannary wastes are also being fed to the dairy cattle in Hawaii after ensiling. The waste obtained from processing of fruits and vegetables is rich in fibre that includes cellulose, hemi cellulose, lignin and silica with poor quantity of protein. Citric acid can be produced commercially by fermenting brewery waste with *Aspergillus niger* by Solid State Fermentation (SSF).

5. ***Potato*****:** Potato waste can be successfully tried as an animal feed. With the help of SSF, it is possible to increase the protein content of this waste, so that these can be used as animal feed. During peeling and slicing of the potatoes starch can be obtained and can be used as thickener. Potato peels supplemented with 0.04% ammonium chloride can be used for the production of protein by using a non-toxic fungi *Pleorotus ostreatus*.

6. ***Tomato*****:** Tomato pulp and pomace from tomato processing waste can also be used for production of SCP using *Aspergillus niger*.

7. ***Cabbage*****:** Various enzymes can be produced by fermenting food processing waste of cabbage. Invertase enzyme can be produced by fermenting Sauerkraut waste with the help of *Canidida utilis*. This enzyme is widely used in the food processing industry. Native micro flora of cabbage waste can be utilized for generation of enzymes like amylase, protease and cellulose from cabbage waste. Microbial gums like xanthan can be produced from cabbage waste by use of *Xanthamonas compestris*.

8. ***Kokum, Phalsa, Plum and Jamun:*** Natural colours are obtained from waste of these fruits.

Utilization of agro by-products

Earlier these agro residues were treated as waste by agriculturists and used to dispose into the surrounding environment causing pollution. However, they realized the significance of these by-products and the invulnerable costs of animal feed and fertilizers, and harmful impact to the environment and started to utilize it as animal feed. The use of crop residues is a good way of discarding materials that could otherwise be a potential health and environmental hazard. Agro by-products plays an important role in improving the nutritional status of various forms of rations and feeds of livestock as these by-products contain numerous amounts of macro and micro nutrients that are necessary for body growth and productivity.

Fermentation processes

Chemical transformation of product into value added products is the process known as Fermentation which is one of the oldest methods used for product transformation through microorganisms. Fermentation processes are mostly done in three types/methods such as solid state, sub merged and liquid fermentation. Selections of the fermentation process are product specific. To obtained bioactive compounds of industrial interest from various substrates such as wastes, solid state and sub-merged fermentation processes are used. Appropriate applications i.e., fermentations used for biotransformation of these wastes into valuable products having low cost and high nutritive value. Undeniably, use of wastes not only excludes the dumping problems but also resolves the pollution-related problems.

Production of ethanol

Currently in many countries food waste are incinerated together with other combustible municipal wastes or landfilled for possible recovery of energy. However, due to these two approaches environment and economy of the countries are more stressed. Due to its composition of organic and nutrient-rich content, theoretically food waste can be utilized as a useful resource for biofuel production through various processes of fermentation.The rapid global demand for the for the ethanol which has wide application in industries is increasing day by day. The main purpose of ethanol is to produce ethylene which is the main raw materials for the production of polyethylene and other plastics that is the reason for the high demand i.e. more than 140 million tonnes per year. The source of bioethanol is the waste from starch and cellulose rich crops, e.g. sugar cane, rice and potato. With the help fermentation in presence of *Saccharomyces cerevisiae* starch undergo breakdown resulted in the conversion of glucose by commercial enzymes and finally production of ethanol. In case of cellulose the breakdown due to hydrolysis is more difficult. If the FW contain large number of cellulose feedstock's than hydrolysis will become difficult, that is why, for the production of ethanol use of abundant and cheap wastes such as municipal, lignocellulosic and food waste has been explored as alternative substrates

Production of methane

Methane is used as a fuel for ovens, homes, water heaters, automobiles, turbines, and other things. Because of its low cost, the production of methane via anaerobic processes is a good approach for management of waste, low production of residual waste and its utilization as a renewable energy source. In addition to biogas, a nutrient-rich digested produced can also be used as soil conditioner or fertilizer.

Production of biodiesel

Biodiesel is synthesized through direct transesterification/acid catalyst using alkaline FW converted to fatty acids and biodiesel via various oleaginous microorganisms. Many yeast strains produce microbial oil and then it can be used as the substitute of plant oils due to their similar fatty acid compositions. It also can be used as raw material for the production of biodiesel. In terms of prevention and concern towards economic and environment, management of food wastes is utmost urgent and important to be implemented. The bioconversion of food waste is economically viable for the conversion of biodiesel, ethanol, hydrogen, and methane. However, problems associated with FW in terms of transportation/collection should also be monitored. Nevertheless, the low or no cost of food waste along with the environmental benefits considering the waste disposal would balance the initial high capital costs of the biorefineries.

Advantages of Waste Management

- Prevention of environmental pollution.
- Good supplement for nutrition of the human population.
- Different types of value added products can be prepared.
- Help in solving the problem of food scarcity.
- Good source of nutrients and can increase fertility of the soil.
- Good supplement for irrigation of the agriculture crop.
- Good source of nutrients and can increase fertility of the soil.
- Solve the problems of salinity hazards**.**
- Can increase economic returns of the industry.

Conclusion

The world Population is increasing rapidly with the decreasing trend of natural resources are at the same time. Raising concerns over the security of global food due to the disparity between food wastage and food poverty, highlights the moral and social food waste dimensions. This chapter suggests that the first step towards a more sustainable resolution of the growing food waste issue is to adopt a sustainable production and consumption approach and tackle food surplus. The distinction between food surplus and food waste on one hand, and avoidable and unavoidable food waste on the other, are crucial in the process of identifying the most appropriate options for addressing the food waste challenge. This study proposes the food waste hierarchy as a framework to identify and prioritize the options for the minimization and management of food surplus and waste throughout the food supply chain. The proposed food waste hierarchy aims to challenge the current waste management approach to food waste, contribute to the debate about waste management and food security, and influence the current academic thinking and policies on waste and food to support more sustainable and holistic solutions.

Preventing food waste in agriculture and food processing requires improved infrastructure and technological solutions in harvesting, storage, transport and distribution, supported by large-scale investment and local policies. Waste management policies should be integrated and aligned with the wider policies on food, agriculture, food standards, food poverty alleviation and sustainable production and consumption.