Food Wastage and Organic Waste Recycling Principle

Arpan Phukan[1] Ayush Gupta[2] Mrinmoy Saikia[3] Prof. Sangmeshwar S. Lohar[4]
[1,2,3,4]Department of Mechanical Engineering
[1,2,3,4]D.Y Patil College of Engineering, Ambi, Talegaon-410507, Pune, India

Abstract— There are significant environmental, economic and social factors favoring the reutilization of fruit and vegetable processing co-products in farm animal nutrition. Current evidence shows that fruit and vegetable processing co-products can be effectively used in farm animal nutrition as functional feed ingredients for the production of food products of improved quality. These ingredients comply with consumer requests for the production of "clean", "natural" and "eco/green" label food products.

Keywords: Reutilization, Processing, Effectively, Functional, Production, Ingredients

I. INTRODUCTION

Roughly one-third of food produced for human consumption is lost or wasted globally, which amounts to about 1.3 billion tons per year. In medium- and high-income countries food is to a great extent wasted, meaning that it is thrown away even if it is still suitable for human consumption. Significant food loss and waste do, however, also occur early in the food supply chain. In low-income countries food is mainly lost during the early and middle stages of the food supply chain; much less food is wasted at the consumer level.

Food is lost or wasted throughout the supply chain, from initial agricultural production down to final household consumption. The causes of food losses and waste in low-income countries are mainly connected to financial, managerial and technical limitations in harvesting techniques, storage and cooling facilities in difficult climatic conditions, infrastructure, packaging and marketing systems. Given that many smallholder farmers in developing countries live on the margins of food insecurity, a reduction in food losses could have an immediate and significant impact on their livelihoods.

The causes of food losses and waste in medium/high-income countries mainly relate to consumer behavior as well as to a lack of coordination between different sectors in the supply chain. Farmer-buyer sales agreements may contribute to quantities of farm crops being wasted. Food can be wasted due to quality standards, which reject food items not perfect in shape or appearance. At the consumer level, insufficient purchase planning and expiring 'best-before-dates' also cause large amounts of waste, in combination with the careless attitude of those consumers who can afford to waste food.

II. ORGANIC WASTES

The production, harvest, sorting and packing of fruits and vegetables produces close to a billion pounds of produce annually, according to the annual agricultural report for Georgia. These processes also result in material that is rotten, has bad spots not noticed in the field, or that is removed from packing lines and not shipped to the consumer. Properly dealing with discarded products can reduce the potential for environmental pollution while also protecting the individual who is responsible for the discarded materials.

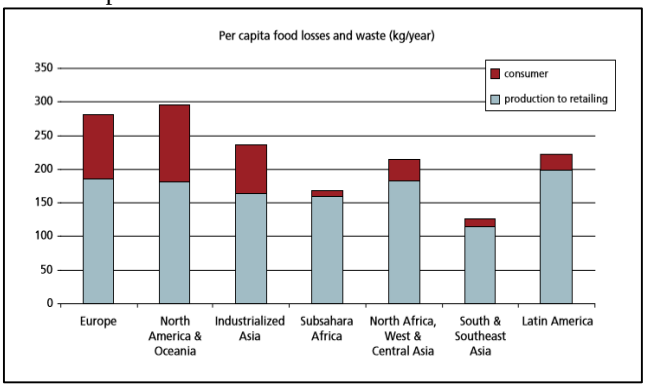

Fig. 1: Global food wastage chart

Figure 1. shows that the per capita food loss in Europe and North-America is 280-300 kg/year. In sub-Saharan Africa and South/Southeast Asia it is 120-170 kg/year. The total per capita production of edible parts of food for human consumption is, in Europe and North-America, about 900 kg/year and, in sub-Saharan Africa and South/Southeast Asia, 460 kg/year.

Per capita food wasted by consumers in Europe and North-America is 95-115 kg/year, while this figure in sub-Saharan Africa and South/Southeast Asia is only 6-11 kg/year.

Food losses in industrialized countries are as high as in developing countries, but in developing countries more than 40% of the food losses occur at post-harvest and processing levels, while in industrialized countries, more than 40% of the food losses occur at retail and consumer levels. Food waste at consumer level in industrialized countries (222 million ton) is almost as high as the total net food production in sub-Saharan Africa (230 million ton).

The graphs of the seven commodity groups below show the percentage food losses and waste of the edible parts of food products that were produced for human consumption.

III. PROBLEMS

Burying organic waste in landfill is a big problem and it's not just because of the resources we lose. When organic waste is dumped in landfill, it undergoes anaerobic decomposition (because of the lack of oxygen) and generates methane. When released into the atmosphere, methane is 20 times more potent a greenhouse gas than carbon dioxide.

Methane is, however, also a valuable resource. The natural gas piped into our homes is primarily methane. Organic waste can also be treated to make compost and soil conditioning products, as many people do in their backyards and gardens.

IV. GLOBAL WASTAGE AND NUTRITION LOST

Fruits and vegetables are extensively processed and the residues are often discarded. However, due to their rich

composition, they could be used to minimize food waste. A third of all food produced globally is lost or wasted. Given the many starving people and poor levels of nutrition around the world, reducing this waste would appear to be a key global priority. By 2050, the global population will reach 9 billion. If current levels of food loss and waste are maintained, food production will need to increase by as much as 70% in developing countries alone, requiring investment of $83 billion a year.

Reducing the levels of loss and waste will have a large impact on food security, nutrition, rural income and the environment. Dealing with hunger though is not just a matter of increasing availability of calories; increased availability for consumption of micronutrients is also important to combat hidden hunger. This can be addressed through loss reduction targeted at key food groups such as fruit and vegetables. By weight, fruit and vegetables have the highest levels of loss and waste globally at 44% of the total, yet account for just 13% of total loss and waste in terms of energy content2. The total calorific content that could potentially be saved if fruit and vegetable loss was reduced by 25% in the four countries we investigate (China, India, Pakistan and Kenya) would be the equivalent of enough energy to satisfy the requirements of up to 22 million people for a year .The impact of the micronutrient content of the fruit and vegetables is even greater, having the equivalent iron content for up to 66 million people and vitamin A content for up to 70 million people. This highlights the pressing need to reduce global perishable food loss.

Food loss and waste contribute to greenhouse gas emissions by both the decomposition of wasted food in landfill and even more importantly the embedded emissions associated with its production, processing, transport and retailing. The 3.3 billion tons of CO2 attributed to food loss and waste places it as the third largest emitter of greenhouse gases after China and the US.

The concentrations of phenolic (phenol + carbolic acid) and other phytochemicals present in the peels, pulp/pomace and seeds of many fruits and vegetables namely citrus, apples, peaches, pears, banana, pomegranate, berries, mangoes, onions, potatoes, tomatoes and sugar beet are generally substantially higher than in their respective edible tissues, suggesting these wastes and residues to be the potential sources for isolating bio-active compounds. All these nutrients can be utilize by recycling it with proper procedure and used for animal feed which can reduce the organic waste disposal. The feed which we prepare for the animals it will contain high amounts of nutrients in it due to the added nutrients in it according to the animal and their consumption of minerals.

V. ORANGE PEEL

Orange peel represents approximately 50% of the fresh fruit weight and could be used to develop value-added products. This study aims to evaluate the effects of drying conditions on the physical properties of orange peel that contains 80% water by weight. The measured responses used to determine the effect of drying process conditions were moisture content, drying time, total soluble solids, color and hardness

The food industry has shown a special interest in finding uses for citrus industry by-products. During the citrus juice extraction process, thousands of tons of by-products are produced .In this sense, orange peel could be dehydrated for different products such as powders, flakes and slices .Drying has become a widely used way of food processing, allowing the extension of the shelf-life of fruits and vegetables

There is a considerable emphasis on the recovery, recycling and upgrading of wastes. This is particularly valid for the food and food processing industry, in which wastes, effluents, residues, and by-products can be recovered and can often be upgraded to useful higher value products. The food industry produces large volumes of wastes, both solids and liquids, resulting from the production, preparation, and consumption of food. Food processing wastes might have a potential for recycling raw materials, for conversion into useful by-products of higher value, or even raw materials for other industries, or for use as food or feed.

VI. METHODOLOGY

A. Sample Preparation

Fresh orange peels obtained from a local juice shops were washed with tap water, cut into small pieces. The smaller pieces increase the area for release of moisture and thus reduced drying process time. These wet pulp is then kept out in the open to dry the excess water retained after washing.

B. Drying Experiments

The drying of peel is done in hot air oven. Samples (4 Kg) were placed on steel grate for treatment. The deterioration of fruit peels was caused by microbial growth due to presence of moisture. The amount of moisture contained is measured in terms of water activity a_w. Higher a_w substances tend to support more microorganisms. Bacteria usually require at least 0.91, and fungi at least 0.7. Water activity a_w can be calculated by Equation 1.

$$a_w = \frac{P}{p*} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where ,

p = vapor pressure of water in the peels at a given temperature

p* = vapor pressure of pure water at same temperature

So in our experiment drying was performed until the water activity (a_w) of the samples was less than 0.6 because, below this a_w the microbiological spoilage of dried samples could be prevented. Samples were placed in the dryer to measure water activity without changing the weights recorded in the trays. The measured water activity was close to 0.6.

Drying temperatures from 30 ºC to 90 ºC and air flow rates between .0281 Kg/sec assessed in the process. The weight loss of the sample was recorded during the process by measuring the weight before and after the drying process .The registered weights were expressed in terms of free moisture contents (kg water/kg dry matter). The moisture content (MC) was calculated by Equation 2 and the time to dry the samples to the desired water activity was obtained.

$$MC = \frac{M(f) - M(i)}{M(i)} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where,

M (f) = Mass of peels after drying process

M (i) = Mass of peels before drying process

1) Grinding

The dried orange peels are collected from the outtake and the checked for required moisture content. Once suitable dryness is obtained the peels are then put into a grinder and grinded into fine powder. These grinded powder then can be used as added nutrients to animal feed.

VII. DISPATCHING

The grinded powder is taken out of the grinder, spread over paper sheets and placed under dry hot conditions (under the sun). This would allow the residual moisture to leave the powder so that after packaging they do not form lumps. After these has been done the powder is put in air tight plastic packages. These plastic packages can be directly sold to suitable customers or can be stored in cold places if immediate consumption is not available. Storing in cold places increases the longevity of the product for use in urgencies.

VIII. CONCLUSION

Thus we have concluded that there is an ever growing need in our society, as well as at a global level, to preserve nutrients from being wasted. This can be done by reducing the amount of our food that goes into our dustbin.

Various methods of food handling, cultivation and consumption have been developed to do the same. Our study aims to help in this process by using the peels of fruits (oranges for instance) to be used as cattle feed additives in their powder form.

REFERENCES

[1] Chafer, M., Gonzalez-Martinez, C., Ortola, M. D., Chiralt, A., Fito, P., Kinetics of osmotic dehydration in orange and mandarin peels. Journal of Food Process Engineering, 24, (4), 273-289 (2001).
[2] Chafer, M., González-Martínez, C., Chiralt, A., Fito, P., Microstructure and vacuum impregnation response of citrus peels. Food Research International, 36, 35-41 (2003).
[3] Senevirathne, M., Jeon, Y. J., Ha, J. H., Kim, S. H., Effective drying of citrus by-product by high speed drying: A novel drying technique and their antioxidant activity. Journal of Food Engineering, 92, 157-163 (2009).
[4] FAOSTAT. 2010a. FAO Statistical Yearbook 2009 - Agricultural Production, available at: http://www.fao. org/economic/ess/publications-studies/statistical-yearbook/fao-statistical-yearbook-2009/b-agriculturalproduction/en/
[5] Parfitt, J., Barthel, M. & Macnaughton, S. 2010. Food waste within food supply chains: quantification and potential for change to 2050, Phil. Trans. R. Soc., vol. 365, pp. 3065-3081
[6] Stuart, T. 2009. Waste – uncovering the global food scandal. Penguin Books: London, ISBN: 978-0-14103634
[7] Wilhelm, Luther R., Dwayne A. Suter, and Gerald H. Brusewitz. 2004. Drying and Dehydration. Chapter 10 in Food & Process Engineering Technology, 259-284. St. Joseph, Michigan: ASAE. Đu169© American Society of Agricultural Engineers. (Rev. Aug. 2005.)
[8] Thermodynamic model of microwave drying of citrus peel with different treatments: Clara Talensa, Marta Castro-Giráldezb, Carlos Balda, Pedro J. Fitob AZTI-Tecnalia, Unidad de Investigación Alimentaria, Derio, Spain Laboratorio de Propiedades Dieléctricas, Instituto Universitario de Ingeniería de Alimentos para el Desarrollo, IIAD, Universidad Politécnica de Valencia, Spain
[9] Fruit and Vegetable Co-Products as Functional Feed Ingredients in Farm Animal Nutrition for Improved Product Quality:Eleni Kasapidou 1,*, Evangelia Sossidou 2 and Paraskevi Mitlianga

