

Waste Compartmentalization and Root Cause Analysis for the Losses of Fruits and Vegetables at Dambulla Economic Center, Sri Lanka

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Abstract

Dambulla Economic Center (DEC) is one of the seventeen economic centers in Sri Lanka with 144 stalls, which do transaction of 65-75% of fruits and vegetable requirement of the country. The average volume of sale in DEC per week is 26,500Mt. Approximately 1000-2000 vehicle loads of fruits and vegetables come to DEC daily, representing each province of the country. The everyday waste generated at DEC throws into the six waste dumps at the DEC and then discard into the nearby forest. It is important to estimate the quantity and to analyze the composition of waste at DEC in order to investigate the utilization avenues of the waste for the establishment of energy security and the food security of the country. The information on daily total loss of fruits and vegetables at the DEC was obtained through personal interview method for 18 months period. The waste composition was assessed using sort-and-weigh methodology (D 5231-92, 2003). 120 kg of waste samples were collected randomly from the dumps twice a month and separated into categories and weighed. The moisture and ash content of waste was analyzed to determine the possibility to generate bio gas from the waste. The root causes for the waste of each component were identified through visual observation. Results revealed that the mean number of vehicle loads of waste at DEC was six/day and the quantity was 10,800 kilograms/day. According to the overall estimation for 18 month period, maximum proportions of waste were non food wastage (10.95%) including banana debris and leaves, king coconut shells and polythene and papers followed by the debris of fruits and vegetables (10.28%), yellow pumpkin (10.23%), leafy vegetables (10.13%) including leeks, kankun, onion leaves, salad leaves, mukunuwenna, niwithi and cucumber (7.81%)(Table 1). Waste component below 1.00 % were snakeguard, beans, pineapple, jackfruit, manioc, umbrella, keselmuwa, belly, kiriala, long beans, bitter guard, ribbed guard, corn, capsicum, broccoli and drumsticks.

Table 1: Average composition of waste at Dambulla Economic Center

Waste component	Average%	Waste component	Average%
Non food wastage	10.95	Radish	3.116
Debris	10.28	Banana	2.103
Yellow pumpkin	10.23	Ash Pumpkin	1.968
Leafy vegetables	10.13	Potatoes	1.795
Cucumber	7.816	Apple, orange, mango	1.662
Brinjal	7.108	Papaya	1.590
Onion	6.460	Tomato	1.575
Kekiri	5.230	Sweet potatoes	1.202
Watermelon	3.545	Food waste	1.077

Average % of each component from May 2015 to November 2016

The identified root causes for the waste were no demand (30.28%), pest damage (19.42%), diseases (18.14%), mechanical damage (16.71%) and poor quality (15.42%). As shown in Figure 01, the root causes for the losses of the debris of fruits and vegetables were mechanical damage (70%), pest damage (15%) and diseases (15%) while for the yellow pumpkin it was no demand (75%), poor quality (25%).

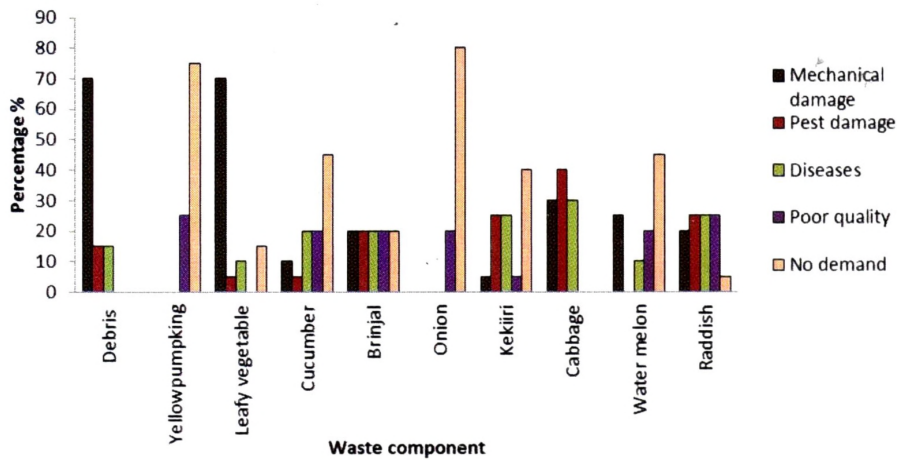


Figure 01: Root causes for the losses of main fruits and vegetable waste components at DEC

The moisture content of waste was 84.59 ± 1.94 % and the ash content was $6.60\% \pm 0.04$. The potential to generate biogas from the daily waste generated at DEC was 216 m^3 . Therefore, it can be concluded that the DEC produces 1,664 kilograms of solid waste per day due to no demand, pest damage, diseases and poor quality of the fruits and vegetables and it can be utilized to generate biogas.

Key words: Bio-gas; Fruits and vegetables; Root causes; Post harvest losses; Waste