



Report on 72-liter Eco Cooker at PG Mess, UICT, Mumbai

About 40 % of the total energy requirement of India is consumed for cooking. Of the energy used for cooking, 14 % comes from commercial fuels such as gas, kerosene or coal; the remaining 86 % is from non – commercial fuels such as firewood, dung cakes and agricultural waste. Cooking being a physico – chemical process, basic Chemical Engineering principles have been combined to develop an energy efficient cooker for the foods that can be cooked by boiling or steaming. The cooker has been named as Eco cooker (earlier called as Bachat cooker) and is available in different sizes ranging from 4.5 liters to 72 liters. Apart from saving fuel, and thereby also reducing pollution, the cooker produces food with better flavor and possibly higher nutrition values than other cooking methods provide.

Any cook has to spend considerable time in the cooking activity, has to stay in a hot surrounding in the kitchen for longer time, monitoring cooking that is likely to affect his / her health. Situation becomes extremely unbearable in the summer season and especially when one has to cook for 300 – 350 persons at a time. In order to save fuel, time and ease of cooking along with the quality of cooked food, 72-liter model of 'Eco' cooker was designed and experimented at UICT PG Mess, Matunga,



Mumbai using LPG as a fuel. Such a model may eventually become useful for other messes, canteens, hotels etc.

'Post Graduate mess' of UICT, Mumbai is run on a co-operative basis and caters food to 300 students including about 70 girls at a time. Their regular requirement of food items at any one time using the usual cooking method is 13 kg of rice and 4.5 kg of dal (tuvar) and 6 kg Potato. One-month stocks of rice and dal required for the mess are procured at a time. Hence, there is chance that rice and dal quality may vary from month to month.

Cooker Description:

72-Liter 'Eco' cooker consists of the specially designed aluminum flat base equipped with the water drain tap. It supports the three stacks of 4 vessels each. Thus, there are 12 vessels made of stainless steel, each of which can accommodate 6 kg of cooked food items. Three stands provide support for the three stacks. It also consists of two aluminum enclosures that ensure the retention of heat contents of the cooking charge during heating and cooling. Nine rings separate the vessels from each other during stacking. Three plates cover the top most vessels in each stack. The drain tap is provided in the base so as to drain excess water at the start of cooling. It is to avoid any contact between the base and the bottom vessels during cooling, as it will avoid faster cooling of the



bottom vessels. The principle of design and operation is the same as that of the smaller versions of Eco cooker.

Cooking performance of Eco cooker

In order to study the cooking performance, heating and cooling was carried out with only water as a charge. Each vessel was charged with 6-kg of water, thus making total charge of 72-liter. 15-liter of water was added in the base. The big flame burner (canteen burner) at 85 ml/s LPG flow rate was used for heating. Charge was heated until all vessels reach 98 °C after which the gas supply was shut off. Drain tap was opened to allow excess water in the base to drain out followed by 30 min cooling. Heating and cooling profiles were in consonance with the cooker of 4.5 and 24.0-liter capacity. These profiles indicated that the bottom vessels in each stack are heated at the earliest and are maintained at higher temperature for a longer period. The top-most vessels in the stacks follow these vessels during heating. Middle level vessels get heated simultaneously albeit at a slower rate. The food that requires longer cooking time such as dal or whole grams can be kept in bottom vessels, rice in top vessels as well as any other middle level vessels and potato or vegetable in any of middle level vessels.

Taking in to consideration that every time, cooker may not be used with full charge, experiments were carried out for different charges (such



as 50 and 75 % of full capacity) and again time was noted to reach the required temperature, i.e. all vessels reaching a temperature of 98 °C.

After studying the temperature profiles for water, actual cooking experiments were conducted with rice, dal and vegetables. Variety of food items used was 'Wada Kolam' of rice and 'Arhar (tuvar)' for dal. Rice to water quantity ratio for this rice was found to be 1:2.3, that for dal to water as 1:3 and that for potato to water as 1:2. Initial experiments were conducted for rice as a full charge, dal as a full charge and the combination of rice, dal and potato. Food items were observed to be satisfactorily cooked to the required texture of food particles at the gas flow rate of about 85 ml/s and time period of about 80 min heating and 30 min cooling. It was observed that average LPG consumption for cooking of food items with the full charge was about 950 g.

Since December 16, 2002, the cooker is being regularly used to cook 12 kg of rice, 4.5 kg of dal and 6 kg of potato in the UICT PG Mess. Cooked rice is completely free flowing (more than the earlier 'boil and drain' method of cooking). Cooked dal can be thoroughly mashed. Potato is also nicely cooked. Taste and flavor are superior over the food items cooked by earlier method as has been discussed later.

Drain Method versus Eco Cooker for rice cooking:

Usually, rice on a larger scale is cooked using the 'Drain method' in order to make it free flowing after cooking. In 'Drain' method, rice is



heated along with water till it reaches boiling temperature and allowed to boil for some time until required texture of rice grain is observed. At this moment, mixture is poured in perforated vessel allowing excess water to drain. Rice thus cooked becomes free flowing. However, all water-soluble vitamins and nutrients are lost in the drained water. This method was also followed in the PG Mess earlier.

In 'Eco' cooker, heating is stopped once the charge attains 98 °C and due to its good insulating ability, the temperature is maintained over the next 30 min and the food gets cooked in its own sensible heat. As no material or water vapors are lost, the flavors and taste – elements of food are retained. Thus, the cooker produces food with better flavor and higher nutrition values than other cooking methods provide. Moreover, food can be kept warm for much longer time if the cooker un-opened.

Feedback from the mess members

Initially, food items were cooked in either a cooker or by traditional way in morning or evening randomly without the knowledge of mess members who were requested to give feedback on cooked items about the flavor, taste, appearance, etc. Almost all members gave their preference to the food cooked in the Eco cooker over that cooked in a traditional way. Since then, cooker is being operated in the morning and evening as well. The comment by one of the student that "In the 8 years



of hostel life, I have never enjoyed the cooked rice like this” is the representative opinion of other members.

Feedback from the cooker operators

Two matriculate persons in the mess were trained for operating the Eco cooker within three days and are now handling the cooker on their own. Earlier, rice, dal and potato were being cooked separately and required lot of attention during the cooking. Also, heat losses were much higher resulting in kitchen having very hot surrounding. In Eco cooker, all these items are being cooked simultaneously. Their experience shows that they are at ease and feeling comfort during the cooking on two counts: one, cooker design itself takes care of not heating the surrounding and two, cook can keep himself away from the cooker and the burner as it does not require any attention. As the heat losses from the cooker are kept to a minimum, kitchen surrounding does not become hot. Once the heating of the cooker is started, operator does not have to look after the cooker from time to time. He / she can get busy in other work. After a specified time, when LPG has to be switched off, operator has nothing to do during the cooling period. When the cooker is opened, cooked food is ready for serving. It has proved a boon to them especially during the coming summer season. ‘What a relief it is that during cooking, you are enjoying the World Cup cricket in TV Hall on upper floor of the Hostel or



that you are enjoying a nap in your rest room!' was one of the comments of the cook.

Safety aspects

Cooking of food item in the Eco cooker is essentially by boiling and steaming. Temperature and pressure never exceeds 100 °C and 1 atm respectively. Hence, there is no chance of any blow-up due to pressure build up if the pressure cooker was used. It may be noted that pressure cooker is not available for the capacities higher than 28 lit. Flame of LPG stove is completely covered by the base of the cooker and hence does not produce any fire hazard. Any touch to outer cover by any mistake is also not likely to cause any serious burn.

Conclusions

1. Cooked food has improved taste and flavor.
2. PG Hostel mess members are very happy as they are getting a better quality and tasty food.
3. PG Hostel administration is pleased about the performance of Eco cooker as it saving monthly bill on LPG cylinders (actual saving will be put forward shortly).
4. Food cooks (operators) are very happy as they are saving their time as well as the stay in hot kitchen surrounding.
5. Eco cooker has reached its perfection and is being given to different parties such as schools, hostels, hotels etc.