

## PROLONGING OF SHELF LIFE OF FRESH VEGETABLES WITH THE HELP OF EMULSION

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Attempts were made in the present investigation to develop a suitable emulsion and easy method for extending the shelf life of vegetables. Vegetable oil based emulsion developed after necessary trial was applied on different vegetables. Change in moisture, respiration and appearance of vegetables treated with emulsion were determined and compared with those of untreated vegetables. It was observed that shelf life of vegetables which can normally be kept for three days, can be extended to three to five days with the help of emulsion.

**Key words:** Vegetable, Shelf life, Emulsion.

### Introduction

Vegetables are perishable and many of them are highly susceptible to losses from damage and deterioration between harvest and final consumer. A large quantity of various vegetables is spoiled during transportation and marketing. Due to lack of suitable transportation and roads connecting vegetables growing areas to the markets, a considerable time is consumed before the vegetables reach the consumer. During this period weight of vegetables decrease continuously, because of transpiration and respiration. Moisture evaporation from their surfaces increases with the increase of air temperature. Water loss results not only in quantitative losses but also in deterioration in appearance due to wilting and shrivelling. There is also a great loss due to break down of organic substrates and microbial decay. Such decayed vegetables are usually discarded in streets or open spaces, thereby creating unhygienic atmosphere and other problems relating to the cleanliness of markets. It is important, therefore, to undertake research to prolong the shelf life of vegetable. The rate of respiration and evaporation of water from their surfaces need to be minimised in order to prolong the shelf life of vegetables. Low temperature retards respiration and consequent ripening and senescence of vegetables. However, it is not practicable to use refrigeration during the transportation to markets for better shelf life and utilization of vegetables. In PCSIR Laboratories Complex, Lahore, formulations of fungicidal wax emulsions were developed for extending the storage life of citrus fruits,[1] mangoes[2] and bananas[3], but these emulsions were not suitable for vegetables. Therefore, investigations were carried out to find means for prolonging the shelf life of vegetables, and formulation of an oil emulsion was made. The moisture loss and decrease in respiration rate of vegetables were used as parameters to evaluate the prolonging of shelf life of fresh vegetables.

### Experimental

*Preparation of emulsion.* 140 g of oil (soybean or sunflower and 14 g of stearic acid were mixed in a pan and heated to 60°-70°C. In another pan 12 ml of triethanolamine (TEA) was dissolved in about 500 ml of soft water and warmed to 60-70°C. To this solution, the oil/stearic acid solution was poured gradually and stirred vigorously. After thorough mixing, it was allowed to cool to room temperature. 10 ml of thiabendazole (TBZ) was added to above prepared solution and again stirred. The concentrated emulsion thus prepared was diluted with soft water to a final volume of 2 litres. The oil emulsion thus prepared contains 7% oil and 0.5% thiabendazole.

*Application of emulsion.* Various vegetables were purchased from the local market. The fresh vegetables were washed thoroughly with water in order to get rid of dust and dirt from their surfaces and then each vegetable was divided into two lots. The first lot was kept as control and second lot was dipped in oil emulsion for 2 min followed by air drying with an electric fan. Both lots were kept at room temperature  $20^{\circ} \pm 1^{\circ}\text{C}$  and relative humidity ranging between 30 - 60% during experimental period.

The weight of each lot of vegetables was determined daily and percentage moisture loss was calculated by AOAC method[4]. Respiration rate of each lot was measured by the method described by Paul Thomas *et al.* [5]. Air was passed through 40% KOH solution to make air supply to vegetables free of CO<sub>2</sub>. The CO<sub>2</sub> evolved was absorbed in Ba(OH)<sub>2</sub> solution of known strength which was later titrated against standard H<sub>2</sub>SO<sub>4</sub>. The results were expressed as mg CO<sub>2</sub> per kg of vegetable/hour.

### Results and Discussion

It is observed from Table-1 that rate of weight loss of untreated calsbash (ghia) was much faster than treated at

TABLE 1. PERCENTAGE LOSS IN WEIGHT OF VARIOUS VEGETABLES DURING STORAGE AT 20 + 1 °C HUMIDITY 30-60% (AVERAGE OF 5 KG. VEGETABLE).

Vegetable	Lot	Moisture % Initial Moisture %	2nd day loss in weight %	3rd day loss in weight %	Visual observation after two days	4th day	5th day loss in weight	6th day loss in weight	Visual observation after 5th day
Calsbash (Ghia)	Control	92.5	4.0	7.0	Slight black spots shrivelling appeared	10.0	12.5	Discontinued	Black spot on the surface and squeezed
Lageneria Vulgaris	Treated	-	2.0	3.5	Light green and fresh appearance	4.5	5.3	6.0	Slight shrivelling appeared
Lady's Finger (Bindi-Tori)	Control	88.8	11.0	21.0	Slight shrivelling appeared dehydrated	30	Discontinued	-	Discontinued
Hibiscus esculentus	Treated	-	4.5	10.5	Fresh appearance no shrivelling	16	21	-	Slight shrivelling
Peas green (Mater)	Control	89.0	13.0	26.0	Shrinkage & dull green in colour	37.0	Discontinued	-	Discontinued
Pisum sativum	Treated	-	7.0	15.0	Green and fresh appearance	26.0	36	-	Slight shrinkage good appearance on 4th day
Bitter Gourd (Karela)	Control	89.7	7.7	15.0	30-40% turn yellow	22.0	Discontinued	-	80% turn yellow
Memordica charantia	Treated	-	4.0	8.0	Green & fresh appearance	12.0	16.0	-	30% turn yellow 70% were green
Bath sponge (Gia-Tori)	Control	93.0	8.0	16.0	Dull green & slightly squeezed	24.0	Discontinued	-	All appeared dehydrated & turn black green
Luffa aegyptica	Treated	-	4.0	10.0	Green soft and fresh look	15.0	20.0	-	Slightly squeezed
Shimla chillies (Shimla Mirch)	Control	93.2	7.0	12.0	Slight shrinkage	17.0	Discontinued	-	Shrinkage on 90%
Papric	Treated	-	3.0	6.0	Green fresh appearance	9.0	12.0	-	Slight shrivelling

any stage during experimental period. Untreated ghia lost 7% weight, due to moisture evaporation on 2nd day of its storage. In comparison, the weight losses of treated ghia were almost the same on 5th day of storage and retained good appearance. The untreated lot lost 12.5% of its weight on 5th day and did not have good appearance due to lot of shrivelling. There were black spots on the surface of ghia. It was observed from Table-2 that rate of CO<sub>2</sub> liberation was less in treated ghia than that of control. It was deduced from these observations that shelf life of ghia can be extended to 5 days whereas control ghia cannot be retained beyond 2 days.

*Lady's finger.* As compared to ghia the rate of loss in weight of Lady's finger was high. Untreated lady's finger lost 21% of its weight on 3rd day and emulsion treated lot lost the same weight on 5th day. The rate of respiration in treated lot was subdued (Table-2). The results showed that shelf life of treated lady's finger can be extended for 2 additional days.

*Peas and bath sponge.* The rates of moisture losses of emulsion treated peas and bath sponge were slightly less than those of untreated lots. The rates of respiration of both lots i.e. untreated and treated peas were similar to both lots of bath sponge. Respiration rate of treated bath sponge was slightly less than that of untreated bath sponge. Shelf life of treated peas and bath sponge were extended to 3 days, in comparison, untreated bath sponge and peas were kept not beyond 2 days.

*Bitter gourd and shimla chillies.* The rates of loss mois-

ture in treated lots of bitter gourd and shimla chillies were similar to each other. However, these rates were less than those of untreated lots. It was also observed from Table-2 that emulsion coating had reduced the evaluation of CO<sub>2</sub>. It was also noted that 40% of untreated bitter gourd was changed to yellow green from green colour in two days. In comparison; 40% of the treated lot of bitter gourd changed to yellow colour after 4 days. The results showed that treated vegetables were retained for 4 days and untreated were kept for 2 days.

Keeping in view the above results of all the vegetables, it was deduced that shelf life of vegetables, which can normally be kept for two days, can be extended from 3 to 5 days, with oil emulsion treatment. The vegetables such as peas and

TABLE 2. RESPIRATION RATE OF VARIOUS VEGETABLES OF VARIOUS LOTS CO<sub>2</sub> IN MG/KG OF VEGETABLE/HOUR.

Vegetable	Lots	1st day	2nd day	3rd day	4th day
Calsbash	Control	8.40	102	133	108
	Treated	-	90	103	102
Ladys finger	Control	112.0	164.0	184.0	140.0
	Treated	-	148.0	144.0	132.0
Peas	Control	84.0	95.0	138	110
	Treated	-	90.0	120	114
Bitter gourd	Control	110	122	140	124
	Treated	-	112	112	112
Bath sponge	Control	37	50	70	56
	Treated	-	45	54	50
Shimla chillies	Control	52.0	71.0	90.0	56.0
	Treated	-	61.0	70.0	60.0

ghia tori which have greater surface area per kg have greater rates of moisture loss and the shelf life of such treated vegetable was extended to one additional day. In comparison, the shelf life of vegetables such as calsbash which have smaller surface area/kg was extended to three days with the help of emulsion treatment. In short, the shelf life of all the vegetables tested can be extended with the oil emulsion treatment. It was also deduced that vegetables deteriorate due to wilting and shrivelling when the weight losses reached about 18-20% of the weight of fresh vegetables. Such decayed vegetables are not saleable.

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