USE OF PROPIONIC ACID FOR THE PRESERVATION OF COCONUT KERNEL

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ABSTRACT

Propionic acid in three concentrations for four soaking durations was tried for preservation of fresh kernel. Concentration of 1000 ppm for 30, 45 and 60 minutes soaking time was found effective for preservation upto a minimum of 96 hours. To avoid spoilage during drying at low temperature and high humidity conditions, effects of 3 concentrations at 2 soaking durations were studied. Application of propionic acid in concentrations of 750 ppm for 30 min. and 1000 ppm for 15 and 30 min. soaking were found satisfactory for arresting the microbial activity during drying. No effect was observed on the rate of drying due to application of the chemical.

INTRODUCTION

Coconut is one of the main important oil seed crops in the country and it is of a special importance to Kerala where it is used for edible purposes. In India dry milling is generally practised. Dried coconut meat commonly known as copra is crushed in chekkus, rotaries or in expellers to get oil. Coconut kernel contains 45 to 50% moisture (on weight basis) which is reduced to 6% upon drying to make copra. This is generally done in open yards by exposing split kernel to the sun. Under bright sun, this operation takes about 7 days. If drying operation is prolonged, microorganisms infest the kernel/copra resulting in bad quality oil, since coconut kernel is a favourable a substrate for the growth of microorganisms. Under high humid conditions which prevail in coconut growing regions, spoilage of copra due to fungal infestation is very frequent. Uncertainty of weather conditions also affects the quality of copra produced, because copra gets infested at all levels of moisture content in inclement weather. The oil obtained from such copra may contain aflatoxins and mico-toxins (Arseculertne and De Silva, 1971, Narasimhan, 1968).

Many workers have tried different chemical dip treatments (Somatmadja and Ali, 1968; Sreemulanathan, 1979; Satyavathi, 1979, and Subramanyan *et al.* 1959) but much success could not be achieved probably because of the heavy doses of chemicals tried and their undesirable residual effect on quality of copra.

In the present investigation propionic acid is tried as an anti-mycotic agent for preservation of kernel. Propionic acid has been found suitable in preservation of high moisture corn (Burroughs, 1974, Jones, *et al.* 1974 and Jones, 1970) sorghum (Nelson *et al.* 1973), soybean (Stevenson and Alexander 1972), bread dough (Pintauro, 1974) and in making tortillas without affecting its quality and nutritional value. Moreover, this acid has been generally regarded as a safe food additive in Canada and USA with a tolerance limit of 2000 ppm (Pungsley, 1959).

Materials And Methods

Since high relative humidity (above 80%) and slight high temperature (30 to 45°C) are conducive to growth of microorganisms, the experiments were conducted in such accelerated favourable conditions for growth of microorganisms to get more feasibility of the treatment during actual sun drying. Fully matured coconuts of West Coast Tall variety were selected for study. Coconuts after husking, were split open and washed under running water. Experiments were conducted in 2 sets; one by keeping cups in single layer in well ventilated room and other in cross flow oven at 35°C. In first set, sample size of 16 cups were soaked in propionic acid solutions of 500, 750 and 1000 ppm concentrations for 15, 30, 45 and 60 min. Two control samples namely washed and unwashed were prepared. Observations for spoilage were recorded at 21, 27, 45, 51, 53, 59, 69 77, 86 and 96 hr. after the treatment. Temperature and relative humidity were also recorded during experimentation. Samples in second set were soaked in 500, 750 and 1000 ppm solution for 15 and 30 min. and then kept in cross flow oven at 35°C. The drier was operated only for six hours in a day to simulate slow and intermittent drying to create more favourable conditions for the growth of microorganisms. Treatments found successful were repeated using smaller lots of 4 cups for confirmation during high humid period from July to September.

RESULTS AND DISCUSSION

Preservation of kernel in a well ventilated room

Ambient conditions of temperature and humidity during the experimental period are given in Table 1. Observations on spoilage of copra are graded in different categories, as given in Table 2. Change in quality in all cups from a sample was uniform due to the application of chemical by soaking method. In control of washed cups when compared to unwashed, little more resistance to deterioration was observed upto 27 hr. After the 27 hr. both the control samples were badly infested by yellow and black fungus (*A. flavus* and *A. niger*). Infestation in all the cases followed the chain of sweating–yellowing (bacterial and fungal infestation). The discolouration or browning was also observed in cups during 45th and 53rd hr. mainly at periphery and inside where fungus infection was present. Cups treated at lower concentration showed more discolouration. For 96 hr. of storage in a well ventilated structure, the treatments of 1000 ppm for 30, 45 and 60 min. were found to be equally effective.

Kernel subjected to 35°C temperature in a cross flow drier

The effectiveness of treatment under this condition is given by percentage of cups infested (Table 3). The treatments of 15 and 30 min. soaking in 1000 ppm solution and 30 min. soaking in 750 ppm solution were found to be effective among the other treatments, giving recovery of about 67% mould free cups as compared to 0% in case of control.

Table 1. Ambient temperature and relative humidity during the period of experiments

Temperature °C				*Relative humidity %*			
Maximum		*Minimum*		*Forenoon*		*Afternoon*	
Mean	*Range*	*Mean*	*Range*	*Mean*	*Range*	*Mean*	*Range*
29.37	25.4 – 30.50	23.40	21.8 – 25.3	93.00	83–97	81	71–95

Table 2. Stage of spoilage during preservation of fresh kernel
(*Sample size* 16 *cups*)

Treatment		*Duration of storage, hr.*								
Conc ppm.	*Soaking time min.*	21	27	45	50	53	69	77	86	96
500	15	B	B	C	C	F+++	G+++	—	—	—
750	15	B	B	C	C	F	G+++	—	—	—
1000	15	A	A	C	D	E	E	F+	G	G+
500	30	B	B	C	C	C	G+	G++	G++	—
750	30	A	A	C	B	B	C	C	G+	G++
1000	30	A	B	B	B	B	C	C	C	C
500	45	A	A	C	C	G+	G+++	—	—	—
750	45	A	A	C	C	C	C	G+	G++	G++
1000	45	A	A	C	C	C	C	C	C	C
500	60	A	A	C	B	G	G+++	—	—	—
750	60	A	A	B	B	B	F+	F++	G+	G++
1000	60	A	A	B	B	B	C	C	C	C
Unwashed Control		D	E	G+++	—	—	—	—	—	—
Washed Control		C	E	G+++	—	—	—	—	—	—

A = No sweating
B = Slightly noticeable sweating
C = Sweating
D = Very high sweating
E = Sweating and yellowing (bacterial infestation)
F = Yellow fungus infestation
G = Black fungus infestation
\+ = more than 2 cups infested
++ = more than 4 cups infested
+++ = more than 6 cups infested

Table 3. Percentage infestation during drying at 35°C in cross flow Drier

Treatment	*Infestation after 3 days*	*Infestation after 5 days*	*%mould free copra obtained*
Control	66	100	—
500 x 15	16	50	50
750 x 15	5	50	50
1000 x 15	5	33	67
500 x 30	—	50	50
750 x 30	—	33	67
1000 x 30	—	33	67

Preservation of fresh kernel becomes essential by chemical treatment where drying is delayed due to uncertainty of weather conditions. If the kernel after splitting not subjected to drying, gets infested by microorganisms such as *Serratia marcessens* and *Stephylococus* (Satyavathi, 1979). This results in bad colour and sliminess of copra. The treatment of propionic acid at 1000 ppm concentration showed the inhibitary effect on microorganisms. It may be due to the hydrogen ions or due to the altered cell permeability causing growth inhibition. (Gershon and Permegiani, 1967). Toxicity of chemical applied is beyond question as concentration in the material may be in the order of 200 to 300 ppm, far below the permissible limit of 2000 ppm. The phenomenon of browning observed during 45th to 53rd h. may be due to the Maillard type of reaction in which one or more carbonyl groups (as in sugars) react with amino groups (as in aminoacids) or proteins (Gershon and Permegiani, 1967). This may also be due to rapid penetration of hyphae of *Aspergillus* species into copra meat under high humidity conditions causing discolouration and complex biochemical changes which result in high lipolytic activity and rise in FFA content. These treatments were tried under accelerated favourable conditions of temperature and relative humidity for the growth of microorganisms and found that the

results were satisfactory on infestation control. This may certainly be practicable for avoiding spoilage of copra during sundrying.

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