HEAT PRE-TREATMENTS TO HELP ALLEVIATE THE DEVELOPMENT OF HARD-TO-COOK COWPEAS DURING STORAGE

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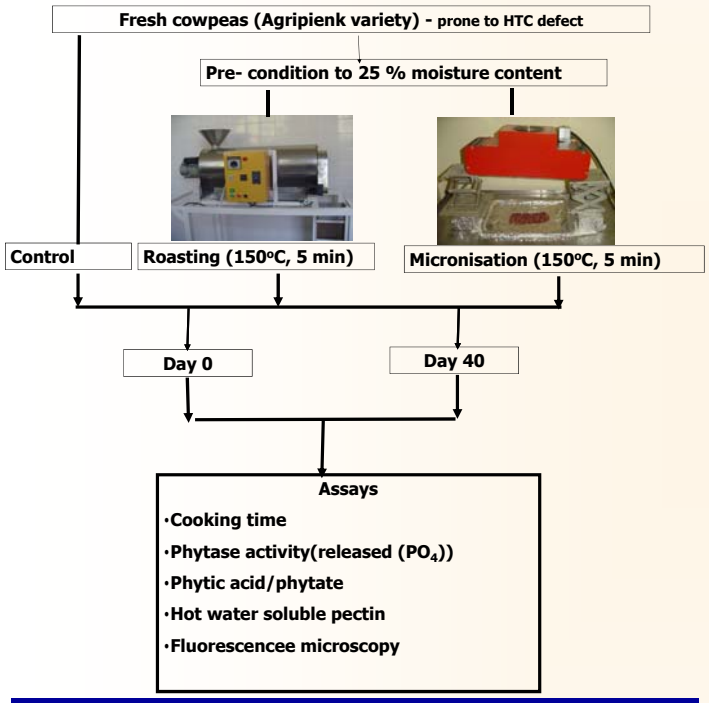
INTRODUCTION

Storage of cowpeas under conditions of high temperature (30-35oC) and high humidity (60-80%) leads to the development of "hard to cook" (HTC) defect. These cowpeas need very long cooking times, thereby limiting their utilization[1]. The two main theories reported in literature implicate increased enzyme activity: "phytase-mineral and mineral-pectin interactions" due to phytase and lignification mechanisms due to peroxidase. Heat pre-treatments before storage of cowpea seeds could be employed to inactivate or reduce enzyme activity during storage.

OBJECTIVE

To evaluate the potential of micronization (infra-red heating) and hot-air roasting as heat pre-treatments of seeds in controlling the HTC defect development in cowpeas during storage under high temperature, high humidity (HTHH) conditions.

EXPERIMENTAL



RESULTS AND DISCUSSION

Cooking time of control cowpeas increased 5 fold while that of micronised and roasted cowpeas increased 2 and 3 fold, respectively (Fig. 1). This could partially be due to some degree of phytase inactivation by the heat.

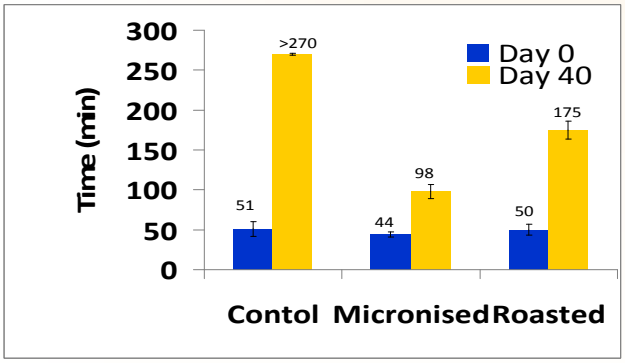


Fig. 1. Effect of heat pre-treatments (i.e. micronisation and hot air roasting) on the cooking time of cowpeas before and after storage for 40d at 40°C and 85% RH

Micronisation was more effective as a heat pre-treatment than roasting to prevent HTC defect as indicated by lower amounts of released inorganic phospate, less hydrolysis of phytic acid and higher levels of soluble pectins. Micronisation's infra-red heating penetrates the product causing internal heating[2] and thus more effective heating.

Table 2 Effect of heat pre-treatments on some physico-chemical characteristics during the development of HTC defect in cowpeas[a]

Treatment	Inorganic phosphate (mmol/g)[b]	Phytic acid (mg/g)	HWSP[c] (mg/g)	Phytase activity (FTU/kg)
Control				
Day 0	$0.009^{a}\pm0.001$	$10.08^{e}\pm0.10$	$2.27^{d}\pm0.02$	$375^{e}\pm14$
Day 40	$0.041^{d}\pm0.003$	$6.86^{a}\pm0.11$	$1.38^{a}\pm0.04$	$267^{d}\pm24$
Micronised				
Day 0	$0.009^{a}\pm0.001$	$9.62^{d}\pm0.10$	$2.56^{f}\pm0.03$	$102^{ab}\pm9$
Day 40	$0.025^{b}\pm0.002$	$8.81^{c}\pm0.22$	$2.09^{c}\pm0.07$	$74^{a}\pm10$
Roasted				
Day 0	$0.009^{a}\pm0.001$	$9.66^{d}\pm0.23$	$2.37^{e}\pm0.02$	$204^{c}\pm17$
Day 40	$0.028^{c}\pm0.001$	$7.82^{b}\pm0.20$	$1.63^{b}\pm0.01$	$130^{b}\pm23$
p	0.0001	0.0001	0.0001	0.0001

[a]Means followed by the different letters in a column are significantly different at level $P\leq0.05$
[b]Increase in inorganic phosphate is indicative of increased phytase activity
[c]Hot water soluble pectin

Microscopy (Fig. 2) showed clear tri-cellular junctions with intact cellular structure in the control cooked cowpea sample after 40 d of storage, indicating that there was minimal alteration in the middle lamella whereas the heat pre-treated samples had less distinct tri-cellular junctions indicating some degree of solubilization or breakdown of the middle lamella.

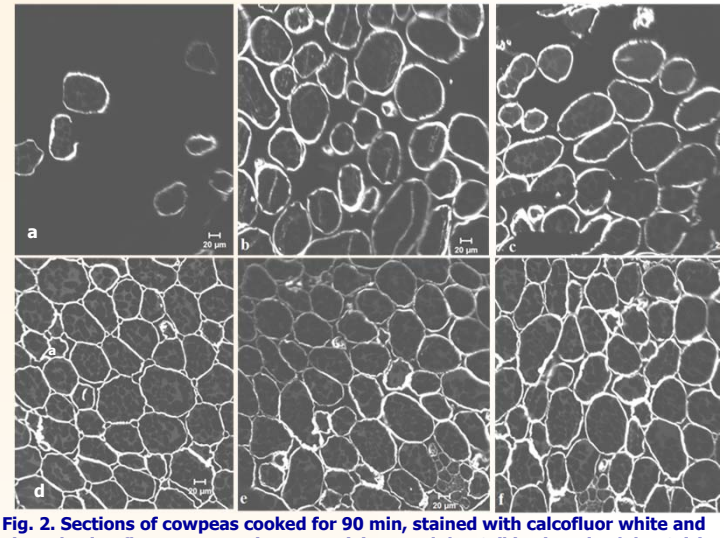


Fig. 2. Sections of cowpeas cooked for 90 min, stained with calcofluor white and viewed using fluorescence microscopy (a) control day 0 (b) micronized day 0 (c) roasted day 0 (d) control day 40 (e) micronis\zed day 40 (f) roasted day 40

CONCLUSION

Micronization was a better heat pre-treatment than hot-air roasting in controlling the development of HTC defect of cowpeas during HTHH storage. The extent of phytase inactivation by heat influences the phytate and soluble pectin content during storage, which eventually influences the cooking time.

REFERENCES

1. Galiotou-Panayotou, M. *et al.*, 2008. *J. Sci .Food Agric.* 88,355–361.
2. Sadhu, C., 1986. *Biotechnol. Prog.* 2,109-119.