

THE EFFECTS OF THE CALCIUM ION ON COOKED DRY BEANS

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BACKGROUND

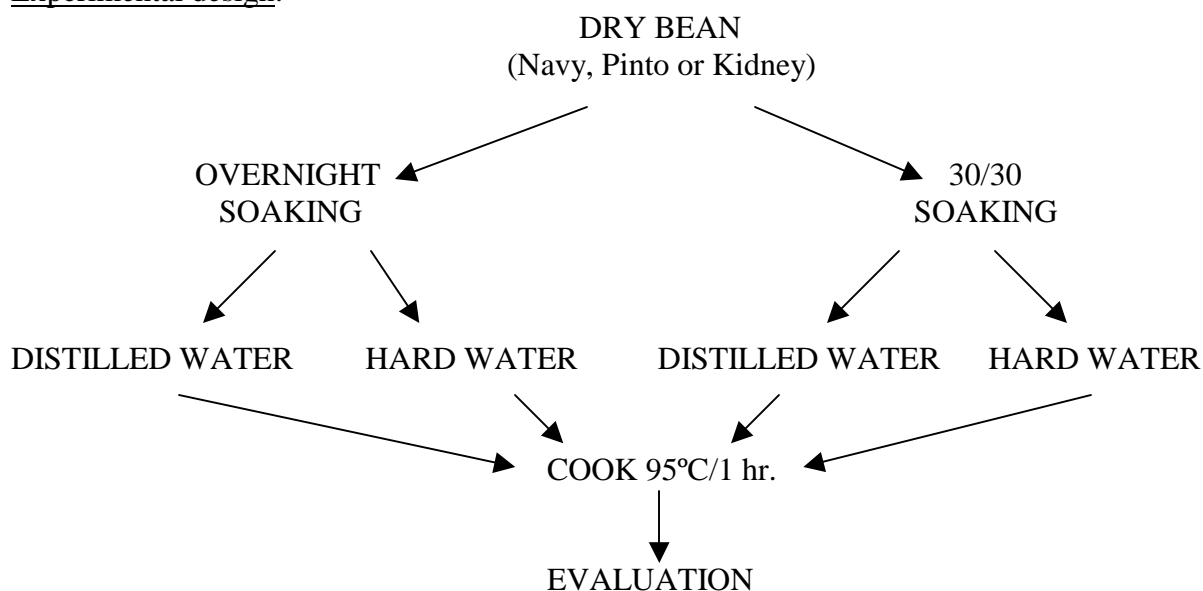
Dry beans have been an important food for many centuries. Together with other legume seeds, they are an excellent source of protein, calories, and dietary fiber. However, they require prolonged soaking, followed by a long cooking time to achieve desirable palatability of cooked beans. Calcium ion is one of the major factors affecting preparation time and quality attributes of thermally processed beans. Since calcium ions can cross-link the galacturonic acid chains and the pectic substance present in the middle lamella of bean tissues, it results in restriction of water uptake and improvement of seed integrity. In modern vegetable canning, the use of calcium ions has been employed to control the texture and the integrity of cooked products.

PROBLEM

Determine the effects of calcium ions in soaking and cooking water on bean quality characteristics including: bean weight gain, color, seed integrity and textures.

MATERIALS AND METHODS

Experimental design:



Evaluation: weight gain, color, seed integrity and texture

Experimental method:

1. Weigh 4 batches of 100 g solid dry bean (i.e. navy bean)

$$X = \frac{100}{(100-Y)} \times 100$$

when: X = Actual weight of dry beans to obtain 100 g solid

Y = Percent moisture content of dry bean

(Calculate moisture by weight loss during drying 80°C/24 hrs)

NOTE: Bean Moisture (%) = Y = $\frac{\text{Dried Bean Weight (g)}}{\text{Fresh Bean Weight (g)}} \times 100$

2. Two soaking techniques are employed at this step:
Traditional overnight soaking – approximately 14 hrs.
30/30 soaking – 30 min. room temperature soaking, then 30 min.
hot (88°C) water soaking.
3. For each soaking technique, two levels of water hardness of soaking water are studied:
Distilled water = 0 ppm Ca⁺⁺
Hard water = 150 ppm Ca⁺⁺

Hard water, 150 ppm Ca⁺⁺ = X g of CaCl₂ in Y of distilled water). Calculate the quantity of CaCl₂ required to yield 150 ppm Ca⁺⁺ based on molecular weight.
4. After soaking, record the weight gain of the soaked beans and cook each batch of soaked beans in water (described above) at 95°C for 1 hr.
5. Determine the weight gain after cooking. Evaluate the cooked bean qualities (color, seed integrity, and texture) by panel test. Use panel sheet provided.

REFERENCES

1. Lopez. A Complete Course in Canning. 11th ed., Book II. Baltimore: The Canning Trade Inc., 260-282, 1981.
2. Luh and Woodruff. Commercial Vegetable Canning. Westport, CT: AVI Publishing Co., 195-210 & 227-229, 1975.

PANEL SHEETATTRIBUTESCALE

COLOR	LIGHT			DARK	
	1	2	3	4	5
SEED INTEGRITY	INTACT (Whole)			BROKEN (Smashed)	
	1	2	3	4	5
TEXTURE	FIRM			SOFT	
	1	2	3	4	5

Report results, discuss observations, and present appropriate conclusions.

QUESTIONS

1. Does the soaking treatment affect the quality attributes of the cooked beans? If so, explain the possible reason(s) why.
2. How and why does the calcium treatment affect the color texture and integrity of cooked beans?
3. Besides adding calcium, what are some other methods that could be used to control the quality of cooked beans?