

Effects of Radio Frequency Heat Treatment on the Postharvest Quality of Rice

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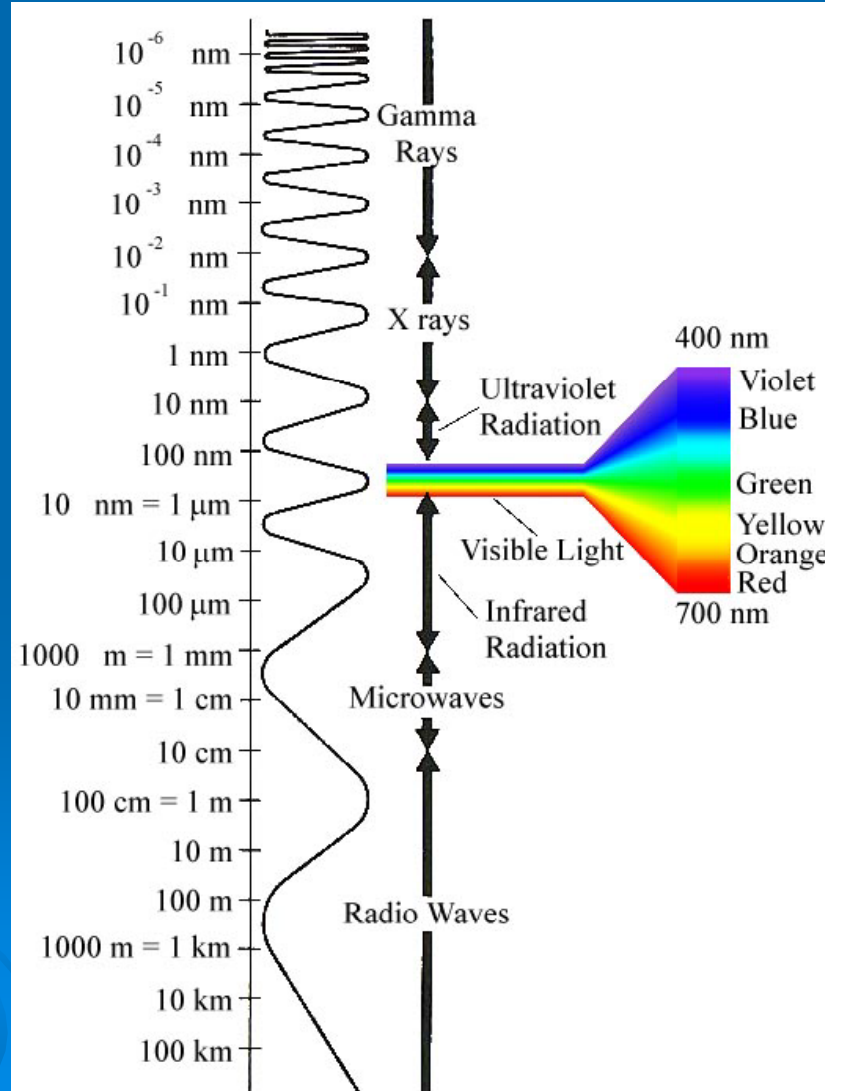
Background:

- The drying temperature is the main factor affecting to the yield of head rice.
- Even though, the higher temperature could increase head rice yield, the conventional dryer with high temperature is high energy and time consuming method.
- The radio frequency (RF) heat treatment is an alternative heating technique which rises temperature rapidly, penetrated deeply in bulk product with low energy consumption.
- ✓ This technique has a possibility to apply in rice postharvest processes.

Radio Frequency

Radio frequency (RF) is a frequency within the range of about 3 Hz to 300 GHz.

27.12 MHz
600 Watt

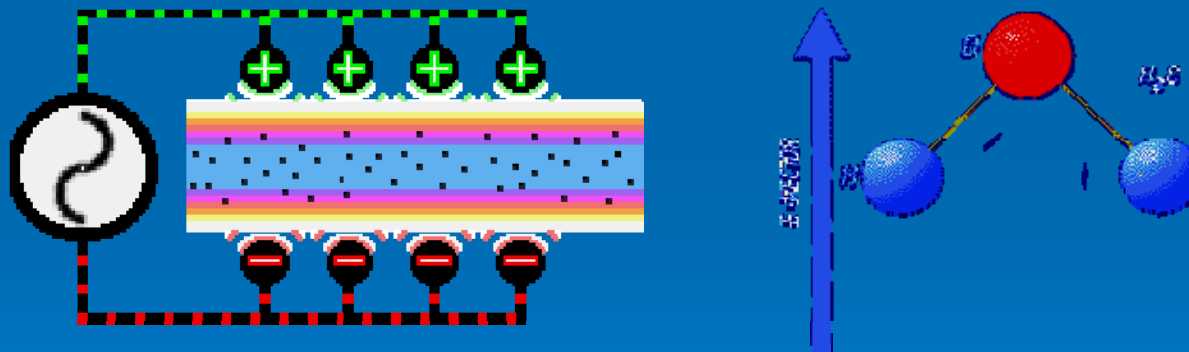
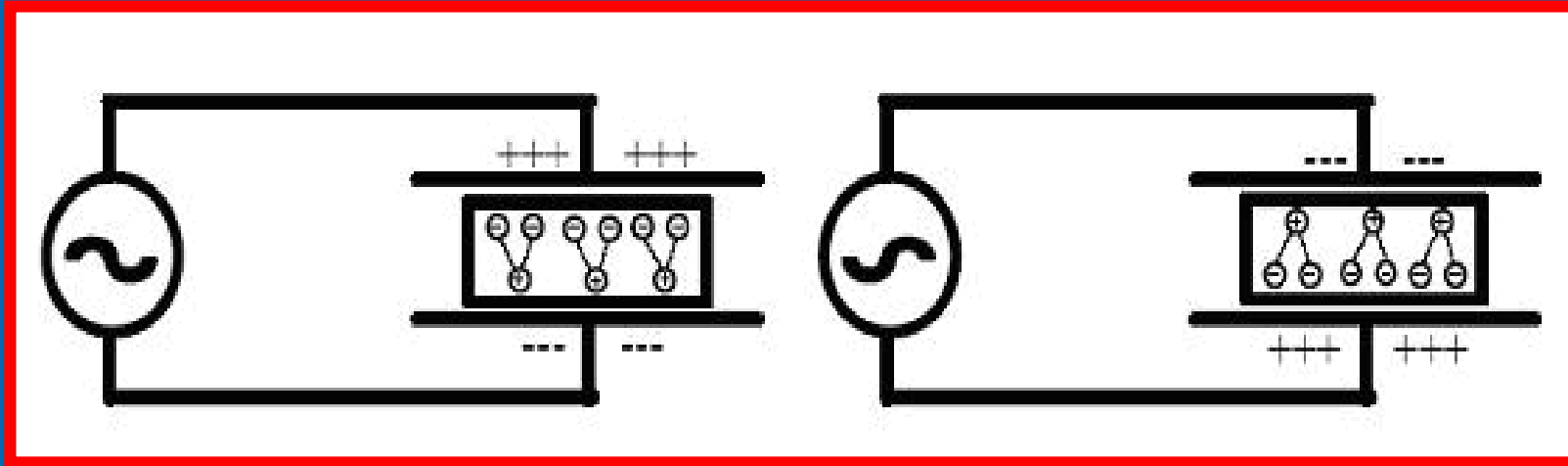


Radio frequency (RF)

RF heating involves the transfer of electromagnetic energy directly into the product, therefore inducing volumetric heating due to frictional interaction between molecules (Piyasene *et al.*, 2003)

Advantages

- No need to contact the product
- Penetrate more deeply in the products
- Continuous process is practicable

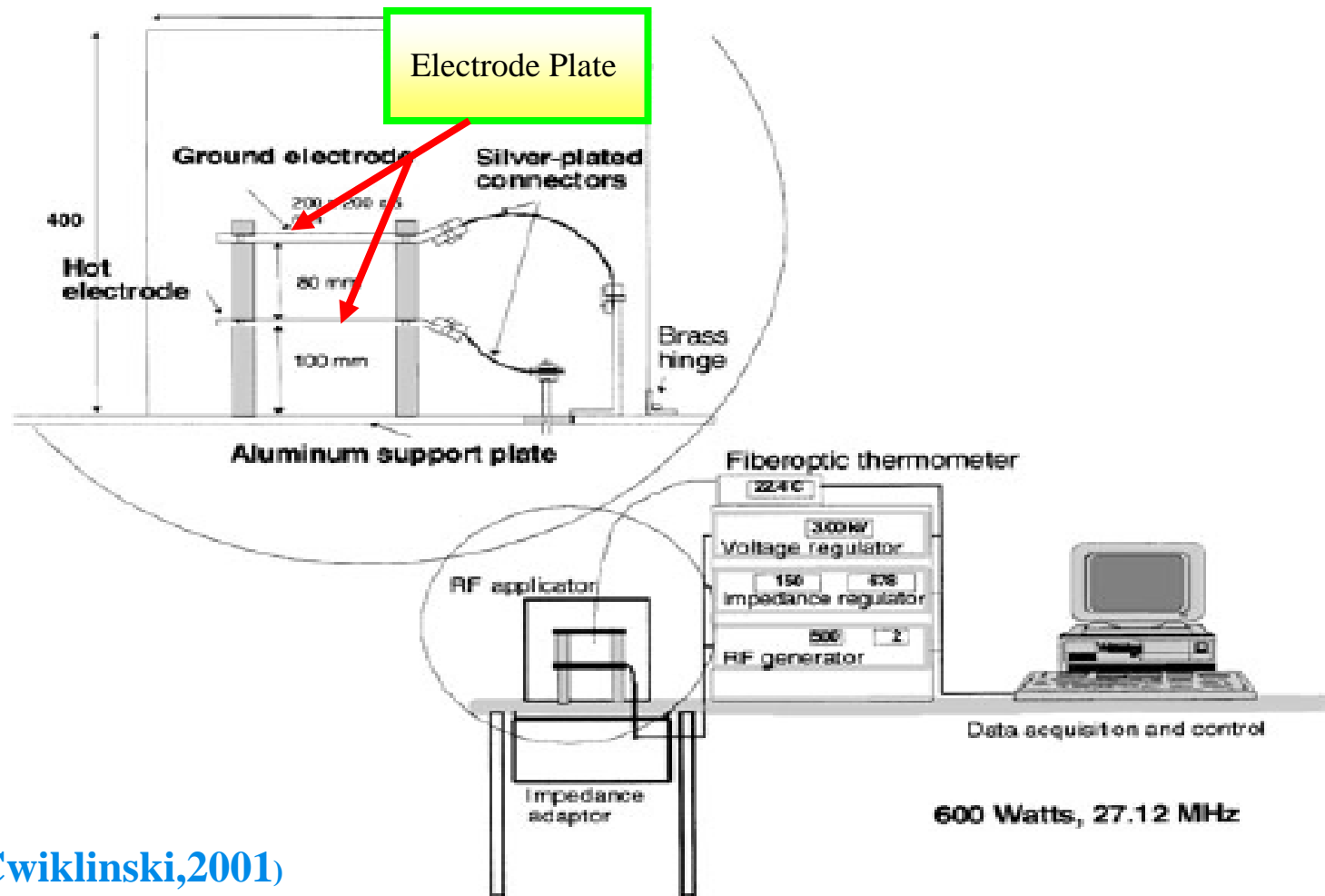


Ref : www.strayfield.com ; www.dielectricsealing.com

Radio frequency VS Hot air drying

	Radio frequency	Hot air
Temperature	stable	unstable
Energy use	50 % lower	100%
Heat transfer efficiency	50-70%	10-30%
Heat transfer technique	conduction	Convection and radiation
Operation time	Short – second, min	Long – hour, days
penetration	9 meters	Low

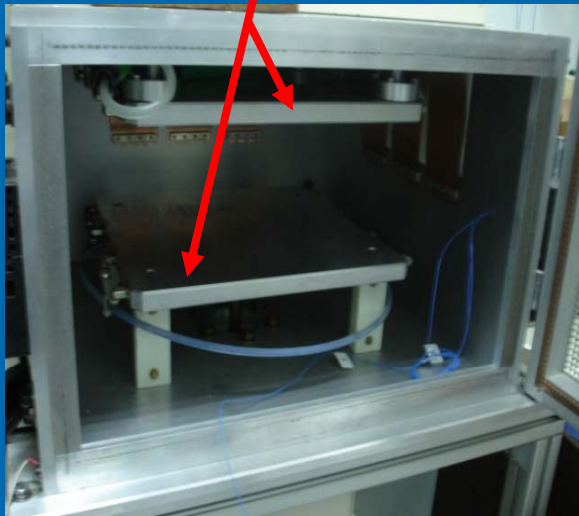
Radio Frequency Heat Treatment System



(Cwiklinski,2001)

RF system

Electrode Plate



RF Generator



PC Controller



Fiberoptic Temperature Sensor



Experimental design

A Complete Randomized Design with 4 replications was used.

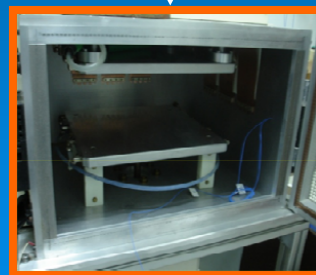
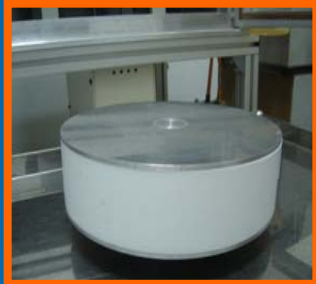
- 10 treatments :
1. control
 2. 70°C 5 min
 3. 70°C 10 min
 4. 70°C 15 min
 5. 85°C 5 min
 6. 85°C 10 min
 7. 85°C 15 min
 8. 100°C 5 min
 9. 100°C 10 min
 10. 100°C 15 min

Materials and method

1



2



3



4



70, 85 and 100°C

5, 10 and 15 min

Determinations

Milling degree

!! **% Moisture content** (AOAC, 2005)

!! **The color of milled rice (L^* and b^*)** (Colorquest XE Hunter Lab, USA)

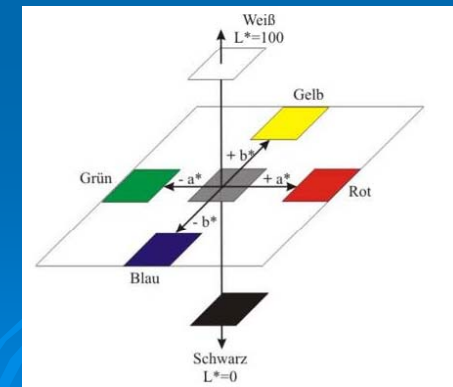
!! **Brown rice percentage**

!! **Head rice yield percentage**

!! **Amylose content** (Juliano, 1971)

Statistical analysis

Analysis of variance (ANOVA) was performed using SPSS software comparison of means by Duncan's test ($p < 0.05$)



Milling process



1



2



3



Color Measurement





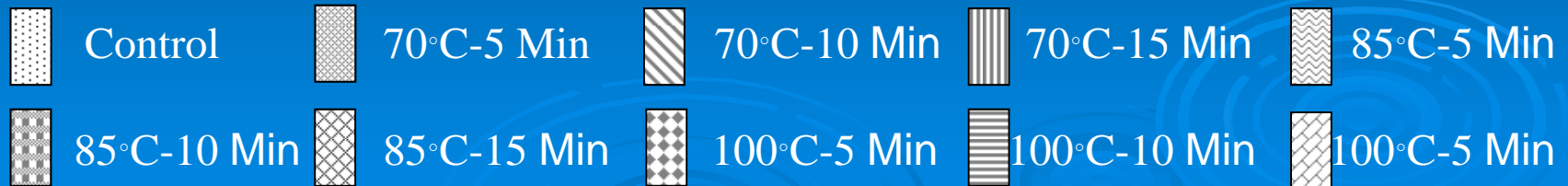
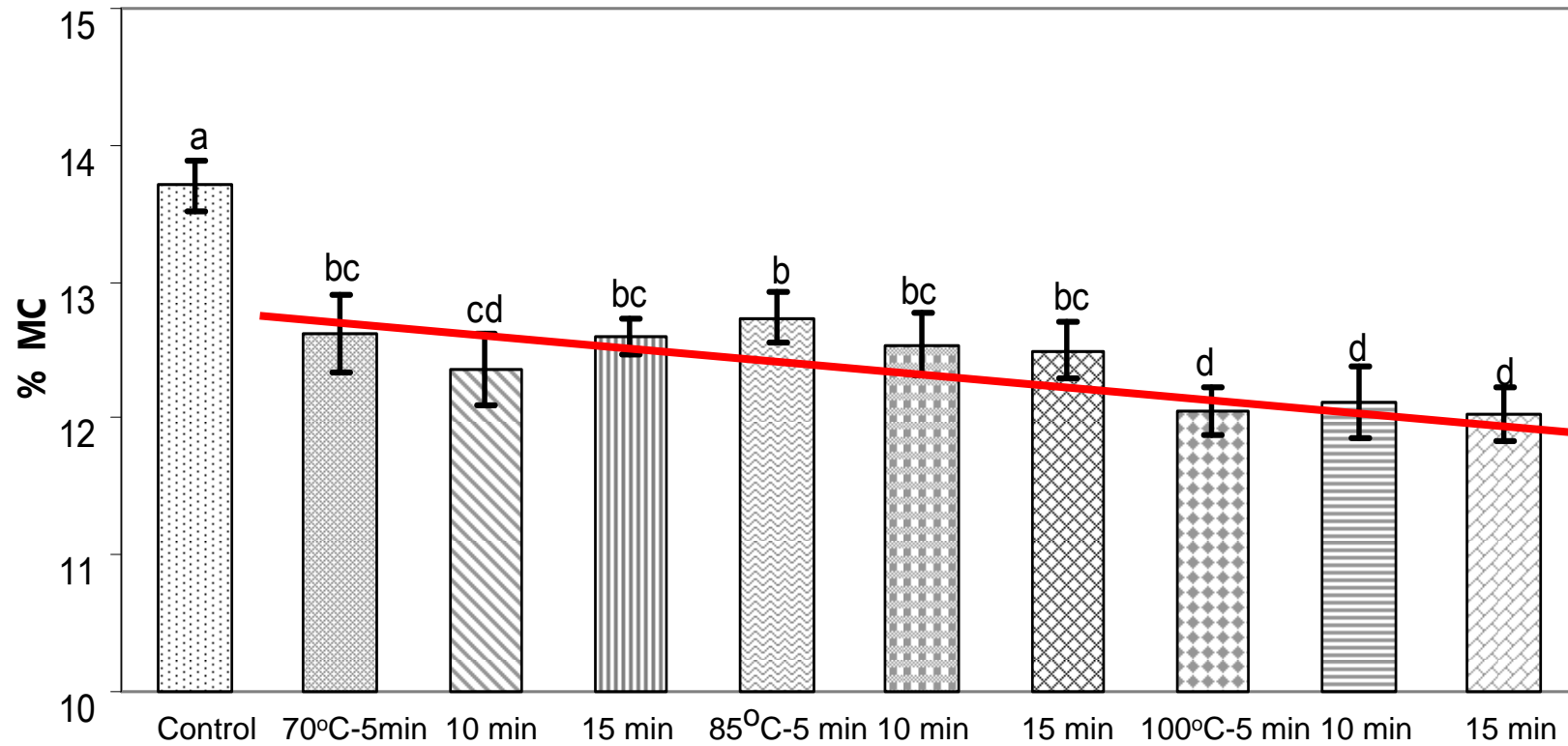
Amylose content determination



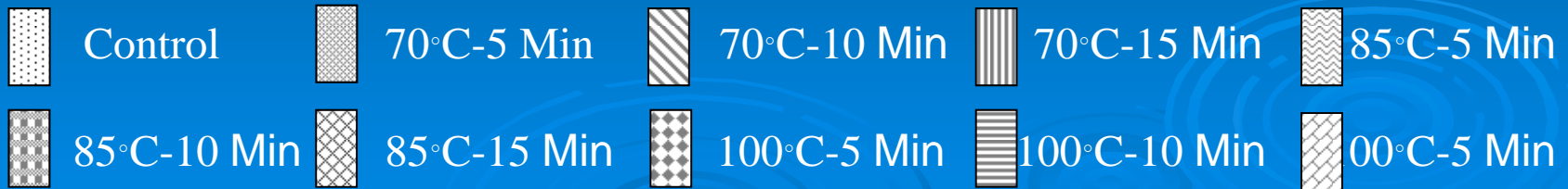
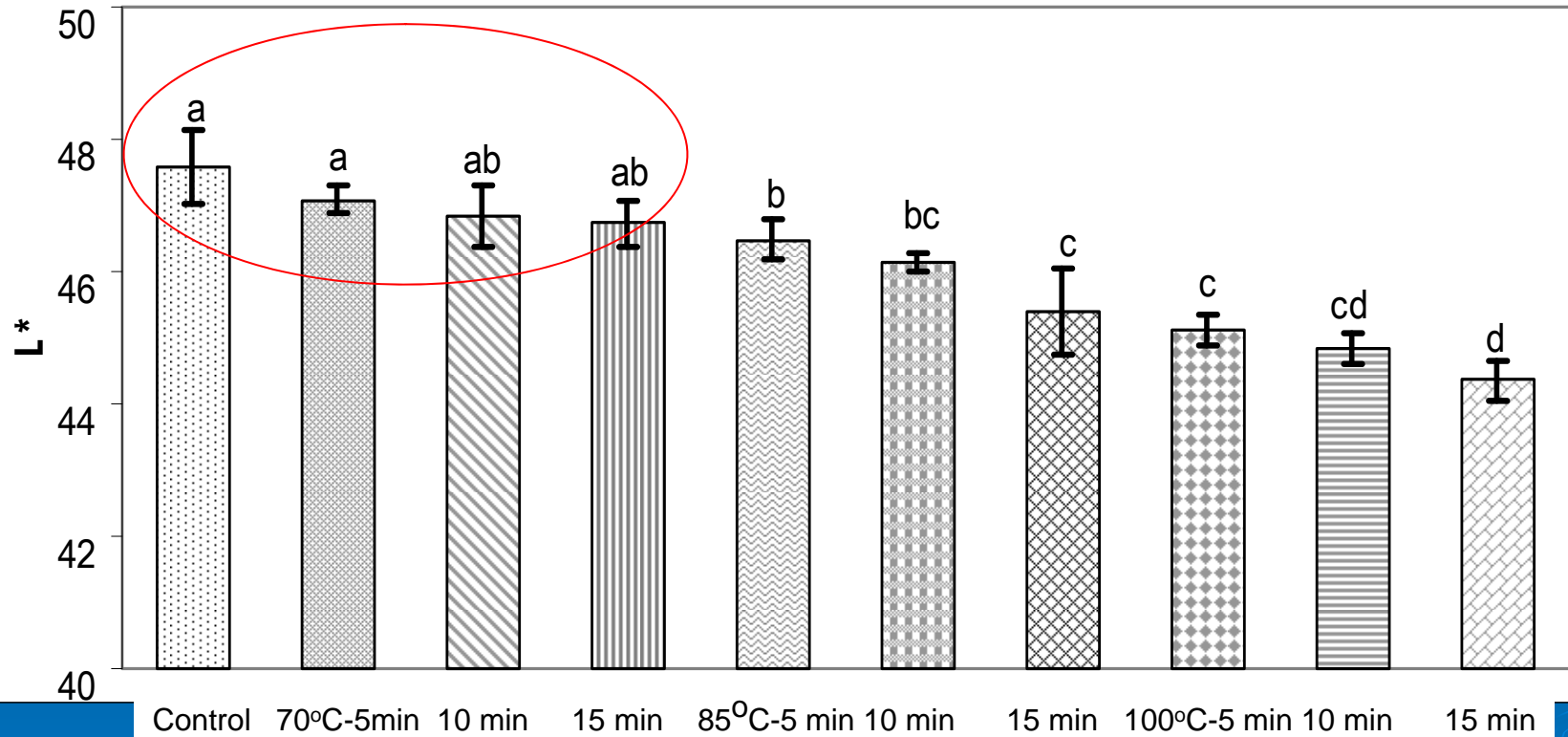
Results

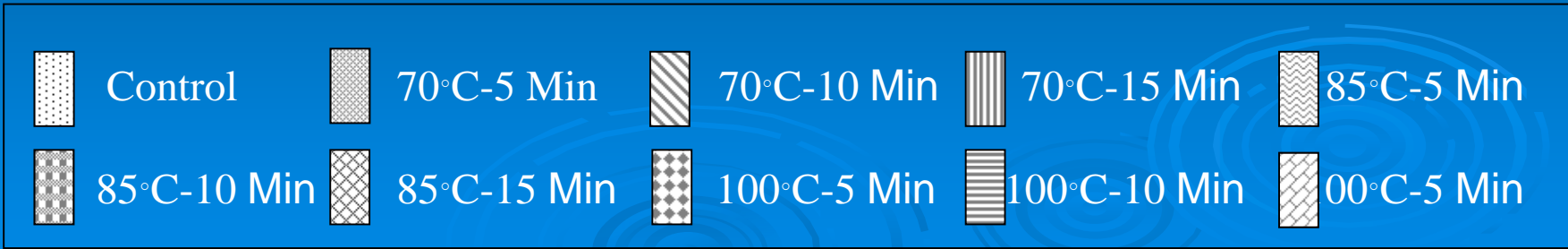
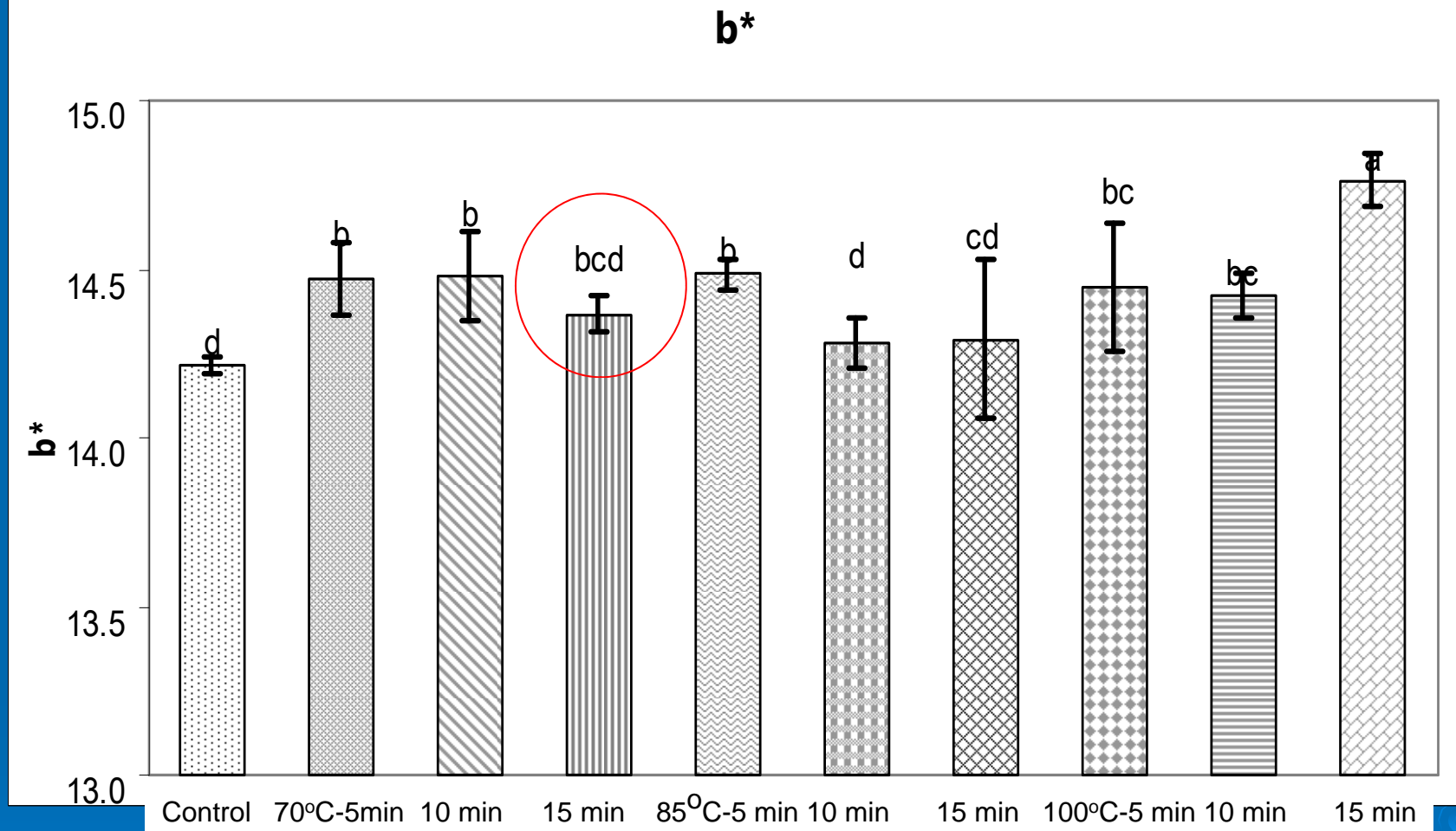


% Moisture content

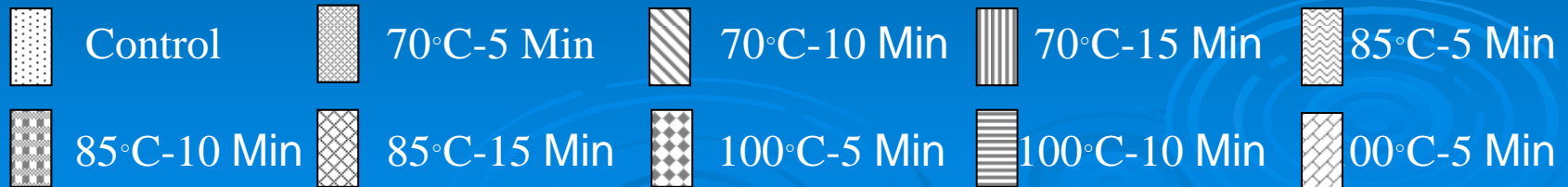
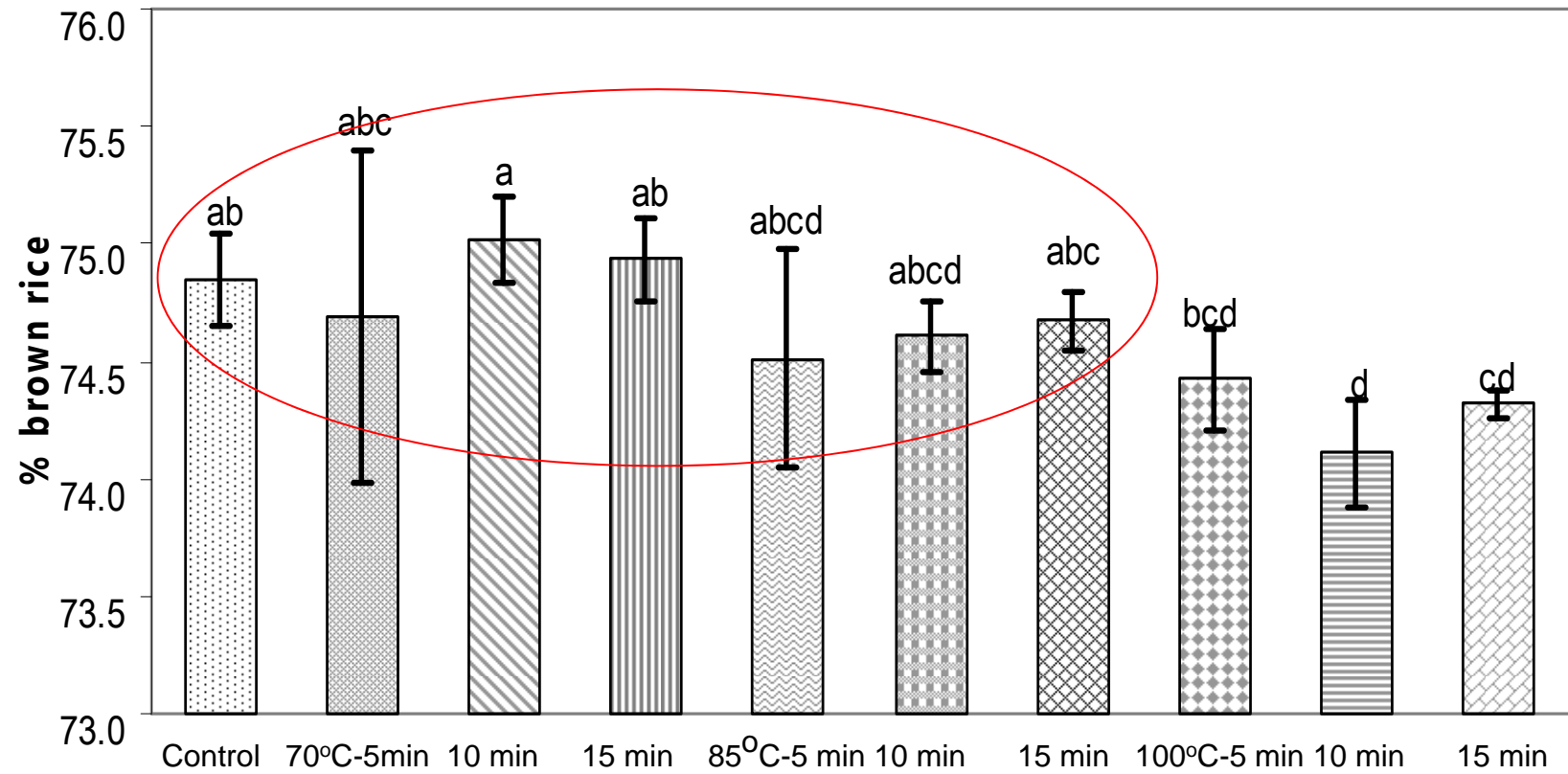


L*

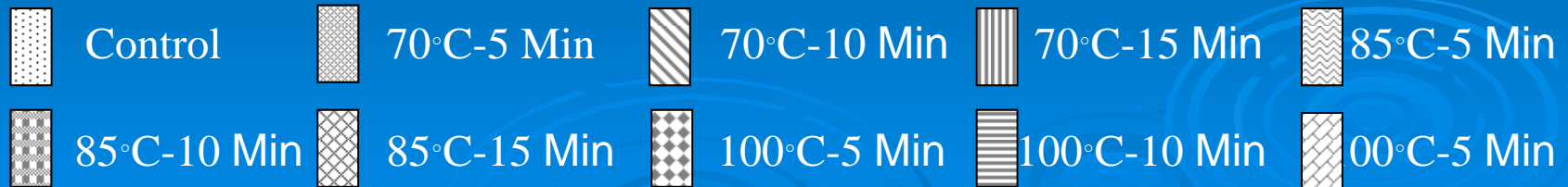
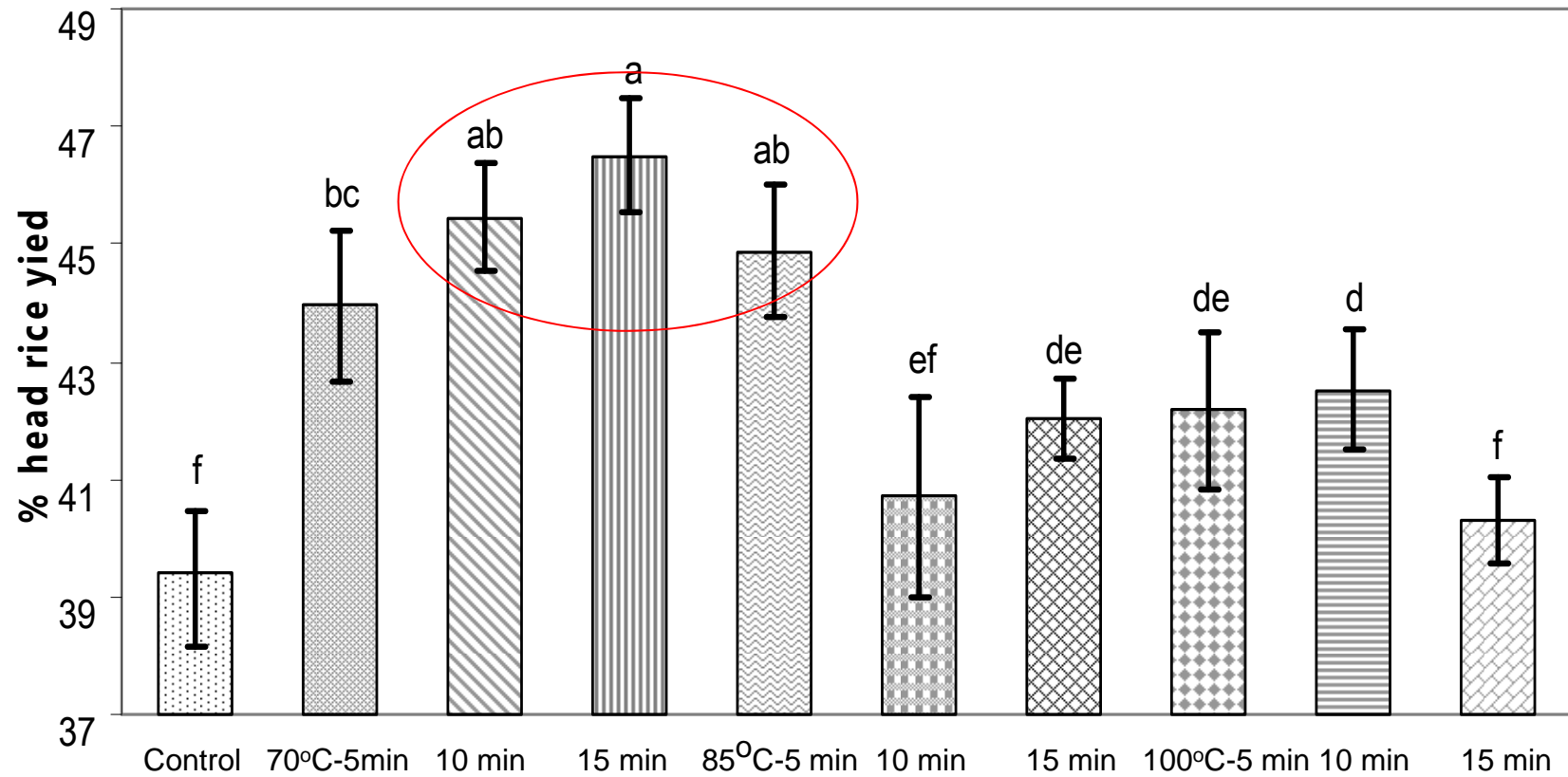




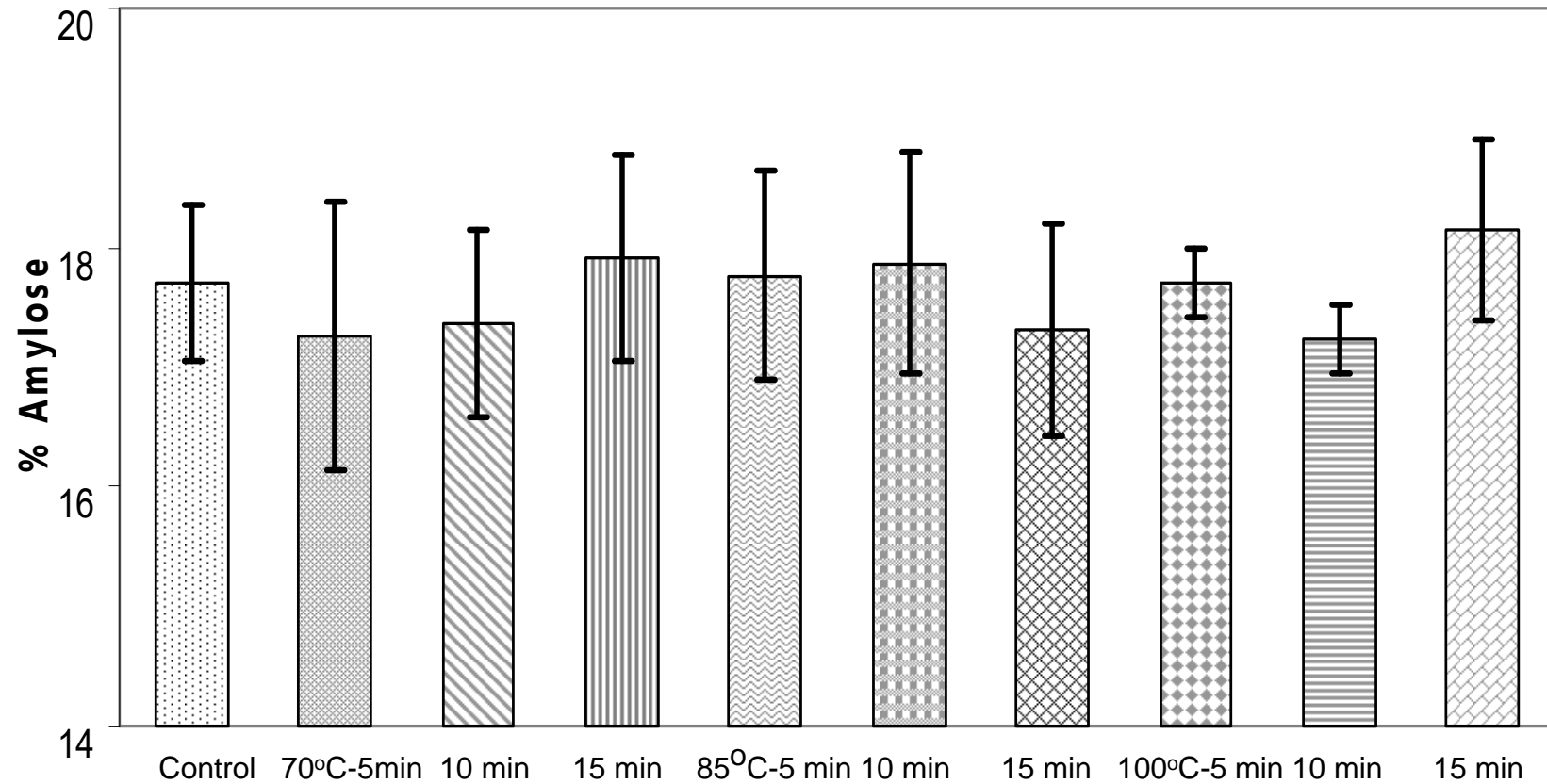
% Brown rice



Head rice yield



Amylose content



Control



70°C-5 Min



70°C-10 Min



70°C-15 Min



85°C-5 Min



85°C-10 Min



85°C-15 Min



100°C-5 Min



100°C-10 Min



100°C-5 Min

Conclusion

RF treatment can increase milling quality when treating rice under the optimal conditions of 70°C for 15 minutes.

- head rice percentage increased
- color was not changed
- % MC was decreased
- amylose content and % brown rice were not changed