CUP QUALITY, PHYSICAL AND CHEMICAL PROPERTIES OF ROBUSTA COFFEE BEAN PRODUCED BY WET PROCESS METHODS

Yhulia Praptiningsih S[1]

Abstract

The quality of smallholder coffee could be improved by wet process method. Natural fermentation method (removing mucilage by fermentation) produced good quality of coffee bean, but it need long time process (24-36 hours). Removing mucilage by chemical could be reduced processing time. The aim of this research was to obtain the wet process method which easy, safe and applicable on smallholder coffee. This research had 4 (four) treatments of coffee bean wet process, they were soaking in 1% sodium bicarbonates solution for 1.5 hours, soaking in 0.3% lime solution for 0.5 hour, without fermentation and natural fermentation. The parameters observed were lightness of dry parchment coffee and coffee bean, moisture and ash content of coffee bean, cup pH, cup quality. The best of wet coffee processing yielded by natural fermentation and followed by soaking in 1% sodium bicarbonates solution for 1.5 hours. Nevertheless the preference score and the most of cup quality score yielded by soaking in 1% sodium bicarbonates solution for 1.5 hours better than natural fermentation. Soaking in 1% sodium bicarbonates solution for 1.5 hours as wet process method which easy, safe and applicable on smallholder coffee.

Key words: *cup quality, physical, chemical properties, robusta, wet process*

Introduction

A most of Indonesian coffee as smallholder coffee (about 95.9%). Generally the smallholder coffee produced by dry process and without selectively of ripe fruit, so the quality of smallholder coffee is low, bad appearance, low flavor, sometimes contaminated by Ochratoxin A (0TA). The OTA content 0.1- 5 µg/kg coffee bean [2, pp 673-675] [9]. This is as reason that the export value of Indonesian coffee is low and Indonesia just on fourth position in the world as producer and exporter of coffee. Indonesian on 2010, production coffee was 684,046 tons (78.3% as robusta coffee) and export volume was 494,664 tons [1] [3].

The solution of this problem can be conducted by wet process method. On wet process only choose of ripe fruits with good quality. The green or coffee bean produced by wet process had higher aromatic oil, smooth, mellow, fine aromatic and acidity [13]. The variations of wet process method for example are without fermentation, removing mucilage by fermentation and by chemical. The compositions of mucilage consist of 85% moisture and 15% solid, while the content of solid consist of 80% pectinic acid and 20% sugars. The mucilage must be removed because it had viscous and sticky properties, inhibit

[1] Agricultural Technology Faculty, Jember University, Jember, Indonesia, email: yhulia.ftp@unej.ac.id.

of drying process and yield of low quality of coffee bean [10]. Natural fermentation method (removing mucilage by fermentation) produced good quality of coffee bean, but it need long time process (24-36 hours). Removing mucilage by chemical could be reduced of processing time. Removing mucilage by fast process could be yielded of coffee which while clean, bland taste, little loss body and coffee produced more than by natural fermentation. Removing mucilage by soaking in organic acids solution (citric, malic, lactic, phosphoric and ascorbic acids 0.0001 and 0.001 M for 12 hours had good body, fair acidity and slight bitter/medicinal taste [12, pp 32-38]. The coffee processing by soaking in sodium bicarbonates or lime solutions on small buckets plastics could be reduced of processing time, easier to handling and easier to control of process condition, and could be conducted by smallholder coffee [5]. Soaking in 1-2% sodium bicarbonates solution for 1.5 hours and in lime solution 0.3% for 0.5-1 hour [8]. Sodium bicarbonates can be softening of mucilage (by hydrolysis of pectin). Calcium from lime can be yielded rigid gel, so easier to remove of mucilage [7]. It is need of research to obtain of wet process method which easy, safe and applicable on smallholder coffee.

Materials and Methods

Robusta coffee fruit were obtained from Indonesian Coffee and Cocoa Research Institute (Jember, Indonesian) used for this experiments. Full ripe and good quality of fruits pulped by pulper, and washed. The wet parchment beans as materials for experiments. Four different wet process methods namely: 1) soaking in 2 liters of 1% sodium bicarbonates solution for 1.5 hours (S); 2) soaking in 2 liters of 3% lime solution for 0.5 hour (L); 3) without fermentation (WF); and 4) natural fermentation for 24 hours (NF). The wet parchment beans on small plastics bucket (5 kg/bucket), and three times repeatedly. The bean washed by manual washing and sun drying about 5 days. Dry parchment bean hulled by mechanical huller, cleaned to produce of coffee bean and packed. The experiments flow chart is presented in figure 1.

The parameter observed were lightness of dry parchment coffee and coffee bean (by color reader), moisture content of coffee beans (by thermo gravimeter method, Indonesian National Standard) [11], ash content of coffee bean (by direct method, Indonesian National Standard) [11], cup pH (by pH meter), cup quality (by professional coffee tasters of Indonesian Coffee and Cocoa Research Institute, 3 numbers). The cup quality test included of quality and intensity of fragrance, quality and intensity of aroma,

quality and intensity of flavor, body, bitterness, astringency, quality and intensity of after taste, clean cup, balance and preference. The score of cup quality were 1 until 10. The notation for taste and intensity: 0 (nil), 1-2 (weak), 3-4 (moderately weak), 5-6 (moderately strong), 7-8 (strong) and 9-10 (very strong). The notation for preference and quality: 0 (inconsumable), 1-2 (very bad), 3-4 (bad), 5-6 (neutral), 7-8 (good) and 9-10 (excellent) [6]. The best treatment determined by effectiveness test [4].

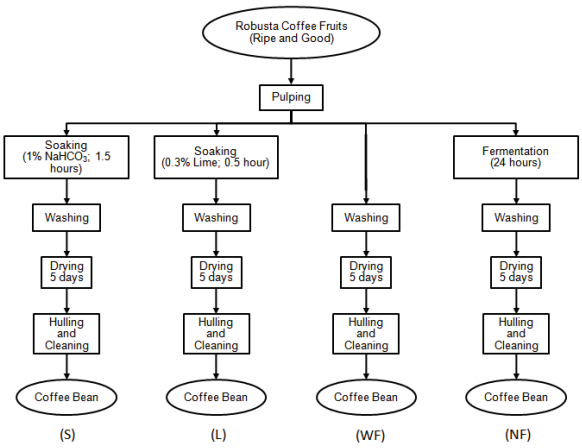

Figure 1.The flow chart of wet coffee processing experiment.

Results and Discussion

The Color (Lightness) of Dry Parchment Coffee and Coffee Bean

The lightness of dry parchment coffee and coffee bean are presented in figure 2. The higher lightness score of dry parchment coffee obtained by natural fermentation and followed by without fermentation, soaking in 0.3% lime solution for 0.5 hour and soaking in 1% sodium bicarbonates solution for 1.5 hours respectively. The conditions on natural fermentation and without fermentation were acid, maillard reaction more inhibited and yielded the dry parchment coffee had highly lightness score, whereas the conditions on soaking in sodium bicarbonates and lime solutions were alkali, so maillard reaction more intensive [7].

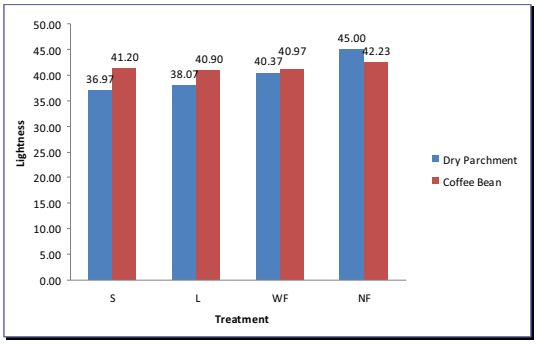

Figure 2. The lightness of dry parchment coffee and coffee bean

The Chemical Properties of Coffee Bean

The chemical properties of coffee bean consist of moisture content, ash content and cup pH are presented in table 1 and figure 3, 4 and 5.

Table1. The chemical properties of coffee bean

Treatment	Moisture content (%)	Ash content (%)	Cup pH
S	6.44	5.00	5.61
L	7.93	4.00	5.50
WF	7.47	5.05	5.56
NF	7.64	4.07	5.63

(S: I% sodium bicarbonates solution for 1.5 hours; L: soaking in 0.3% lime solution for 0.5 hour; WF: without fermentation; NF: natural fermentation).

The coffee bean moisture content of all treatments were <12%. The coffee bean produced by wet process, so easier and faster for drying process.

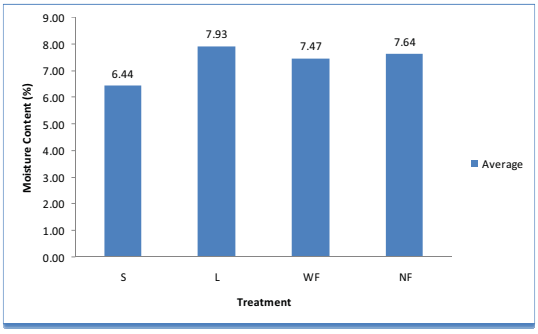

Figure 3. The moisture content of coffee bean.

The coffee bean ash content of all treatments were 4-5%, it match with Indonesian National Standard. According to Indonesian National Standard maximum ash content of coffee bean is 5% [11]. Excepted the ash content of coffee bean yielded by without fermentation slightly more than Indonesian National Standard, it was 5.05%. The ash content of coffee bean produced by soaking in 1% sodium bicarbonates solution for 1.5 hours more than soaking in 0.3% lime solution for 0.5 hour. Soaking time in 1% sodium bicarbonates solution is longer so the absorption of minerals was highly. Ash consist are minerals.

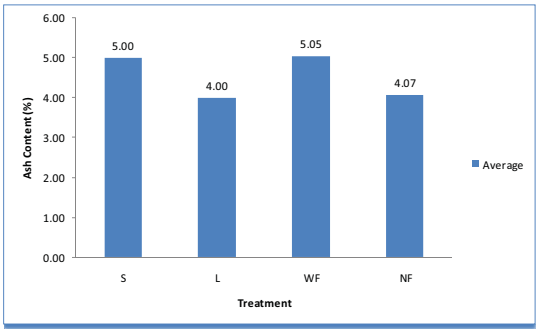

Figure 4. The ash content of coffee bean.

The cup pH of all treatments are 5.50 – 5.63. The experiments were used of robusta coffee. According to Lingle , the cup pH of Indonesian robusta coffee about 5.6 - 5.8 (weak acid) [6].

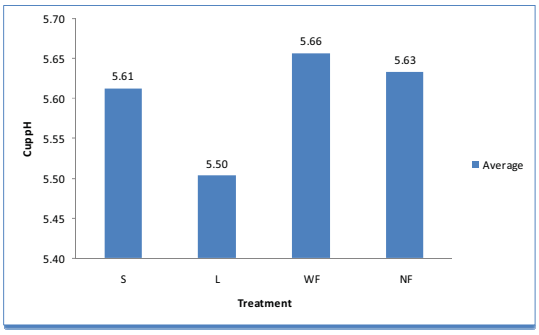

Figure 5. The cup pH of coffee.

The Cup Quality of Coffee

Table 2. The cup quality of coffee

Coffee characteristics	Treatment			
	S	L	WF	NF
Quality of fragrance (QFR)	6.9	7.0	6.9	7.2
Intensity of fragrance (IFR)	7.0	6.9	6.9	7.2
Quality of aroma (QAR)	7.0	6.8	6.7	7.0
Intensity of aroma (IAR)	7.1	6.9	6.8	6.9
Quality of flavor (QFL)	6.9	6.4	6.6	6.7
Intensity of flavor (IFL)	6.8	6.7	6.6	6.8
Body (BOD)	6.7	6.9	6.5	6.7
Bitterness (BIT)	6.0	6.6	6.1	6.3
Astringency (AST)	4.3	4.6	4.8	4.8
Quality of aftertaste (QAT)	6.9	6.4	6.4	6.4
Intensity of aftertaste (IAT)	7.0	6.8	6.6	6.5
Clean cup (CLE)	9.6	9.7	9.1	9.2
Balance (BAL)	7.1	6.3	6.5	6.5
Preference (PRE)	7.1	6.5	6.5	6.6

(S: I% sodium bicarbonates solution for 1.5 hours; L: soaking in 0.3% lime solution for 0.5 hour; WF: without fermentation; NF: natural fermentation).

The cup quality of coffee included of quality and intensity of fragrance, quality and intensity of aroma, quality and intensity of flavor, body, bitterness, astringency, quality and intensity of after taste, clean cup, balance and preference are presented in table 2 and figure 6.

From the table 2 and figure 6, it was found that coffee had taste and intensity score 6.0-7.2 (moderately strong to strong), and the score of quality were 6.0-7.2 (neutral to good). The body score of coffee were 6.5-6.9 (moderately strong). The higher score of body by soaking in 0.3% lime solution for 0.5 hour. The lowest of bitterness and astringency score by soaking in I% sodium bicarbonates solution for 1.5 hour. The clean cup score of all treatments were >9 (excellent). It showed that the coffee quality just affected by components on the coffee bean. The higher score clean cup was coffee by soaking in I% sodium bicarbonates solution for 1.5 hours. The higher score of balance was coffee by soaking in I% sodium bicarbonates solution for 1.5 hours and followed by natural fermentation and without fermentation processed. The higher preference score was yielded by soaking in I% sodium bicarbonates solution for 1.5 hours and followed by natural fermentation. The most of cup quality score yielded by soaking in 1% sodium bicarbonates solution for 1.5 hours was higher and followed by natural fermentation.

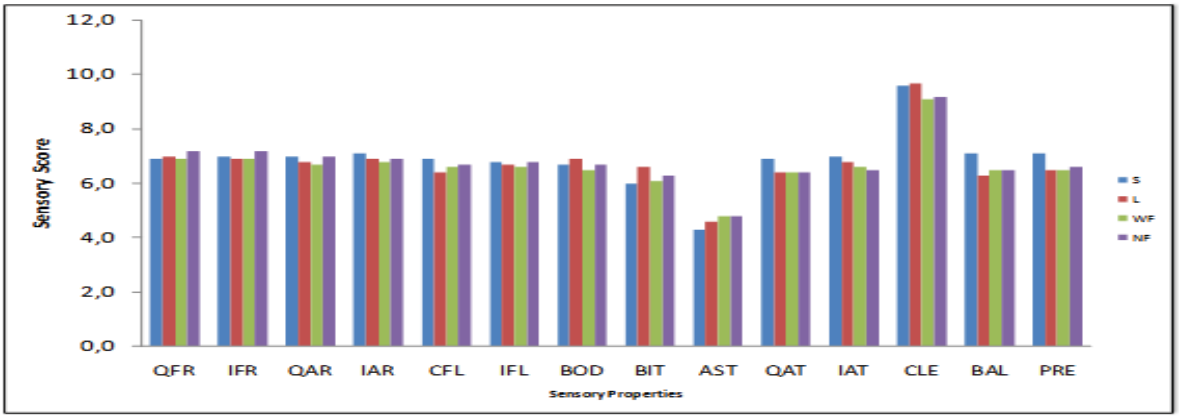

Figure 6. The Cup Quality of Coffee

The Best of Wet Coffee Processing Method

The best treatment determined by effectiveness test. The score of effectiveness test are presented in table 3. Based on effectiveness test, the best treatment obtained by natural fermentation and followed by soaking in I% sodium bicarbonates solution for 1.5 hours.

Table 3. The Score of Effectiveness Test.

Treatment	Effectiveness score
S	0.56
L	0.23
WH	0.18
NF	0.60

(S: soaking in I% sodium bicarbonates solution for 1.5 hours; L: soaking in 0.3% lime solution for 0.5 hour; WF: without fermentation; NF: natural fermentation).

Conclusion

This research showed that based on effectiveness test, the best of wet coffee processing method by natural fermentation and followed by soaking in 1% sodium bicarbonates solution for 1.5 hours. Nevertheless the preference score yielded by soaking in 1% sodium bicarbonates solution for 1.5 hours was 7.1 (good) more than by natural fermentation, it was 6.6 (neutral to good). The most of cup quality score yielded by soaking in 1% sodium bicarbonates solution for 1.5 hours better than natural fermentation.

Based on this research recommended that Soaking in 1% sodium bicarbonates solution for 1.5 hours as wet process method which easy, safe and applicable on smallholder coffee. The coffee quality is good and reduced of processing time.

References

[1] AEIKI (Asosiasi Eksporter dan Industri Kopi Indonesia). **Ekspor Kopi Indonesia per tahun**. Jakarta. 2011.

[2] Blanc, M., Pittet, A., Box, R. M. and Viani, R. **Behavior of Ochratoxin A during Green Coffee Roasting and Soluble Coffee Manufacture.** J. Agric. Food Chem. 1998, 4(2), 673-675.

[3] Ditjen Perkebunan. **Luas dan Areal Kopi Indonesia Menurut Jenis Tahun 1999-2011**. Jakarta. Kementerian Pertanian, 2011.

[4] De Garmo, E. P., Sulivan, W. G. and Canada, C. R. **Engineering Economy.** 7th Ed. New York: Ed. Milan Publish. Co., 1984.

[5] Drinnan, J. **Coffee Processing at Home**. Queensland: Dept. of Primary Industries and Fisheries. 2004.

[6] Lingle, T. R. **The Coffee Cupper's Handbook (Systematic Guide to the Sensory Evaluation of Coffee's Flavor).** 3th Ed. Long Beach, California: Coffee Association of America, 2001.

[7] Meyer, L. H. **Food Chemistry.** Third Ed. Westport, Connecticut: The AVI Publish. Co. Inc., 1978.

[8] Praptiningsih, Y dan Sulistyowati. **Modifikasi Fermentasi pada Pengolahan Kopi Biji Secara Basah pada Kopi Rakyat.** Jember, Universitas Jember, 2009.

[9] Quiros, M. S., Rios, O. G., Barell, M., Guyot, B., Galindo, S. S. and Guiraud. **Study of Ocratoxin A Producing Strain in Coffee Processing.** France: Universite Montpeller, 2003.

[10] Sivetz, M and Foote, H. E. **Coffee Processing Technology.** Westport, Connecticut: The AVI Publish. Co. Inc., 1963.

[11] Standar Nasional Indonesia. **Standar Mutu Kopi**. Jakarta:1999.

[12] Velmourougane, K. **Effect of Wet Processing Methods and Subsequent Soaking of Coffee.** World Journal of Science and Technology. 2011, 1 (7), 32-38.

[13] Viani, R. **Global Perspectives in Coffee Quality Improvement.** Bangalore, India. Proceeding of International Scientific Symposium on Coffee, 2000.