

**PULP REDUCTION AND THE ADDITION OF LOCAL  
MICROORGANISMS AS A STARTER FOR COCOA FERMENTATION  
AT THE FARM LEVEL: ITS INFLUENCE ON THE  
MICROBIOLOGICAL, PHYSICAL, AND CHEMICAL  
CHARACTERISTICS OF FERMENTED COCOA BEANS**

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**Abstract**

The low quality of dried cocoa beans produced by smallholder Indonesian plantations due to poor postharvest handling. This condition needs to be improved by controlled fermentation through the application of a combination of reducing cocoa pulp and adding starter. This study aims to (1) determine the effect of using a combination of reducing pulp and adding starter on the growth of fungi during fermentation and on fermented cocoa beans, (2) determine the effect of applying a combination of reducing pulp and adding starter to the physical and chemical characteristics of fermented cocoa beans. Factorial Randomized Block Design was used in this study with experimental units consisting of 1) spontaneous fermentation, 2) fermentation with reduced pulp, 3) fermentation with addition of starter and 4) fermentation with reduction of pulp and addition of starter. The pulp was reduced by  $\pm 35\%$  and the fermented starter was added in the form of a mixture of local microorganisms *Candida famata* HY-37, *Lactiplantibacillus plantarum* subsp. *plantarum* HL-15, and *Acetobacter* sp HA-37. The results showed that the fermentation lasted well for five days of fermentation. Yeast, lactic acid bacteria and acetic acid bacteria are able to grow. The temperature rose to 45 °C; Fermentation pH decreased to pH 3.7; The seed pH reduced to 4.7 and the fermentation index between 1.0 and 1.6 from two days of fermentation. Reducing the pulp resulted in a higher fermentation temperature and reached a peak on the third day, one day earlier than not reducing the pulp. The addition of starter was able to suppress the growth of fungi during fermentation and the combination of reducing pulp and adding starter was able to suppress the total population of fungi in fermented cocoa beans. The quality of fermented cocoa beans is still able to meet SNI 2323:2008/Amd I:2010 for quality II, the fermentation index is between 1 and 1.6; hydrophobic amino acids: acidic range 1, pH 4.7-5.4. Thus, the addition of starter treatment was able to suppress fungal growth during fermentation, the combination of reducing pulp and adding starter was able to suppress fungal populations in fermented cocoa beans. The combination of reducing pulp and adding starter had no significant effect on the physical and chemical characteristics of fermented cocoa beans

. **Keyword:** *Acetobacter* sp HA-37; *Candida famata* HY-37; cocoa fermentation; *Lactiplantibacillus plantarum* subsp. *plantarum* HL-15; pulp

**PENGURANGAN PULP  
DAN PENAMBAHAN MIKROORGANISME LOKAL  
SEBAGAI STARTER FERMENTASI KAKAO DI TINGKAT PETANI:  
PENGARUHNYA TERHADAP KARAKTERISTIK MIKROBIOLOGIS,  
FISIK, DAN KIMIAWI BIJI KAKAO FERMENTASI**

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**Intisari**

Kualitas biji kakao kering dari perkebunan rakyat Indonesia masih rendah karena penanganan pascapanen yang kurang baik. Kondisi ini perlu diperbaiki dengan fermentasi terkontrol melalui penerapan kombinasi pengurangan pulp kakao dan penambahan starter. Penelitian ini bertujuan untuk (1) mengetahui pengaruh penerapan kombinasi pengurangan pulp dan penambahan starter pada pertumbuhan jamur selama fermentasi dan pada biji kakao fermentasi, (2) mengetahui pengaruh penerapan kombinasi pengurangan pulp dan penambahan starter pada karakteristik fisik dan kimiawi biji kakao fermentasi. Rancangan Acak Kelompok Faktorial digunakan pada penelitian ini dengan unit percobaan terdiri dari 1) fermentasi spontan, 2) fermentasi dengan pengurangan pulp, 3) fermentasi dengan penambahan starter dan 4) fermentasi dengan pengurangan pulp dan penambahan starter. Pulp dikurangi  $\pm 35\%$  dan starter fermentasi yang ditambahkan berupa campuran mikroorganisme lokal *Candida famata* HY-37, *Lactiplantibacillus plantarum* subsp. *plantarum* HL-15, dan *Acetobacter* sp HA-37. Hasil penelitian menunjukkan bahwa fermentasi dapat berlangsung dengan baik selama lima hari fermentasi. Yeast, bakteri asam laktat dan bakteri asam asetat mampu tumbuh dan beraktivitas. Suhu meningkat hingga 45 °C; pH fermentasi turun hingga pH 3,7; pH biji berkurang hingga 4,7 dan indeks fermentasi antara 1,0 dan 1,6 sejak dua hari fermentasi. Pengurangan pulp dapat mengakibatkan suhu fermentasi lebih tinggi dan mencapai puncak pada hari ketiga, satu hari lebih cepat daripada tidak dikurangi pulpnya. Penambahan starter mampu menekan pertumbuhan jamur selama fermentasi serta kombinasi pengurangan pulp dan penambahan starter mampu menekan populasi total jamur pada biji kakao fermentasi. Mutu biji kakao fermentasi tetap mampu memenuhi SNI 2323:2008/Amd I:2010 pada mutu II, indeks fermentasi antara 1 dan 1,6; asam amino hidrofofik: acidic berkisar 1, pH 4,7-5,4. Dengan demikian, perlakuan penambahan starter mampu menekan pertumbuhan jamur selama fermentasi, kombinasi pengurangan pulp dan penambahan starter mampu menekan populasi jamur pada biji kakao fermentasi. Kombinasi pengurangan pulp dan penambahan starter tidak berpengaruh signifikan pada karakteristik fisik dan kimiawi biji kakao fermentasi.

**Kata kunci:** *Acetobacter* sp HA-37; *Candida famata* HY-37; fermentasi kakao; *Lactiplantibacillus plantarum* subsp. *plantarum* HL-15; pulp.