# DAFTAR PUSTAKA


Ali, AA. 2010. *Benefical role of lactic acid bacteria in food preservation and human health : A Review*. *Research Journal of Microbiology.* 5:1213-1221. DOI: 10.3923/jm.2010.1213.1221.

Axelsson, L.S. and Von, W.A. (2004). Lactic acid bacteria: Classification and physiology. (Eds.). Lactic Acid Bacteria: Microbiology and Functional Aspects. Marcel Dekker Inc, New York. 1-73.

Bao Y, Zhang Y, Zhang Y, Li Y, Wanga S, Dong X, Wang Y, Zhang H. (2010). Screening of Potential Probiotic Properties of Lactobacillus fermentum Isolated from Traditional Dairy products*. Food Control J*. 21: 695-701.

Bintang, M. (2010). Biokimia teknik Penelitian. Jakarta: Erlangga.

Brady, L.J., D.D. Gallaher and F.F. Busta. (2000). The Role of Probiotic Cultures in the Prevention of Colon Cancer. J. Nutr. 130 : 410-414

.Briggiler-Marco, M., Capra, M.L., Quiberoni, A., Vinderola, G., Reinheimer, J.A. and Hynes, E. (2007). *Nonstarter Lactobacillus Strains as Adjunct Cultures For Cheese Making: In Vintro Characaterization and Performance in Two Model Cheeses*.Journal of Dairy Science. Vol 90(10): 4532-4542.

Chatterjee, M., Jana, S., C. and Raychaudhuri, U. (2018). Optimization of Media and Culture Conditions for Improved Production of Bacteriocin by Using Conventional One-Factor-At-A-Time (OFAT) Method. *Ec Microbiology* 14.8.

Coda, R., Rizzello, C.G., Pinto, D. and Gobbetti, M. (2012). *Selected Lactic Acid Bacteria Synthesize Antioxidant Peptides during Sourdough Fermentation of Cereal Flours*. Applied and Environmental Microbiology. 78(4):1087-1096. doi: 10.1128/AEM.06837-11.

Dawson, R.M.C., Elliott, D.C. and Elliott, W.H. (1969). Data for Biochemical Research. Oxford University Press, Oxford

De Vuyst, L. and Vandamme, E. J. (1994) b. Lactid acid bacteria and bacteriocins: their practical importance. In Bacteriocins of lactic acid bacteria: Microbiology, genetics, and applications. Blackie Academic dan Professional. London.

.,B., Dubois D., R., Tine, E., Ngom, A., Destain, J., Thonart, P. 007). Bacteriocinproducers from traditional food products. *iotechnol. Agron. Soc. Environ.* 11(4):275–281.

Djide, N., J., N. dan Asri, R., M. (2018) .Potensi Bakteri Probiotik Dari Dangke sebagai Kandidat Penghasil Antikanker Melalui Uji Antiproliferasi Terhadap Sel Kanker Kolorektal Widr. *Laporan Akhir Penelitian Dosen Pejula.* Fakultas Farmasi Universitas Hasanuddin.

Even S, N.D., Lindley, P., Loubière and M. Cocaign-Bousquet. (2002). Dynamic Response Of Catabolic Pathways To Autoacidification In *Lactococcus lactis*: Transcript Profiling And Stability In Relation To Metabolic And Energi Constraints. *Mol. Microbiol.* 45:1143-52.

Fatmawati, N., Hatta, M., Natzir., R., Djide, N. (2015). Isolation of Lactic Acid Bacteria as A Potential Probiotic in Dangke, A Traditional Food from Enrekang,Indonesia. *IJSBAR*.35(1): 19-27.

Fardiaz, S. (1989). Mikrobiologi Pangan Jilid I. Jurusan TPG. Fakultas Teknologi Pertanian, IPB, Bogor.

Gokoglu, N. (2018). Novel Natural Food Preservation and Application in Seafood Preservation : a Review. *Food Sci Biotechnol*. pp. 36:191-197.

Jaya, F.P. (2004). Pengaruh pH dan Suhu pada Produksi Bakteriosin dari Bakteri Asam Laktat Galur M6-15. Skripsi. Program Studi Kimia, Departemen Kimia. FMIPA, IPB, Bogor.

Jenie, B.S.L., (1996). “Peranan Bakteri Asam Laktat sebagai Pengawet Hayati Makanan.” *Jurnal Ilmu dan Teknologi Pangan* 2: 60-73

Korhenen, J. (2010). *Antibiotic Resistance of Lactid Acid Bacteria*. Dissertations In Forestry and Natural Sciences. University of Eastern. Finland.

Kristanti, N.D., (2001). Pemurnian Parsial dan Karakterisasi Lipase Ekstasellular dari Kapang R. Oryzae TR 32 (tesis). Bogor: Program Pascasarjana Ilmu Pangan, Institut Pertanian Bogor.

Kumar, M., Jain A., K., Ghosh, M., Ganguli, A. (2012) Statistical optimization of

physical parameters for enhanced bacteriocin production by L. casei. *Biotechnol Bioproc Engin.* 17(3):606–16.

Mallesha., Shylaja, R. and Selvakumar, D.J.H. (2010). *Isolation and Identification of Lactic Acid Bacteria From Raw and Fermented Products and Their Antibacterial Activity*. Recent Research in Science and Technology. Vol 2(6): 42-46.

ar, M., and Zilmer, M. (2009). Lactobacillus fermentum ME-3–an ntimicrobial and antioxidative probiotic. Microbial Ecology in Health nd Disease, Vol 21(1): 1- 27.

., S., Brandelli, A. (2007). Evaluation of environmental conditions for

production of bacteriocin-like substance by Bacillus sp. strain P34.*World J Microbiol Biotechnol.* 24(5):641–6.

Nagarjun, P.A. (2015). Parametric Optimization Of Lactic Acid Production And Its Scale Up Using Free And Immobilized Cells Of *Lactobacillus amylovorus* NRRL B- 4542 , *Int. J. Pure Appl.*

Naidu, A.S. dan Clemens, R.A. (2000). Probiotics. Natural Food Antimicrobial Systems. CRC Press, New York.

Nissen-Meyer, J., Holo, H., Havarstein, L.S., Sletten, K. and Nes, I.F. (1992). "A novel Lactococal Bacteriocin Whose Activity Depends on The Comlementary Action of Two Peptides." *Journal Bacteriology* 172:5688-5692

Nowroozi, J., M. Mirzaii and M. Norouzi. 2004. Study of *Lactobacillus* as probiotic bacteria. Iran. J. Publ. Health. 33 (2): 1-7.

Okerentugba P.O., I.O. Ijeoma and N.A. Oranusi. (2015). *Lactobacillus plantarum* subsp *plantarum*: Influence Of Growth Parameter On Bacteriocin Production And Characterization. *Nat Sci.* 13:75-82. doi: 10.7537/marsnsj131215. 10

Ouwehand , A.C. dan Vesterlund, S. (2004). Antimicrobial Components from Lactic Acid Bacteria.Marcel Dekker Inc., New York.

Parente, E., Brienza, C., Ricciandi, A., and Addario, G (1997). Growth and Bacteriocin Production by Enterococcus faecium DPC 1146 in Batch and Continuous Culture. *J. Ind Microbiol Biotechnol* 18 : 62-67

Pelczar, M. J. dan Chan, E. C. S. (2008). Dasar-Dasar Mikrobiologi Jilid I. Jakarta: UI Press.

Pezeshk, S., Ojogh, S., N., and Alishaki, A. (2015). Effect of Plant Antioxidant and Antimicrobial Compounds on The Shelf-Life of Seafood-a Review. *Czezh J Food Sci.*

Pratiwi, S.T., (2008). *Mikrobiologi Farmasi* . Jakarta: Erlangga.

Prescott, L.M. (2002). Prescott-Harley-Klein: Microbiology 5th Edition. USA: The McGrawth-Hill Companies.

Ray B. and Bhunia A. (2004). Fundamental Food Microbiology. 3rd ED. Florida. CRC Press. London. New York

Riley M.A., Wertz J.E. (2002). Bacteriocins: Evolution, Ecology, and Application. Annu RevMicrobiol; 56: 117-137.

, Apridamayanti, P. and Octaviani, M. (2018). Optimasi Aktivitas akteriosin yang Dihasilkan oleh Bakteri Lactobacillus plantarum dari inuman Ce Hun Tiau Optimization of Bacteriocin Activity Produced

by Lactobacillus plantarum Bacteria from Ce Hun Tiau Beverages', *Pharmaceutical Sciences and Research*, 5(1), p. 2.

Scopes, R.K. (1982). Protein Purification. Springer Verlag. New York.

Simonov, M. & Laukova, A. (2007). Bacteriosin activity of *Enterococci* from rabbit. *Vet. Res. Commun.*, (31), 143–152.

Singh, R., Sivasubramani, K., Jayalakshmi, S., 2013. Strainion and production of bacteriocin by marine Lactobacillus fermentum SBS001. Int J Curr Microbiol App Sci. 2(4):67-73.

Suardana, I., W., Suarsana I., N., Sujaya, I., N., Wiryawan K., G. (2007). Isolasi dan Identifikasi BakteriAsam Laktat dari Cairan Rumen Sapi Bali Sebagai Kandidat Biopreservatif. *Jurnal Veteriner.* Vol.8 (4) : 155-159

Songisepp, E., Kullisaar, T. Hutt, P. Elias, P. Brilene, T. Zilmer, and M. Mikelsaar. (2004). A new probiotic cheese with antioxidative and antimicrobial activity. J Dairy Sci 87: 2017-2023.

Usmiati, S. & Marwati, T. (2007). Seleksi dan optimasi proses produksi bakteriosin dari *Lactobacillus* sp. *J. Pascapanen, 4*(1), 27–37.

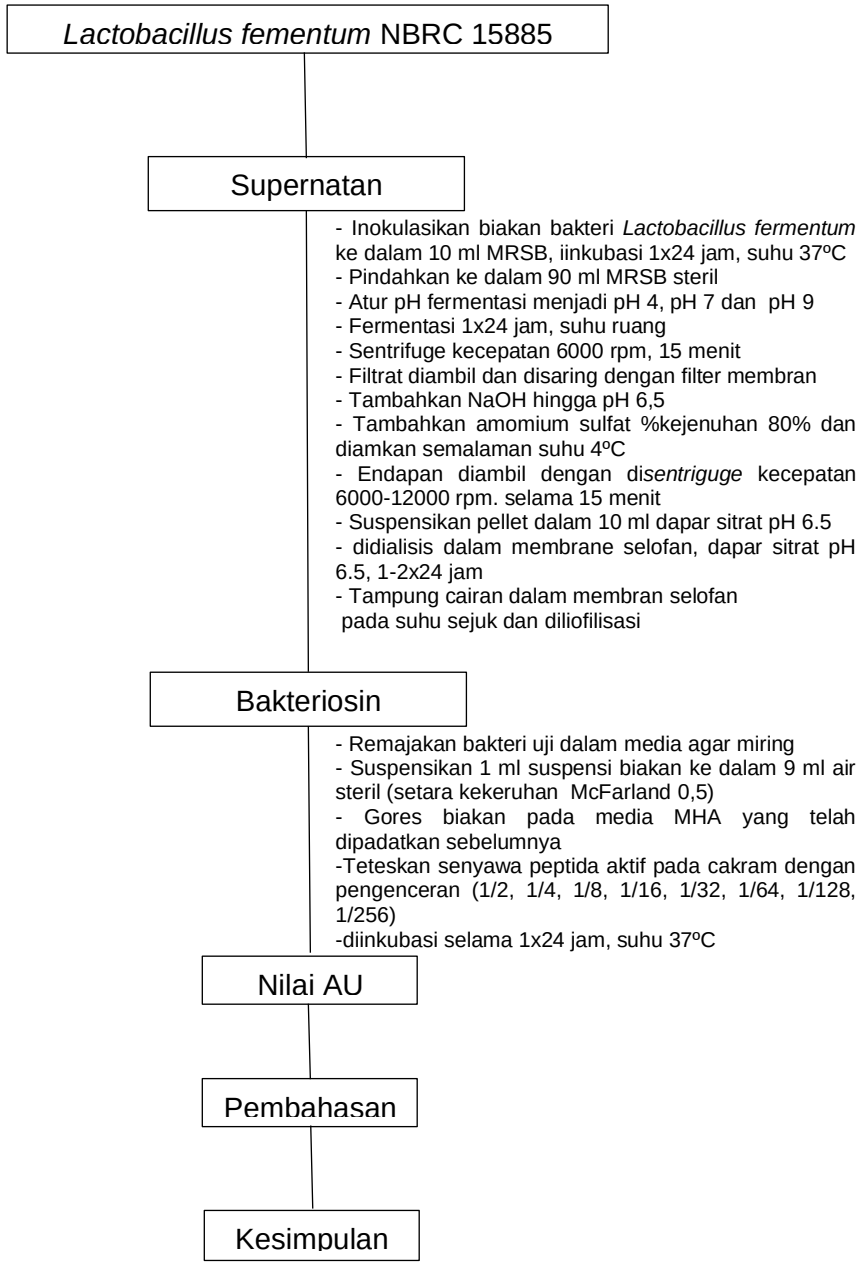
Vandenberg, P.A. (1993). Lactic Acid Bacteria, their metabolic products and interference with microbial growth. *FEMS Microbial Rev* 12: 221-238.

Zhang J, Y. Zhang , S.N. Liu , Y. Han & Z.J. Zhou. (2012). Modelling Growth And Bacteriocin Production By *Pediococcus acidilactici* PA003 As A Function Of Temperature and pH value, *Appl. Biochem. Biotechnol.* 166:1388-400. doi: 10.1007/s12010-011-9532-4

Zoumpopoulou G, Foligne B, Christodoulouk, Gnangette C, Pot B, Tsakalidov E. (2008). Lactobacillus fermentum ACA-DC 179 displays probiotics potential in vitro and protect against trinitrobenzen sulfonic acid (TNBS) induced colitis and salmonella infection in marine models. *Inf JFood Microbiol.* 12:18-19.

# LAMPIRAN

## Lampiran 1. Skema Kerja Penelitian



## Lampiran 2. Analisis Protein

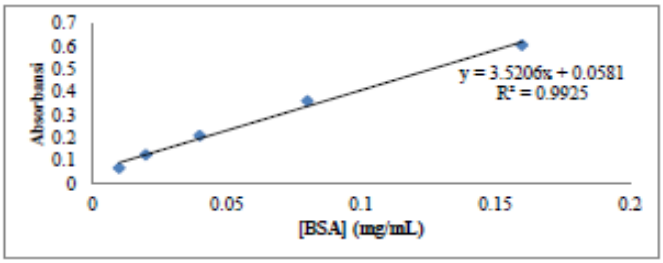
LABORATORIUM BIOKIMIA
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
UNIVERSITAS HASANUDDIN
Kampus UNHAS Tamalanrea, Jl. Perintis Kemerdekaan KM. 10, Makassar, 90245
Telp. 0411-586498, 0411-586200 Ext. 1092

**HASIL ANALISIS**

Nama/NIM : Fahrul Ramadan/N11116039
Asal Institusi : Farmasi Universitas Hasanuddin
Jenis Sampel : Isolat Bakteri *Lactobacillus fermentum NBRC 15885*
Jumlah : 3 (Tiga) Duplo
Analisis : Penentuan Kadar Protein

**STANDAR PROTEIN**

| [BSA] (mg/mL) | Absorbansi (λ = 660 nm) |
|---|---|
| 0.01 | 0.071 |
| 0.02 | 0.128 |
| 0.04 | 0.212 |
| 0.08 | 0.363 |
| 0.16 | 0.608 |




x : Kadar Protein
y : Absorbansi
y = 3,5206x + 0,0581
x = y - 0,0581/3,5206

**SIMPLO**

| Kode sampel | Absorbansi | FP | Protein terukur (mg/mL) |
|---|---|---|---|
| pH 4 | 0.880 | 10 | 2.33 |
| pH 7 | 1.180 | 10 | 3.19 |
| pH 9 | 1.500 | 10 | 4.10 |

**DUPLO**

| Kode sampel | Absorbansi | FP | Protein terukur (mg/mL) |
|---|---|---|---|
| pH 4 | 0.830 | 10 | 2.19 |
| pH 7 | 1.220 | 10 | 3.30 |
| pH 9 | 1.520 | 10 | 4.15 |

Makassar, 13 Maret 2020
PLP Lab. Biokimia

Mahdalia, S.Si, M.Si
19750826 199601 2 001

**Lampiran 3. Perhitungan Nilai AU (*Activity Unit)***

Rumus umum :

$$\text{Nilai AU} = \text{faktor pengenceran x } \frac{1000\ (\mu L)}{vol.cuplikan\ (\mu L)}$$

a. pH 4

$$\text{Nilai AU} = 8 \text{ x } \frac{1000\ (\mu L)}{20(\mu L)} = 8 \text{ x } 50 = 400\ \text{AU/mL}$$

b. pH 7

$$\text{Nilai AU} = 4 \text{ x } \frac{1000\ (\mu L)}{20\ (\mu L)} = 4 \text{ x } 50 = 200\ \text{AU/mL}$$

## Lampiran 4. Konsentrasi Akhir Amonium Sulfat

**Tabel 2. Konsentrasi akhir ammonium sulfat**

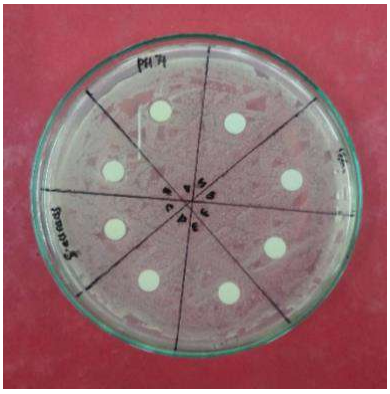
| Initial % saturation ammonium sulfate | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 10.6 | 13.4 | 16.4 | 19.4 | 22.6 | 25.8 | 29.1 | 32.6 | 36.1 | 39.8 | 43.6 | 47.6 | 51.6 | 55.9 | 60.3 | 65 | 69.7 |
| 5 | 7.9 | 10.8 | 13.7 | 16.6 | 19.7 | 22.9 | 26.2 | 29.6 | 33.1 | 36.8 | 40.5 | 44.4 | 48.4 | 52.6 | 57 | 61.5 | 66.2 |
| 10 | 5.3 | 8.1 | 10.9 | 13.9 | 16.9 | 20 | 23.3 | 26.6 | 30.1 | 33.7 | 37.4 | 41.2 | 45.2 | 49.3 | 53.6 | 58.1 | 62.7 |
| 15 | 2.6 | 5.4 | 8.2 | 11.2 | 14.1 | 17.2 | 20.4 | 23.7 | 27.1 | 30.6 | 34.3 | 38.1 | 42 | 46 | 50.3 | 54.7 | 59.2 |
| 20 | 0 | 2.7 | 5.5 | 8.3 | 11.3 | 14.3 | 17.5 | 20.7 | 24.1 | 27.6 | 31.2 | 34.9 | 38.7 | 42.7 | 46.9 | 51.2 | 55.7 |
| 25 | | 0 | 2.7 | 5.6 | 8.4 | 11.5 | 14.6 | 17.9 | 21.1 | 24.5 | 28 | 31.7 | 35.5 | 39.5 | 43.6 | 47.8 | 42.2 |
| 30 | | | 0 | 2.8 | 5.6 | 8.6 | 11.7 | 14.8 | 18.1 | 21.4 | 24.9 | 28.5 | 32.3 | 36.2 | 40.2 | 44.5 | 48.8 |
| 35 | | | | 0 | 2.9 | 5.7 | 8.7 | 11.8 | 15.1 | 18.4 | 21.8 | 25.8 | 29.6 | 32.9 | 36.9 | 41 | 45.3 |
| 40 | | | | | 0 | 2.9 | 5.8 | 8.9 | 12 | 15.3 | 18.7 | 22.2 | 26.3 | 29.6 | 33.5 | 37.6 | 41.8 |
| 45 | | | | | | 0 | 3 | 5.9 | 9 | 12.3 | 15.6 | 19 | 22.6 | 26.3 | 30.2 | 34.2 | 38.3 |
| 50 | | | | | | | 0 | 3 | 6 | 9.2 | 12.5 | 1.9 | 19.4 | 23.5 | 26.8 | 30.8 | 34.8 |
| 55 | | | | | | | | 0 | 3.1 | 6.1 | 9.3 | 12.7 | 16.1 | 20.1 | 23.5 | 27.3 | 31.2 |
| 60 | | | | | | | | | 0 | 3.1 | 6.2 | 9.5 | 12.9 | 16.8 | 20.1 | 23.9 | 27.9 |
| 65 | | | | | | | | | | 0 | 3.2 | 6.3 | 9.7 | 13.2 | 16.8 | 20.5 | 24.4 |
| 70 | | | | | | | | | | | 0 | 3.2 | 6.5 | 9.9 | 13.4 | 17.1 | 20.9 |
| 75 | | | | | | | | | | | | 0 | 3.3 | 6.6 | 10.1 | 13.7 | 17.4 |
| 80 | | | | | | | | | | | | | 0 | 3.4 | 6.7 | 10.3 | 13.9 |
| 85 | | | | | | | | | | | | | | 0 | 3.4 | 6.8 | 10.5 |
| 90 | | | | | | | | | | | | | | | 0 | 3.4 | 7 |
| 95 | | | | | | | | | | | | | | | | 0 | 3.5 |
| 100 | | | | | | | | | | | | | | | | | 0 |

Sumber : Dawson *et al.*, 1969

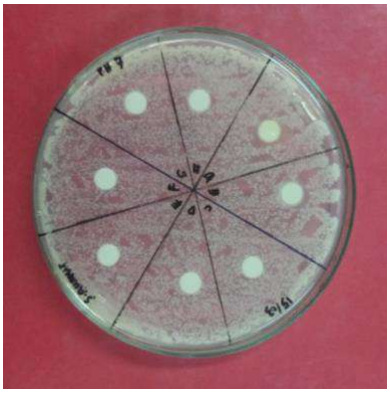
## Lampiran 5. Hasil Uji Aktivitas Antibakteri

### a. *Staphylococcus aureus*

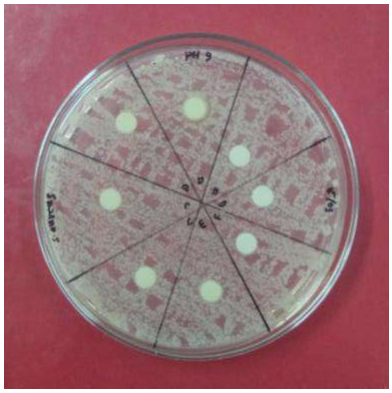
(a)



(b)



(c)



(d)

Keterangan :

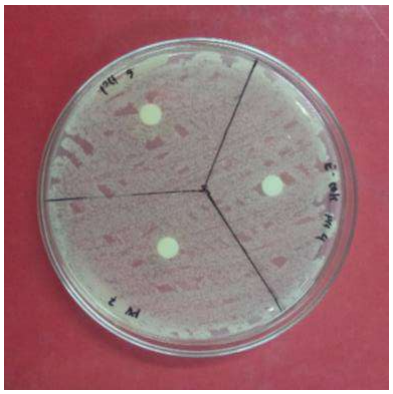
(a) *Crude*
(b) pH 4

| Variasi pH | Pengenceran | Zona bening |
|---|---|---|
| pH 4 | 1/2 | + |
| | 1/4 | + |
| | 1/8 | + |
| | 1/16 | - |
| | 1/32 | - |
| | 1/64 | - |
| | 1/128 | - |
| | 1/256 | - |

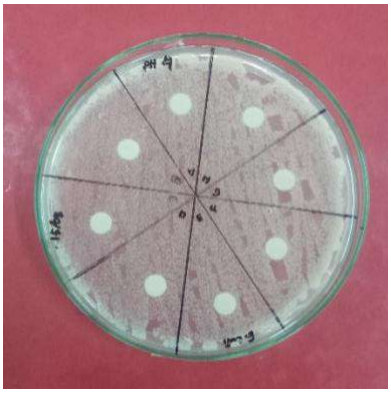
| Variasi pH | Pengenceran | Zona bening |
|---|---|---|
| pH 7 | 1/2 | + |
| | 1/4 | + |
| | 1/8 | - |
| | 1/16 | - |
| | 1/32 | - |
| | 1/64 | - |
| | 1/128 | - |
| | 1/256 | - |

| Variasi pH | Pengenceran | Zona bening |
|---|---|---|
| pH 9 | 1/2 | - |
| | 1/4 | - |
| | 1/8 | - |
| | 1/16 | - |
| | 1/32 | - |
| | 1/64 | - |
| | 1/128 | - |
| | 1/256 | - |

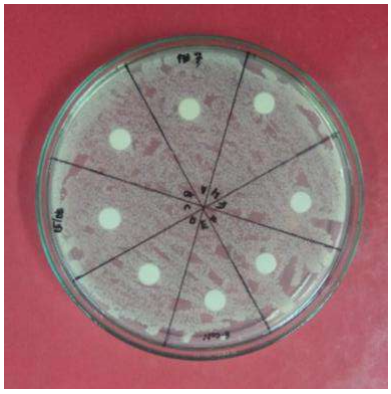
**b. *Escherichia coli***



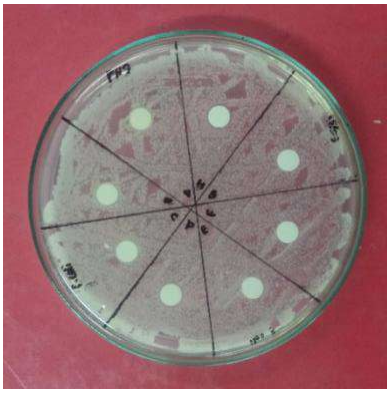
(a)



(b)



(c)



(d)

Keterangan :

(a) Crude
(b) pH 4

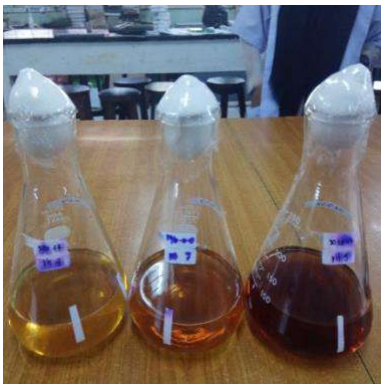
| Variasi pH | Pengenceran | Zona bening |
|---|---|---|
| pH 4 | 1/2 | - |
| | 1/4 | - |
| | 1/8 | - |
| | 1/16 | - |
| | 1/32 | - |
| | 1/64 | - |
| | 1/128 | - |
| | 1/256 | - |

| Variasi pH | Pengenceran | Zona bening |
|---|---|---|
| pH 7 | 1/2 | - |
| | 1/4 | - |
| | 1/8 | - |
| | 1/16 | - |
| | 1/32 | - |
| | 1/64 | - |
| | 1/128 | - |
| | 1/256 | - |

| Variasi pH | Pengenceran | Zona bening |
|---|---|---|
| pH 9 | 1/2 | - |
| | 1/4 | - |
| | 1/8 | - |
| | 1/16 | - |
| | 1/32 | - |
| | 1/64 | - |
| | 1/128 | - |
| | 1/256 | - |

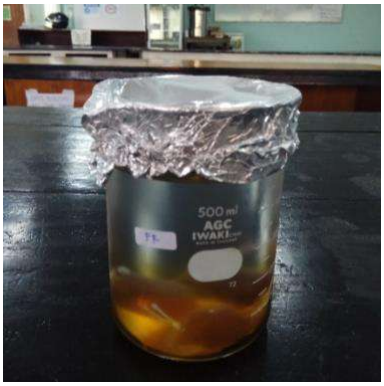
**Lampiran 6. Dokumentasi Penelitian**


(a)



(b)


(c)




(d)

(e)

(f)

Keterangan :

(a) Inokulasi starter ke dalam medium fermentasi
(b) Proses pengaturan pH media fermentasi
(c) Proses fermentasi
(d) Proses dialisis
(e) Proses uji kuantitatif protein
(f) Proses uji aktivitas antimikroba