

DAFTAR PUSTAKA

- Aaisha, G.A., and Barate, D.L. 2015. Isolation and Identification of Pectinolytic Bacteria from Soil Samples of Akola Region, India. *Int J of Current Microbiol and Applied Sci.* 5(1): 514-521.
- Adri, W., Mardiah, E., dan Afrizal. 2013. Produksi Enzim Selulase dari *Aspergillus niger* dan Kemampuannya Menghidrolisis Jerami Padi. *Jurnal Kimia Unand.* 2(2): 103-108.
- Akhdiya, A. 2003. Isolasi Bakteri Penghasil Enzim Protease Alkalin Termostabil. *Buletin Plasma Nutfah.* 9(2): 38 - 44.
- Alkorta, I., Garbisu, C., Llama, M.J., and Serra, J.L. 1998. Industrial Application of Pektin Enzymes: A Review. *Process Biochemistry,* 33: 21-28.
- Anggraeni, D.N., Usman, M. 2015. Uji Aktivitas dan Identifikasi Jamur Rhizosfer Pada Tanah Perakaran Tanaman Pisang (*Musa paradisiaca*) Terhadap Jamur *Fusarium*. *Jurnal BioLink,* 1(2): 89-98.
- Astutik, R.P., Kuswytasari, N.D., dan Shovitri, M. 2010. Uji Aktivitas Enzim Selulase dan Xilanase Isolat Kapang Tanah Wonorejo Surabaya. Laporan Penelitian, Jurusan Biologi FMIPA ITS, Surabaya.
- Asyanti, H. 2019. Seleksi Isolat Cendawan Rhizosfer Kemiri (*Aleurites moluccana*) Potensi Pendegradasi Selulosa. Skripsi. Universitas Hasanuddin, Makassar.
- Campbel, R. and Mitchell. 2003. *Biologi Edisi Kelima – Jilid Dua.* Erlangga. Jakarta.
- Cappuccino, J.G., Sherman, N. 2014. Manual Laboratorium Mikrobiologi. EGC, Jakarta.
- Dharmaputra, O.S., W.G. Agustin dan Nampiah. 1989. Penuntun Praktikum: Mikologi Dasar. Departemen Pendidikan dan Kebudayaan. Direktorat Jenderal Pendidikan Tinggi Pusat Antar Universitas Ilmu Hayati. IPB, Bogor.
- Dibisono, M.Y. 2014. Respon Pertumbuhan Vegetatif Tanaman Pisang Barangan (*Musa paradisiaca sapientum* L.) Akibat Penggunaan Pupuk Kotoran Kambing dan Jamur *Trichoderma harzianum*. *Jurnal Agroekoteknologi* 6 (2): 169-177.
- Djaenuddin, N., Faesal, F., dan Syafruddin, S. 2018. Viabilitas Kombinasi Bakteri dan Cendawan Pada Berbagai Komposisi Bahan Pembawa dan Efektifitasnya Dalam Mendekomposisi Biomas Jagung. *Jurnal Penelitian Pertanian Tanaman Pangan,* 2(2): 111.

- Fowler, M.W. 1988. *Enzyme Technology in Biotechnology for Engineers, Biological System in Technological Processes*. John Wiley & Sons, New York.
- Gandjar, I, Sjamsuridzal, W, Oetari, A. 2006. *Mikologi: Dasar dan Terapan, ed.1*. Yayasan Obor Indonesia. Jakarta.
- Hanson, J.R. 2008. *The Chemistry of Fungi*. Royal Society of Chemistry. Cambridge.
- Hanum, A.M. dan Nengah D.K. 2014. Laju Dekomposisi Serasah Daun Trembesi (*Samanea saman*) dengan Penambahan Inokulum Kapang. *Jurnal Sains dan Seni Pomits*, 3(1): 2337-3520.
- Hardjo, S., Indrasi, N.S., dan Bantacut, T. 1989. Biokonversi: Pemanfaatan Limbah Industri Pertanian. Pusat Antar Universitas Pangan dan Gizi IPB, Bogor.
- Harti, A.S. 2015. *Mikrobiologi Kesehatan Peran Mikrobiologi Dalam Bidang Kesehatan*. CV. Andi Offset. Yogyakarta.
- Herlina, Firda. 2014. Bioactivators Effectiveness and Utilization in Bulking Agents of Water Hyacinth as Compost. *JISI: Jurnal Integrasi Sistem Industri*, 1 (2): 35-44
- Ikram, U.H., Javed, M.M., Khan, T.S., and Siddiq, Z. 2005. Cotton Saccharifying Activity of Cellulases Produced by Co-culture of *Aspergillus niger* and *Trichoderma viride*. *Res. J. Agric & Biol. Sci.* 1(3):241-245.
- Jacob, N., Poorna, C.A., and Prema, P. 2008. Purification and Partial Characterization of Polygalacturonase from *Streptomyces lydicus*. *Bioresource Technology*. 99: 6697-6701.
- Joshi, V.K., Mukesh, P. and Neerja, R. 2011. Purification and Characterization of Pectinase Produced from Apple Pomace and Evaluation of Its Efficacy in Fruit Juice Extraction and Clarification. *Indian Journal of Natural Products and Resources*. 2(2): 189-197.
- Kamase, L.A. 2019. Identifikasi Keragaman Cendawan dari Serasah Jati (*Tectona grandis* L.) di Hutan Rakyat Kab. Barru, Sulawesi Selatan. Skripsi. Universitas Hasanuddin, Makassar.
- Kashyap, D.R., Chandra, S., Kaul, A., and Tewari, R. 2000. Production, Purification and Characterization of Pectinase from a *Bacillus* sp. DT7. *World J Microbiol Biotech*. 16: 277-282.
- Kavanagh, K. 2005. *Fungi Biology and Applications*. England: John Wiley.
- Kıran, Ö.E., Çömlekçiöğlü, U., and Dostbil, N. 2006. Mikrobiyal Enzimler ve Endüstride Kullanım Alanları. *Kahramanmaraş Sütçüimam Üniversitesi Fen ve Mühendislik Dergisi*, 9(1): 12-19.

- Kirk, O., Borchert, T.V., and Fuglsang, C.C. 2002. Industrial Enzymes Applications. *Curr Opin Biotechnol.* 13: 345-351.
- Knabner, I.K. 2002. The Macromolecular Organic Composition of Plant and Microbial Residues as Input to Soil Organic Matter. *Soil Biol Biochem.* 34: 139-162.
- Lelana, N.E. 2009. Seleksi Cendawan Potensial Penghasil Enzim Endoglukanase (Karboksimetil Selulase) dan Isolasi Gen Penyandinya. Tesis. IPB, Bogor.
- Liu, Y.T., Xuan, S.X., Long, C.N., Long, M.N., and Hu, Z. 2008. Screening, Identifying of Cellulose Decomposing Strain L-06 and Its Enzyme-Producing Conditions. *Chin. J. Biotech* 24: 1872-2075.
- Lynd, L.R., Weimer, P.J., Van Zyl, W.H., and Pretorius, I. S. 2002. Microbial Cellulose Utilization: Fundamentals and Biotechnology. *Microbiology and Molecular Biology Reviews*, 66: 506-577.
- Mahmood K., Y Wei-Jun, K Nazir, RZ Iqbal, and AG Abdullah. 2006. Study of Cellulolytic Soil Fungi and Two Nova Species and New Medium. *Journal of Zhejiang University* 7(6): 459-466.
- Maki, M., Leung, K.T., and Qin, W. 2009. The Prospects of Cellulose-Producing Bacteria for The Bioconversion of Lignocellulosic Biomass. *Int J Biol Sci.* 5: 500-516.
- Meilina, H. dan Illah S. 2003. Produksi Pektin dari Kulit Jeruk Lemon (*Citrus medica*). IPB, Bogor.
- Merin, M.G., Mendoza, L.M., Farias, M.E., and Ambrosini V.I.M. 2011. Isolation and Selection of Yeasts from Wine Grape Ecosystem Secreting Cold-Active Pectinolytic Activity. *Int J of Food Microbiol.* 147: 144-148.
- Milala, M.A., Shugaba, A., Gidado, A., Ene, A.C., and Wafar, J.A. 2005. Studies on The Use of Agricultural Wastes for Cellulase Enzyme Production by *Aspergillus niger*. *Res. J. Agric. Biol. Sci.* 1: 325-328.
- Moore, E. 1996. *Fundamentals of The Fungi*. Pentice-Hall, New Jersey.
- Nuryani, S. H. U., & Sutanto, R. 2002. Pengaruh Sampah Kota terhadap Hasil dan Tahana Hara Lombok. *Jurnal Ilmu Tanah dan Lingkungan*, 3 (1): 24-28.
- Paesha, N. 2019. Seleksi Isolat Cendawan Rhizosfer Kemiri (*Aleurites moluccana* Wild) Penghasil Enzim Pektinase. Skripsi. Universitas Hasanuddin, Makassar.
- Patandean, H. 2020. Seleksi Isolat Cendawan Rhizosfer Mahoni (*Swietenia mahagoni*) yang Berpotensi Sebagai Pendegradasi Bahan Organik. Skripsi. Universitas Hasanuddin, Makassar.

- Pelczar, M.J. dan Chan, E.C.S. 2005. *Dasar-Dasar Mikrobiologi, Jilid I*, Penerjemah Hadiutomo, R.S., Imas, T., Tjitrosomo, S.S., dan Angka, S.L. UI-Press. Jakarta.
- Perez, J., Munoz-Dorado, J., de la Rubia, T., and Martinez, J. 2002. Biodegradation and Biological Treatments of Cellulose, Hemicellulose and Lignin: an Overview. *Int. Microbiol.* 5:53-63.
- Prasetyowati, Karina P.S., dan Healty P. 2009. Ekstraksi Pektin dari Kulit Mangga. *Jurnal Teknik Kimia.* 16(4).
- Prihandarini. 2004. *Manajemen Sampah*. Perpod. Jakarta
- Prihanto, A.A., Timur, H.D.L., Jaziri, A.A., Nurdiani, R., dan Pradarameswari, K.A. 2018. Isolasi Dan Identifikasi Bakteri Endofit Mangrove *Sonneratia Alba* Penghasil Enzim Gelatinase Dari Pantai Sendang Biru, Malang, Jawa Timur. *Indonesia Journal of Halal*, 1(1): 31-42.
- Purwadaria, T., Marbun, P.A., Sinurat, A.P., dan Ketaren, P.P. 2003. Perbandingan Aktivitas Enzim Selulase dari Bakteri dan Kapang Hasil Isolasi dari Rayap. *JITV* 8(4): 213-219.
- Purwati dan Hamidah. 2018. Biodiversitas Mikroba Rizosfer Tanaman Jeruk Keprok Borneo Prima (*Citrus reticulata* cv *Borneo Prima*). *Jurnal Agrifarm*, 7(2): 50-53
- Rahim, I. 2015. Studi Pemanfaatan Cendawan Pelapuk Dalam Proses Dekomposisi Limbah Kulit Kakao dan aplikasinya Pada Bibit Kakao (*Theobroma cacao* L). Disertasi Pascasarjana Universitas Hasanuddin, Makassar.
- Reddy, P.L., and Sreeramulu, A. 2012. Isolation, Identification and Screening of Pectinolytic Fungi from Different Soil Samples of Chittoor District. *Int J of Life Sci Biotechnol and Pharma Research.* 1(3):186-19.
- Rozali, G. 2015. Penapisan Jamur Antagonis Indigenus Rizosfir Kakao (*Theobroma cacao* Linn.) yang Berpotensi Menghambat Pertumbuhan Jamur *Phytophthora palmivora* Butler. Skripsi. Universitas Andalas, Padang.
- Saraswati, K. 2010. Aktivitas Anti jamur Ekstrak Etanol Daun Benalu Cengkeh (*Dendrophthoe pentandra* (L.) Miq.) terhadap *Candida albicans* dan *Trichophyton rubrum*. Skripsi. Universitas Muhammadiyah Surakarta, Surakarta.
- Saraswati, R. 2007. *Pengembangan Teknologi Mikroflora Tanah Multiguna Untuk Efisiensi Pemupukan dan Keberlanjutan Produktivitas Lahan Pertanian*. Pusat Penelitian dan Pengembangan Tanah dan Agroklimat, Bogor.
- Saraswati, R., Edi S., dan Erny Y. 2006. *Organisme Perombak Bahan Organik*. Departemen Pertanian. 211-230.

- Smith, D. and Onions, H.S. 1994. *The Preservation and Maintenance of Living Fungi* 2 ed. London (GB): Commonwealth Agricultural Bureaux International.
- Stryer, L., Tymoczko, J.L., and Berg, J.M. 2002. *Biochemistry Fifth Edition*. WH Freeman, New York.
- Suhartono, M.T. 1989. *Enzim dan Bioteknologi*. Dirjen Dikti, PAU Bioteknologi IPB, Bogor.
- Sukanto. 2013. Pembuatan Agen Bioaktivator Untuk Pengolahan Kotoran Ternak Menjadi Pupuk Organik Majemuk Secara Fermentasi. Makalah. Disampaikan dalam kegiatan penyuluhan dalam rangka Desa Binaan Fakultas Biologi UNSOED 2013/2014.
- Syatrawati. 2007. Parasitisme *Gliocladium sp.* Terhadap *Rhizoctonia solani* Sebagai Penyebab Penyakit Rebah Kecambah Pada Jagung Secara *In-Vitro*. *Prosiding Seminar Ilmiah dan Pertemuan Tahunan PEI dan PFI XVI Komda Sul-Sel*. ISBN: 979-95025-6-7 ISBN 979-95025-6-7.
- Taurisia, P.P., Meitini, W. P., dan Irsan N. 2015. Pengaruh Media Terhadap Pertumbuhan dan Biomassa Cendawan *Alternaria alternata* (Fries) Keissler. *Jurnal Biologi*, 19 (1): 30-33.
- Thomas, D.B. 1989. *A Textbook of Industrial Microbiology, Second Edition*. Sinauer Associates, Sunderland, USA.
- Utami, A. P., Setyaningsih, R., Pangastuti, A., dan Lusi, S. S. A. 2019. Optimasi Produksi Enzim Selulase Dari Jamur *Penicillium Sp. SLL06* Yang Diisolasi Dari Serasah Daun Salak (*Salacca edulis*). *Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia*, 5(2): 145-149.
- Wahyuno, D., D. Manohara, dan K. Mulya. 2009. Peranan Bahan Organik Pada Pertumbuhan dan Daya Antagonisme *Trichoderma harzianum* dan Pengaruhnya Terhadap *P. capsici*. Pada Tanaman Lada. *Jurnal Fitopatologi Indonesia* 7:76–82.

LAMPIRAN

Lampiran 1. Pembuatan Media Biakan *Cendawan Potato Destrose Agar (PDA)* dan Peremajaan Isolat Cendawan



Proses Penimbangan Bahan



Melarutkan Media dengan *Hot Plate*



Proses Sterilisasi Media PDA
Menggunakan *Autoclave*



Proses Sterilisasi Cawan Petri di
dalam *Laminary Air Flow*



Proses Penuangan Media
kedalam Cawan Petri



Proses Inokulasi Isolat
Cendawan kedalam Media PDA

Lampiran 2. Pembuatan Media Uji Isolat Cendawan dengan Substrat Selulosa dan Pektin



Proses Penimbangan Bahan



Melarutkan Media dengan
Hot Plate



Proses Sterilisasi Media CDA
Menggunakan *Autoclave*

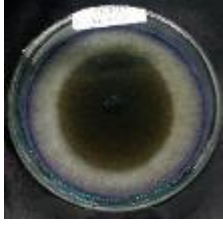





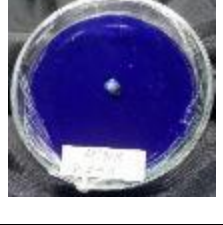

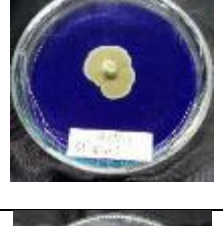
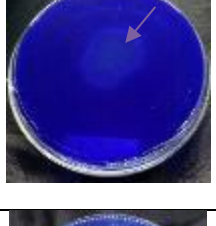





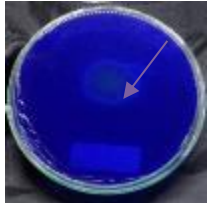


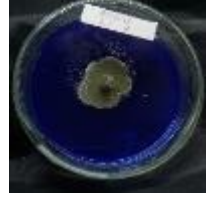
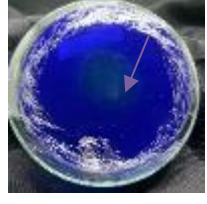

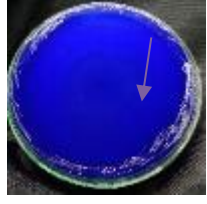








Proses Penuangan Media CDA
kedalam Cawan Petri






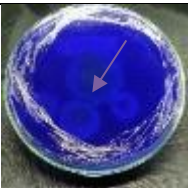












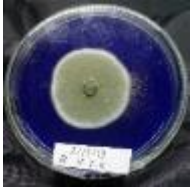
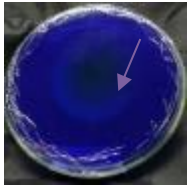

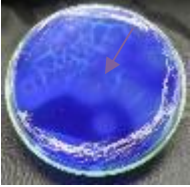

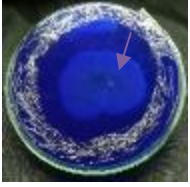
Proses Pemindehan Isolat
kedalam Media Uji Enzim

**Lampiran 3. Hasil Pengamatan Skoring Degradasi Substrat Selulosa pada
Isolat Cendawan**

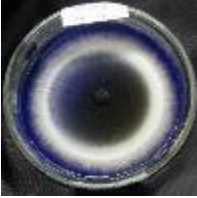



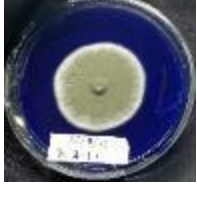






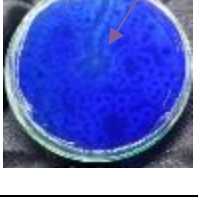
No	Isolat	Genus	Skoring	Gambar	
				Depan	Belakang
1	1.1	Aspergillus	+		
2	1.3	Penicillium	++++		
3	2.1	Aspergillus	+		
4	2.4	Aspergillus	+		
5	3.1	Penicillium	+		
6	4.3	Penicillium	++++		


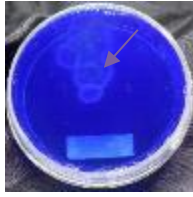







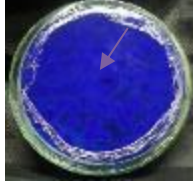






7	5.1	Penicillium	+		
8	7.3	Penicillium	+		
9	8.1	Penicillium	+		
10	10.2	Aspergillus	+		
11	10.3	Penicillium	++++		
12	11.1	Aspergillus	++		
13	12.1	Gliocladium	+		
14	12.4	Aspergillus	+		


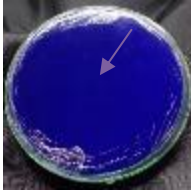
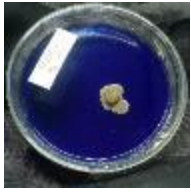
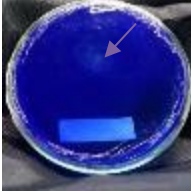



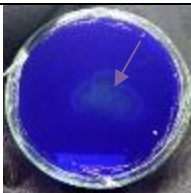

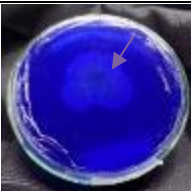


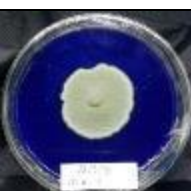
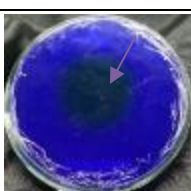


15	13.2	Trichoderma	+		
16	13.6	Penicillium	+		
17	13.7	Penicillium	++		
18	13.9	Penicillium	++++		
19	14.1	Penicillium	++		
20	14.4	Aspergillus	+		
21	15.2	Aspergillus	+		
22	15.3	Penicillium	+++		

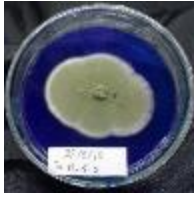


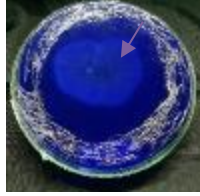

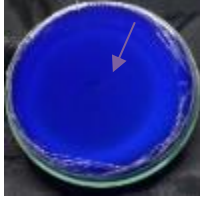
23	15.5	Penicillium	++		
24	15.6	Penicillium	+++		
25	15.7	Aspergillus	++		

Lampiran 4. Hasil Pengamatan Skoring Degradasi Substrat Pektin pada Isolat Cendawan

No	Isolat	Genus	Skoring	Gambar	
				Depan	Belakang
1	1.1	Aspergillus	+		
2	1.3	Penicillium	+		
3	2.1	Aspergillus	++		
4	2.4	Aspergillus	+++		
5	3.1	Penicillium	+		
6	4.3	Penicillium	++++		

7	5.1	Penicillium	+		
8	7.3	Penicillium	+		
9	8.1	Penicillium	+		
10	10.2	Aspergillus	+		
11	10.3	Penicillium	++++		
12	11.1	Aspergillus	++		
13	12.1	Gliocladium	+		
14	12.4	Aspergillus	+		

15	13.2	Trichoderma	+		
16	13.6	Penicillium	+		
17	13.7	Penicillium	++		
18	13.9	Penicillium	+		
19	14.1	Penicillium	+		
20	14.4	Aspergillus	+		
21	15.2	Aspergillus	+		
22	15.3	Penicillium	+		

23	15.5	Penicillium	++		
24	15.6	Penicillium	+		
25	15.7	Aspergillus	+		

Lampiran 5. Uji Independent Sampel T Test pada Data Genus Enzim Selulase

Independent Samples T Test Summary

Descriptive Statistics

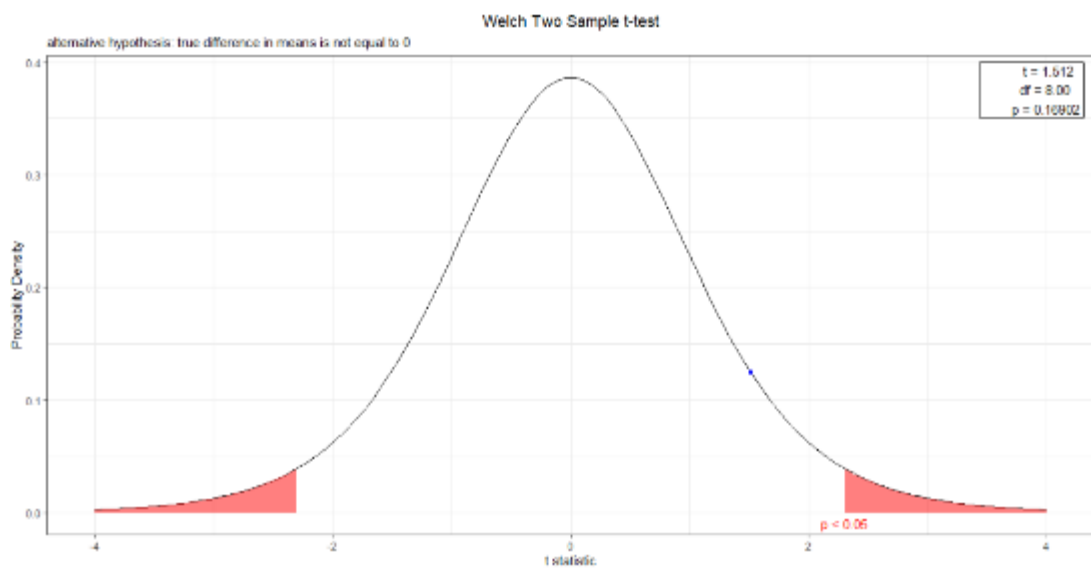
	N	mean	standard_deviation	standard_error
Selulosa_Aspergillus	9	1.111	0.2205	0.07349
Selulosa_Gliocladium	2	1	0	0

F test

F statistics	num df	denom df	p value
Inf	8	1	0

T test

t statistics	df	p value	conf_int_lower	conf_int_upper
1.512	8	0.169	-0.05836	0.2806



Descriptive Statistics

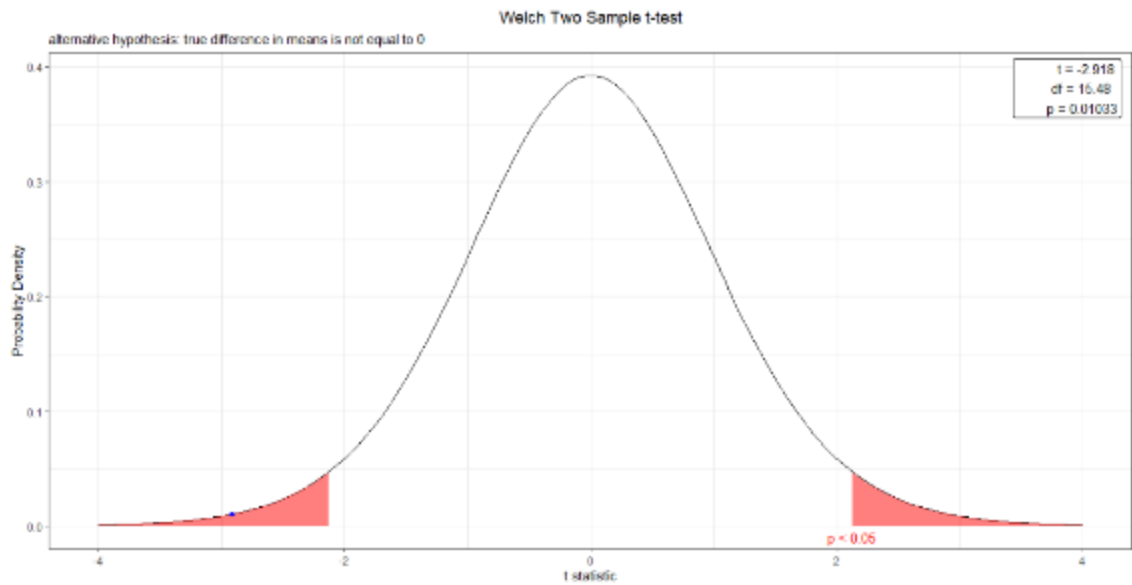
	N	mean	standard_deviation	standard_error
Selulosa_Aspergillus	9	1.111	0.2205	0.07349
Selulosa_Penicillium	14	1.821	0.8684	0.2321

F test

F statistics	num df	denom df	p value
0.06446	8	13	0.0005865

T test

t statistics	df	p value	conf_int_lower	conf_int_upper
-2.918	15.48	0.01033	-1.228	-0.1928



Descriptive Statistics

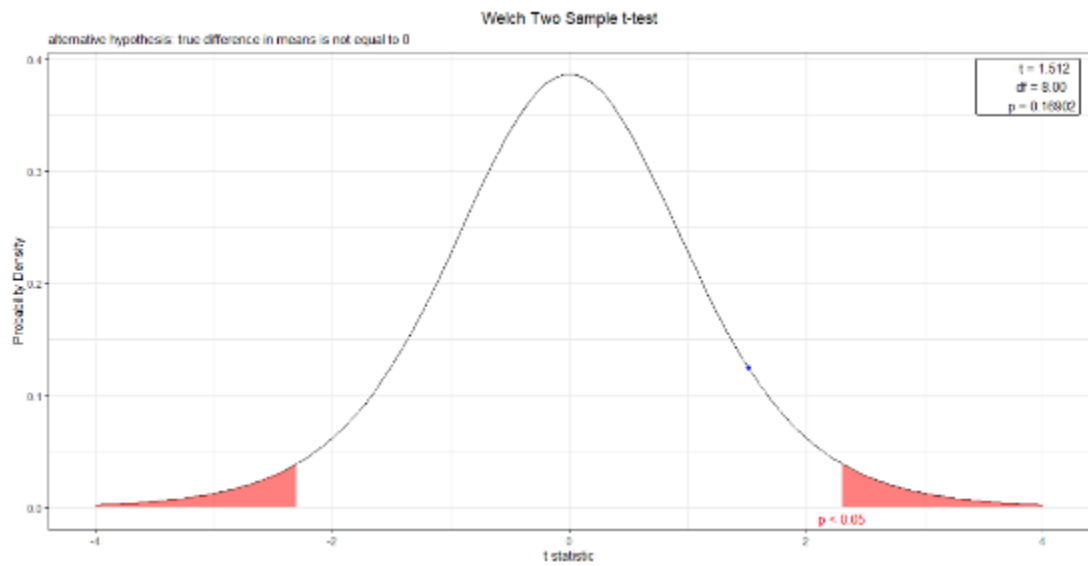
	n	mean	standard_deviation	standard_error
Selulosa_Aspergillus	9	1.111	0.2205	0.07349
Selulosa_Trichoderma	2	1	0	0

F test

F statistics	num df	denom df	p value
Inf	8	1	0

T test

t statistics	df	p value	conf_int_lower	conf_int_upper
1.512	8	0.169	-0.05836	0.2806



Descriptive Statistics

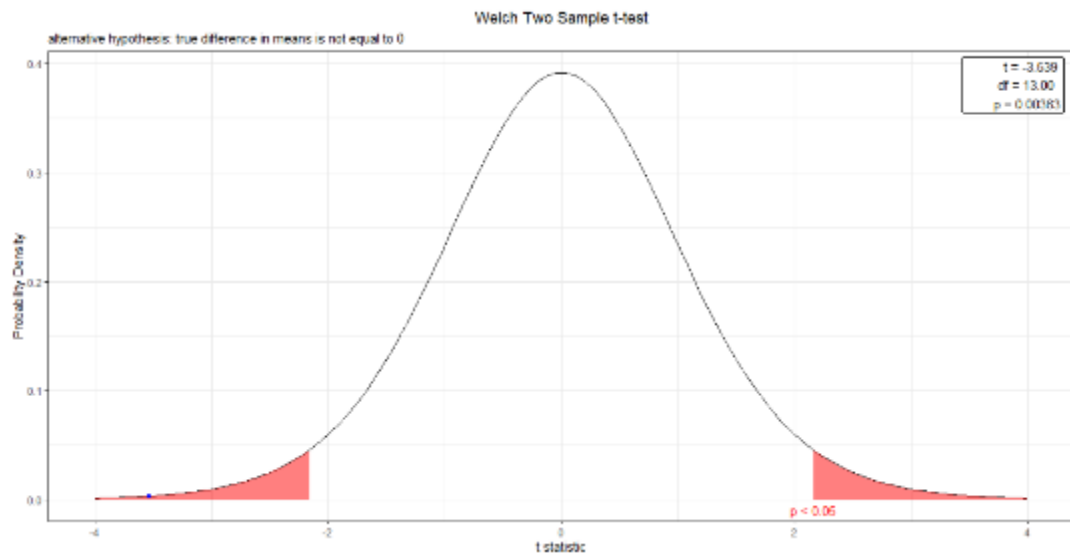
	N	Mean	standard_deviation	standard_error
Selulosa_Gliocladium	2	1	0	0
Selulosa_Penicillium	14	1.821	0.8684	0.2321

F test

F statistics	num df	denom df	p value
0	1	13	0

T test

t statistics	df	p value	conf_int_lower	conf_int_upper
-3.539	13	0.00363	-1.323	-0.32



Descriptive Statistics

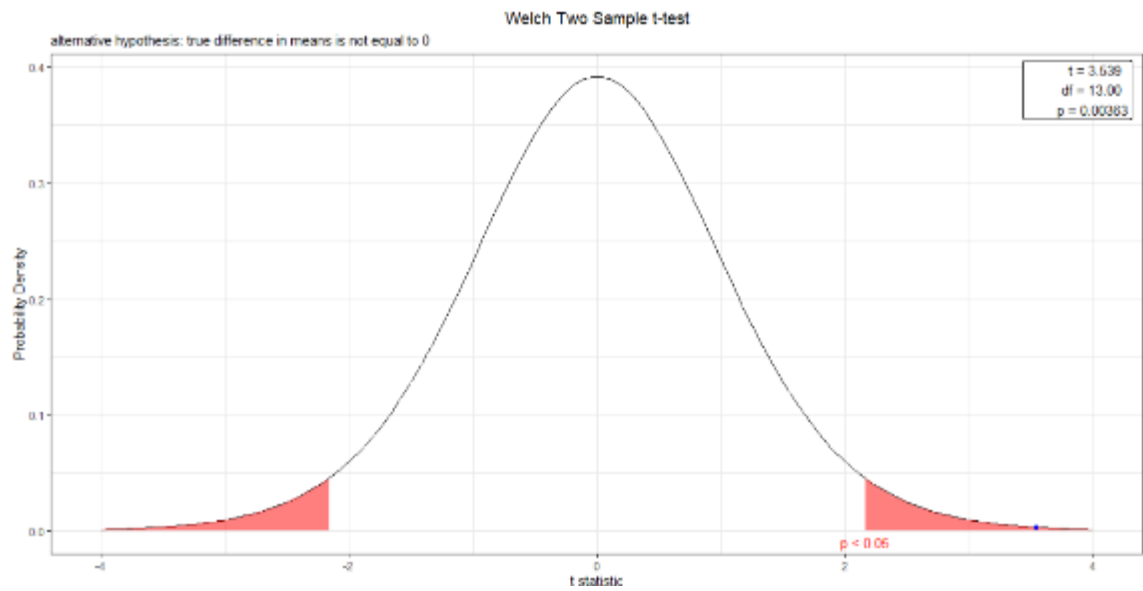
	n	mean	standard_deviation	standard_error
Selulosa_Penicillium	14	1.821	0.8684	0.2321
Selulosa_Trichoderma	2	1	0	0

F test

F statistics	num df	denom df	p value
Inf	13	1	0

T test

t statistics	df	p value	conf_int_lower	conf_int_upper
3.539	13	0.00363	0.32	1.323



Lampiran 6. Uji Independent Sampel T Test pada Data Genus Enzim Pektin

Independent Samples T Test Summary

Descriptive Statistics

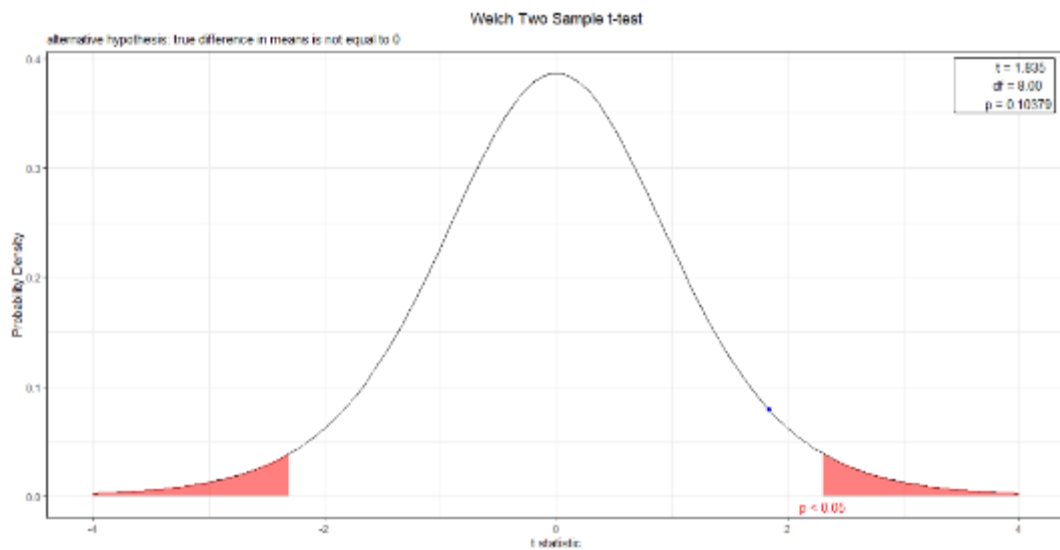
	N	mean	standard_deviation	standard_error
Pektin_Aspergillus	9	1.222	0.3632	0.1211
Pektin_Gliocladium	2	1	0	0

F test

F statistics	num df	denom df	p value
Inf	8	1	0

T test

t statistics	df	p value	conf_int_lower	conf_int_upper
1.835	8	0.1038	-0.05699	0.5014



Descriptive Statistics

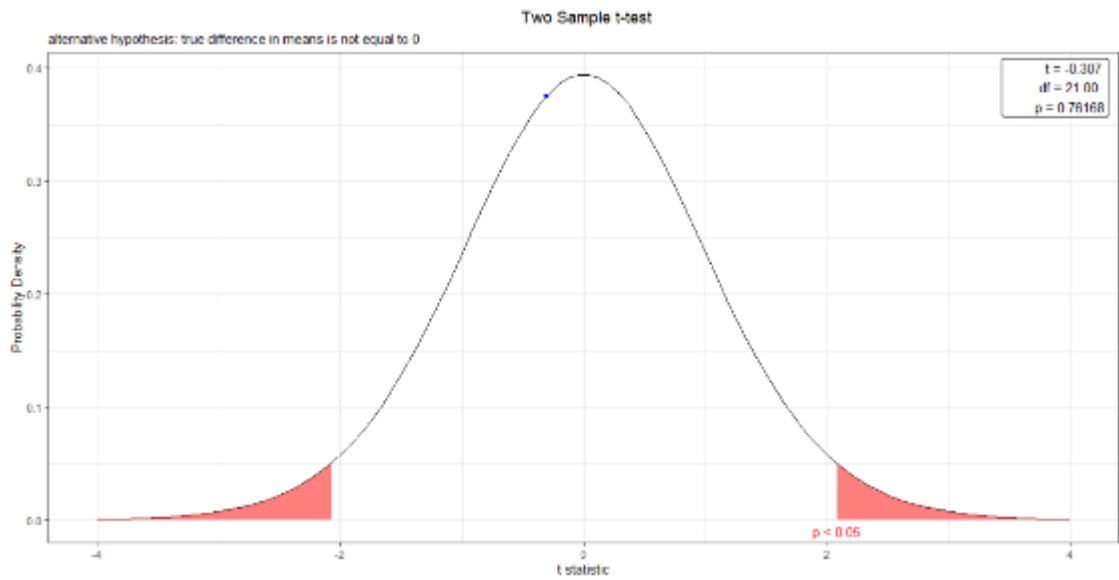
	N	mean	standard_deviation	standard_error
Pektin_Aspergillus	9	1.222	0.3632	0.1211
Pektin_Penicillium	14	1.286	0.5447	0.1456

F test

F statistics	num df	denom df	p value
0.4447	8	13	0.2536

T test

t statistics	df	p value	conf_int_lower	conf_int_upper
-0.3072	21	0.7617	-0.4932	0.3663



Descriptive Statistics

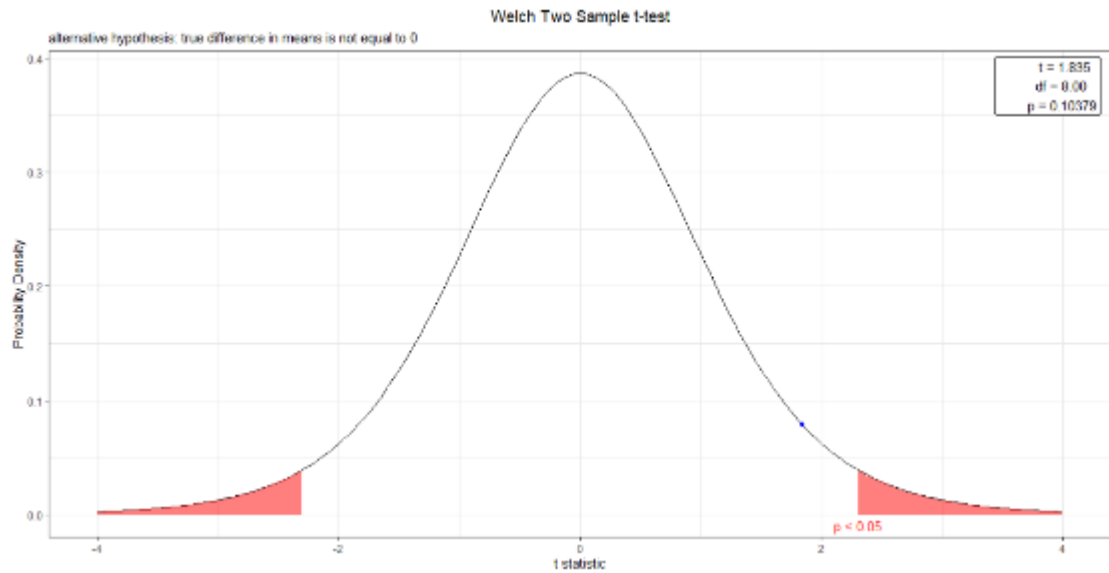
	N	mean	standard_deviation	standard_error
Pektin_Aspergillus	9	1.222	0.3632	0.1211
Pektin_Trichoderma	2	1	0	0

F test

F statistics	num df	denom df	p value
Inf	8	1	0

T test

t statistics	df	p value	conf_int_lower	conf_int_upper
1.835	8	0.1038	-0.05699	0.5014



Descriptive Statistics

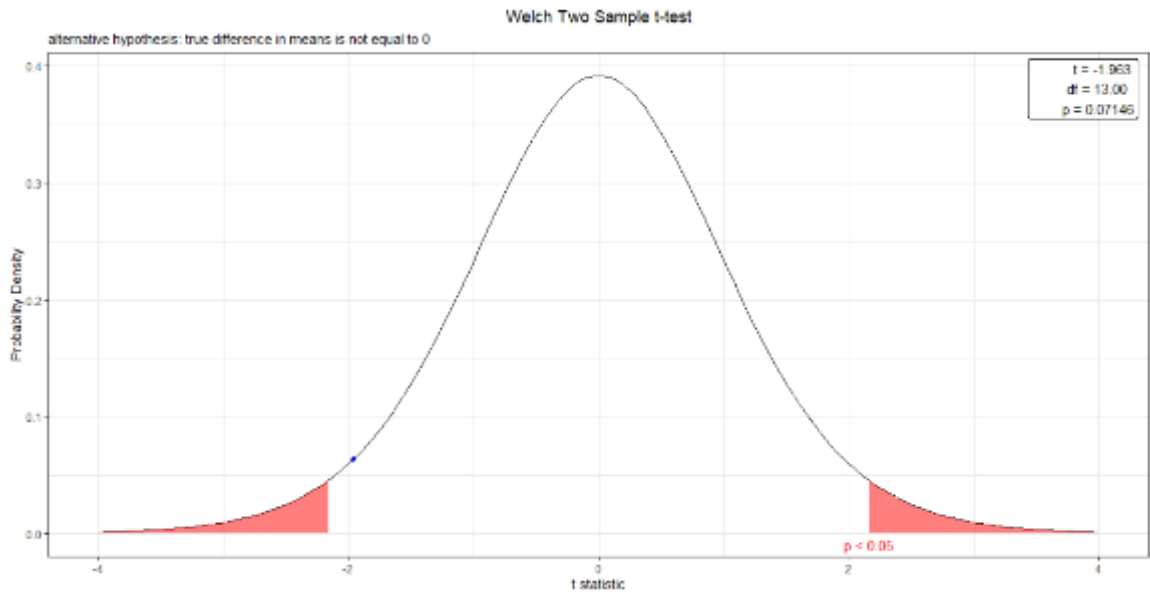
	N	mean	standard_deviation	standard_error
Pektin_Gliocladium	2	1	0	0
Pektin_Penicillium	14	1.286	0.5447	0.1456

F test

F statistics	num df	denom df	p value
0	1	13	0

T test

t statistics	df	p value	conf_int_lower	conf_int_upper
-1.963	13	0.07146	-0.6002	0.02879



Descriptive Statistics

	N	mean	standard_deviation	standard_error
Pektin_Penicillium	14	1.286	0.5447	0.1456
Pektin_Trichoderma	2	1	0	0

F test

F statistics	num df	denom df	p value
Inf	13	1	0

T test

t statistics	df	p value	conf_int_lower	conf_int_upper
1.963	13	0.07146	-0.02879	0.6002

