LAMPIRAN

Pembersihan dan Pengupasan Pisang

Maserasi Hingga *Pulp* vs Air 1:1

Aplikasi Enzim Lignoselulotik (pektinase, selulase, dll)

Aplikasi Enzim Amilase

Inaktivasi Enzim

Filtrasi

Fermentasi *Wine*

Gambar 1. Kombinasi Proses Enzimatis Pembuatan *Wine* Pisang (Chersilp dan Umsakul, 2008)

Tabel 1. Pengaruh Konsentrasi Enzim Pektinase dengan Rendemen dan Viskositas Jus Pisang

|  |  |  |  |
| --- | --- | --- | --- |
| **Konsentrasi Pektinase (% w/w)** | **Waktu (jam)** | **Volume Ekstrak Jus (mL)** | **Viskositas (cp)** |
| 0 | 0 | 16±0,5b | 465±2,08a |
| 0,0125 | 1 | 56±1,00a | 335±7,02b |
| 0,05 | 1 | 59±0,58a | 251±0,58c |
| 0,10 | 1 | 61±0,58a | 218±8,74d |

Sumber: Chersilp dan Usmakul (2008)

Tabel 2. Pengaruh Waktu Proses Pektinase dengan Rendemen dan Viskositas Jus Pisang

|  |  |  |  |
| --- | --- | --- | --- |
| **Konsentrasi Pektinase (% w/w)** | **Waktu (jam)** | **Volume Ekstrak Jus (mL)** | **Viskositas (cp)** |
| 0,05 | 0,5 | 47±1,53b | 346±2,65a |
| 0,05 | 1 | 59±0,58a | 251±0,58b |
| 0,05 | 1,5 | 58±1,16a | 228±3,00c |
| 0,05 | 2 | 59±1,53a | 207±4,36d |

Chersilp dan Usmakul (2008)

Tabel 3. Hubungan Temperatur, Waktu, & Konsentrasi terhadap Karakteristik Rendemen

|  |  |  |
| --- | --- | --- |
| **Karakteristik** | **Persamaan** | **R2** |
| Viskositas (mPa.s) | = 3.34 - 0.11X1 + 0.003X2 +8.18X3 + 0.003X12 - 0.001X1X2 -1.41X1X3 + 0.0001X22 + 0.35X2X3 + 274.7X32 | 0,99 |
| Kejernihan (%T) | = -24.6 + 2.6 X1+0,1X2-1312X3 - 0.03X12- 0.01X1X2+ 9,6X1X3 + 0.01X22 + 0.3X2X3 + 2513X32 | 0,95 |
| Padatan Tak Terlarut Alkohol  (%w/w) | = 0,22 + 0,002 X1+0,012X2-0,82X3 + 0.0001X12- 0.0001X1X2+ 0,13X1X3 -0.00001X22 - 0.17X2X3 + 39,01X32 | 0,85 |
| Polifenol  (mg GAE / 100g) | = 4,68 + 0,3 X1+0,22X2+ 18,96X3 - 0.004X12- 0.003X1X2+ 1,2X1X3 -0.003X22– 1,49 X2X3 + 280,13X32 | 0,90 |
| Protein  (mg / L) | = 4499,3 -130,5 X1+ 39,3X2-52090,8X3 + 0.53X12- 0.08X1X2+ 2190,5 X1X3 -0.2X22 – 498,2X2X3 - 27685X32 | 0,92 |

\*X1 = temperatur, X2 = Waktu, X3 = Konsentrasi

Sumber: Sagu et al. (2014)

|  |  |  |  |
| --- | --- | --- | --- |
| **Konsentrasi Substrat (%)** | **Waktu (jam)** | **Suhu (°C)** | **Aktivitas PG (u/mil)** |
| 5 | 65,00 | 32,50 | 2,9 |
| 6,01 | 56,08 | 28,04 | 1,7 |
| 6,01 | 73,92 | 28,04 | 1,5 |
| 6,01 | 56,08 | 36,96 | 1,9 |
| 6,01 | 73,92 | 36,96 | 1,5 |
| 7,50 | 65,00 | 25,00 | 2,7 |
| 7,50 | 50,00 | 32,50 | 1,2 |
| 7,50 | 65,00 | 32,50 | 6,2 |
| 7,50 | 65,00 | 32,50 | 6,9 |
| 7,50 | 65,00 | 32,50 | 5,3 |
| 7,50 | 65,00 | 32,50 | 7,3 |
| 7,50 | 65,00 | 32,50 | 6,7 |
| 7,50 | 65,00 | 32,50 | 6,1 |
| 7,50 | 80,00 | 32,50 | 3,8 |
| 7,50 | 65,00 | 40,00 | 1,7 |
| 8,99 | 56,08 | 28,04 | 2,7 |
| 8,99 | 73,92 | 28,04 | 1,3 |
| 8,99 | 56,08 | 36,96 | 1,2 |
| 8,99 | 73,92 | 36,96 | 2,7 |
| 10,00 | 65,00 | 32,50 | 6,9 |

Tabel 4. Hubungan Konsentrasi Substrat Lama Waktu, & Temperatur terhadap Aktivitas Poligalakturonase

\*PG: Poligalakturonase

Barman et al. (2014)

Tabel 5. Aplikasi Enzim dalam Pembuatan Sari Buah Pisang

|  |  |  |  |
| --- | --- | --- | --- |
| **Tipe Enzim** | **Konsentrasi (%)** | **Waktu (menit)** | **Absorbansi** |
| A | 1 | 30 | 0,65±0,03a |
| B | 1 | 30 | 0,37±0,02e |
| A | 2 | 30 | 0,52±0,03c |
| B | 2 | 30 | 0,12±0,02f |
| A | 1 | 60 | 0,60±0,04b |
| B | 1 | 60 | 0,33±0,03e |
| A | 2 | 60 | 0,45±0,03d |
| B | 2 | 60 | 0,10±0,02f |

\*A: enzim kasar, B: enzim murni sebagian

Barman et al. (2014)

Tabel 6. Pengaruh Konsentrasi Enzim α-Amilase terhadap Kadar Gula

|  |  |  |  |
| --- | --- | --- | --- |
| **Konsentrasi α-Amilase (% w/w)** | **Waktu (jam)** | **Total Gula Terlarut (mg/mL)** | **Gula Pereduksi (mg/mL)** |
| Kontrol\* |  | 104,25 ±0,67c | 64,19 ±2,64c |
| 0 | 0 | 117,61 ±1,44b | 81,53 ±2,06b |
| 0,05 | 3 | 119,50 ±3,31b | 89,19 ±3,57b |
| 0,1 | 3 | 123,27 ±1,09b | 88,74 ±2,81a |
| 0,3 | 3 | 127,36 ±3,40ab | 89,19 ±2,71a |
| 0,5 | 3 | 127,99 ±1,96a | 90,99 ±1,56a |

\*pisang yang tidak diberikan perlakuan enzim

Cherslip dan Usmakul (2008)

Tabel 7. Pengaruh Waktu Proses Enzim α-Amilase terhadap Kadar Gula

|  |  |  |  |
| --- | --- | --- | --- |
| **Konsentrasi α-Amilase (% w/w)** | **Waktu (jam)** | **Total Gula Terlarut (mg/mL)** | **Gula Pereduksi (mg/mL)** |
| 0,05 | 3 | 119,50 ±3,32a | 89,19 ±3,57a |
| 0,05 | 6 | 118,87 ±0,95a | 86,49 ±5,46b |
| 0,05 | 9 | 119,50 ±1,44a | 87,84 ±2,82c |
| 0,05 | 12 | 117,61±1,44a | 86,49 ±5,89d |

\*pisang yang tidak diberikan perlakuan enzim

Sumber: Cherslip dan Usmakul (2008)

Tabel 8. Perbandingan *Wine* dengan perlakuan enzim dan kontrol

|  |  |  |  |
| --- | --- | --- | --- |
| **Perlakuan** | **Total padatan terlarut (Brix)** | **Total Gula Terlarut (mg/mL)** | **Alkohol (mg/mL)** |
| A | 5,70±0,12 | 2,76±0,30 | 13,9 ±3,57 |
| B | 6,30±0.46 | 5,31±1,66 | 14,4 ±5,46 |

A: control, B: wine dengan perlakuan enzimatis

Sumber: Cherslip dan Usmakul (2008)

Tabel 9. Pengaruh Sonikasi Terhadap Kinerja Enzim Pektinase dan Selulase (*Yield* & Viskositas)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S (%)** | **P (%)** | ***Ultrasound Time* (menit)** |  | ***Yield* (%)** | **Viskositas (mPa.s)** |
| 0 | 0 | 0 |  | 47,30 ±0,85f | 219,00 ±5,29a |
| 0,2 | 0 | 0 |  | 64,10 ±0,07e | 198,67 ±8,50b |
| 0 | 0,2 | 0 |  | 71,40 ±3,06d | 160,33 ±6,80c |
| 0,2 | 0,2 | 0 |  | 76,2 ±1,04c | 158,67 ±3,51c |
| 0 | 0 | 30 |  | 49,05 ±1,01f | 195,33 ±2,08b |
| 0,2 | 0 | 30 |  | 77,10 ±1,41c | 114,33 ±2,89d |
| 0 | 0,2 | 30 |  | 85,50 ±1,15b | 113,67 ±1,53d |
| 0,2 | 0,2 | 30 |  | 89,40 ±1,21a | 118,33 ±1,53d |

\*S: Selulase, P: Pektinase

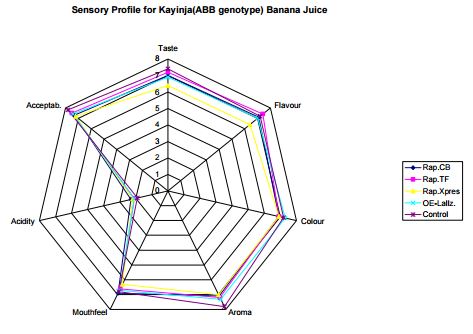
Sumber: (Boraet al., 2017)

Tabel 10. Pengaruh Sonikasi Terhadap Kinerja Enzim Pektinase dan Selulase (Kejernihan danTSS)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S (%)** | **P (%)** | **Ultrasound Time (menit)** | **Kejernihan (%T)** | **TSS (°Brix)** |
| 0 | 0 | 0 | 51,50 ±2,72g | 9,00 ±0,46e |
| 0,2 | 0 | 0 | 50,60 ±1,67g | 9,35 ±0,38e |
| 0 | 0,2 | 0 | 57,9 ±0,95f | 11,00 ±0,17c |
| 0,2 | 0,2 | 0 | 71,1 ±1,34d | 11,65 ±0,43b |
| 0 | 0 | 30 | 63,70 ±1,21e | 10,30 ±0,33d |
| 0,2 | 0 | 30 | 83,90 ±1,73b | 12,20 ±0,20a |
| 0 | 0,2 | 30 | 84,90 ±1,18b | 12,40 ±0,20a |
| 0,2 | 0,2 | 30 | 88,50 ±1,01a | 12,50 ±0,26a |

\*S: Selulase, P: Pektinase, TSS: Total Soluble Sugar

Sumber: Bora et al. (2017)

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Gambar 2. Pengaruh Penggunaan Enzim terhadap Presepsi Sensoris Sari Pisang

(Byarugaba-Bazirakeet al., 2012)

Tabel 11. Pengaruh Jenis Enzim Terhadap Flavor *Wine* yang Dihasilkan

|  |  |
| --- | --- |
| ***Wine* Pisang** | **Deskripsi Flavor *Wine*** |
| *Wine Rapidase CB* | *Sweet, fruity, acidic* |
| *Wine Rapidase TF* | *Fruity, astringent, sweet* |
| *Wine Rapidase Xpress* | *Acidic, astringent, dry* |
| *Wine OE-Lalizzyme* | *Sweet, fruity, smooth* |
| *Wine* Kontrol | *Sweet, light body, sour* |

Sumber: Byarugaba-Bazirakeet al. (2012)