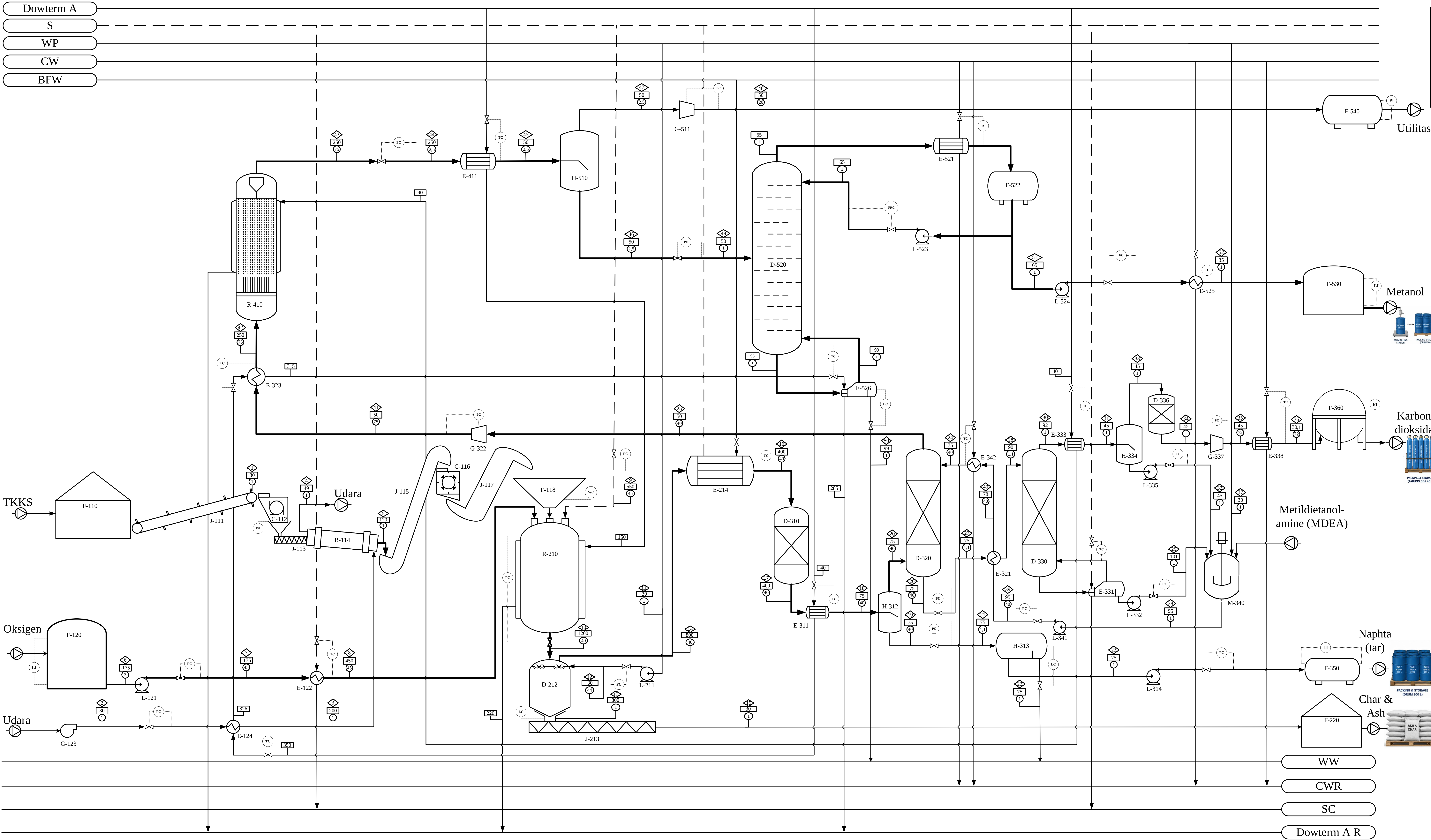


PRA RANCANGAN PABRIK METANOL DENGAN PROSES GASIFIKASI DARI LIMBAH BIOMASSA (TANDAN KOSONG KELAPA SAWIT)



| Keterangan |                 |  |                      |
|------------|-----------------|--|----------------------|
|            | Nomor Aliran    |  | Dowterm              |
|            | Temperatur (°C) |  | Dowterm Return       |
|            | Tekanan (atm)   |  | Cooling Water Return |
|            | Steam           |  | Steam Condensate     |
|            | Water Process   |  | Waster Water         |
|            | Cooling Water   |  | Boiler Feed Water    |

| No | Kode Alat | Nama Alat                         |
|----|-----------|-----------------------------------|
| 1  | F-110     | Gudang Penyimpanan TKKS           |
| 2  | J-111     | Belt Conveyor                     |
| 3  | C-112     | Shredder                          |
| 4  | J-113     | Screw Conveyor                    |
| 5  | B-114     | Rotary Dryer                      |
| 6  | J-115     | Bucket Elevator                   |
| 7  | C-116     | Hammer Mill                       |
| 8  | J-117     | Bucket Elevator                   |
| 9  | F-118     | Lock hopper                       |
| 10 | F-120     | Tangki Penyimpanan Oksigen        |
| 11 | L-121     | Pompa 1                           |
| 12 | E-122     | Vaporizer                         |
| 13 | G-123     | Blower                            |
| 14 | E-124     | Heater 1                          |
| 15 | R-210     | Reaktor Gasifier Entrained Flow   |
| 16 | L-211     | Pompa 2                           |
| 17 | D-212     | Quench Tower                      |
| 18 | J-213     | Cooling Screw conveyor            |
| 19 | F-220     | Char & Ash Storage                |
| 20 | E-214     | Waste Heat Boiler                 |
| 21 | D-310     | Kolom Adsorber 1                  |
| 22 | E-311     | Kondensor 1                       |
| 23 | H-312     | Knock Out Drum 1                  |
| 24 | H-313     | Decanter                          |
| 25 | L-314     | Pompa 3                           |
| 26 | D-320     | Kolom Amine Absorber              |
| 27 | E-321     | Heat Exchanger                    |
| 28 | G-322     | Kompresor 1                       |
| 29 | E-323     | Heater 2                          |
| 30 | D-330     | Kolom Amine Regenerator           |
| 31 | E-331     | Reboiler 1                        |
| 32 | L-332     | Pompa 4                           |
| 33 | E-333     | Kondensor 2                       |
| 34 | H-334     | Knock Out Drum 2                  |
| 35 | L-335     | Pompa 5                           |
| 36 | D-336     | Kolom Adsorber 2                  |
| 37 | G-337     | Kompresor 2                       |
| 38 | E-338     | Kondensor 3                       |
| 39 | F-340     | Tangki Pelarut Amine (MDEA)       |
| 40 | L-341     | Pompa 6                           |
| 41 | E-342     | Cooler 1                          |
| 42 | F-350     | Tangki Penyimpanan Naphta         |
| 43 | F-360     | Tangki Penyimpanan Karbondioksida |
| 44 | R-410     | Reaktor Fluidized Bed             |
| 45 | E-411     | Kondensor 4                       |
| 46 | H-510     | Flash Drum                        |
| 47 | G-511     | Kompresor 3                       |
| 48 | D-520     | Kolom Distilasi                   |
| 49 | E-521     | Kondensor 5                       |
| 50 | F-522     | Akumulatur                        |
| 51 | L-523     | Pompa 7                           |
| 52 | L-524     | Pompa 8                           |
| 53 | E-525     | Cooler 2                          |
| 54 | E-526     | Reboiler 2                        |
| 55 | F-530     | Tangki Penyimpanan Metanol        |
| 56 | F-540     | Tangki Penyimpanan Fuel Gas       |

| Komponen                                       | Aliran Massa (kg/jam) |            |            |            |            |           |           |           |            |            |           |           |           |            |           |            |            |            |            |            |            |            |        |              |           |              |
|------------------------------------------------|-----------------------|------------|------------|------------|------------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|------------|-----------|------------|------------|------------|------------|------------|------------|------------|--------|--------------|-----------|--------------|
|                                                | 1                     | 2          | 3          | 4          | 5          | 6         | 7         | 8         | 9          | 10         | 11        | 12        | 13        | 14         | 15        | 16         | 17         | 18         | 19         | 20         | 21         | 22         | 23     | 24           | 25        | 26           |
| H <sub>2</sub> O                               | 18.241,35             | 8.297,69   | 8.297,69   | 25.706,66  | 832,38     |           |           |           | 206.939,02 | 190.900,33 | 92.913,10 | 92.913,10 |           | 283.813,43 | 15        | 283.813,43 | 283.996,88 | 283.996,88 | 282.254,76 | 1.742,12   | 282.254,76 | 282.254,76 |        | 1.650.589,82 | 1.742,12  | 1.650.589,82 |
| C                                              | 68.979,67             |            |            |            | 68.979,67  |           |           |           |            |            |           |           |           |            |           |            |            |            |            |            |            |            |        |              |           |              |
| H                                              | 7.871,96              |            |            |            | 7.871,96   |           |           |           |            |            |           |           |           |            |           |            |            |            |            |            |            |            |        |              |           |              |
| O                                              | 69.824,69             |            |            |            | 69.824,69  |           |           |           |            |            |           |           |           |            |           |            |            |            |            |            |            |            |        |              |           |              |
| N                                              | 1.245,28              |            |            |            | 1.245,28   |           |           |           |            |            |           |           |           |            |           |            |            |            |            |            |            |            |        |              |           |              |
| S                                              | 326,15                |            |            |            | 326,15     |           |           |           |            |            |           |           |           |            |           |            |            |            |            |            |            |            |        |              |           |              |
| Ash                                            | 17.395,48             |            |            |            | 17.395,48  |           |           |           |            |            |           |           | 17.395,48 |            | 17.395,48 |            |            |            |            |            |            |            |        |              |           |              |
| O <sub>2</sub>                                 |                       | 101.760,10 | 101.760,10 | 101.760,10 |            | 64.381,03 | 64.381,03 | 64.381,03 |            |            |           |           |           |            |           |            |            |            |            |            |            |            |        |              |           |              |
| CO                                             |                       |            |            |            |            |           |           |           |            | 43.618,15  |           |           |           | 43.618,15  |           | 43.618,15  | 43.618,15  | 43.618,15  |            | 43.618,15  |            |            |        |              | 43.618,15 |              |
| CO <sub>2</sub>                                |                       |            |            |            |            |           |           |           |            | 170.724,69 |           |           |           | 170.724,69 |           | 170.724,69 | 170.724,69 | 170.724,69 |            | 170.724,69 |            |            |        | 25.631,03    | 5.564,80  | 190.790,93   |
| CH <sub>4</sub>                                |                       |            |            |            |            |           |           |           |            | 3.770,89   |           |           |           | 3.770,89   |           | 3.770,89   | 3.770,89   | 3.770,89   |            | 3.770,89   |            |            |        |              |           | 3.770,89     |
| H <sub>2</sub>                                 |                       |            |            |            |            |           |           |           |            | 8.737,43   |           |           |           | 8.737,43   |           | 8.737,43   | 8.737,43   | 8.737,43   |            | 8.737,43   |            |            |        |              |           | 8.737,43     |
| C <sub>10</sub> H <sub>8</sub>                 |                       |            |            |            |            |           |           |           |            | 735,78     |           |           |           | 735,78     |           | 735,78     | 735,78     | 735,78     |            | 735,78     |            | 8,47       | 727,32 |              |           |              |
| H <sub>2</sub> S                               |                       |            |            |            |            |           |           |           |            | 346,53     |           |           |           | 346,53     |           | 346,53     |            |            |            |            |            |            |        |              |           |              |
| N <sub>2</sub>                                 |                       | 334.960,34 | 334.960,34 | 334.960,34 |            |           |           |           |            | 1.245,28   |           |           |           | 1.245,28   |           | 1.245,28   | 1.245,28   | 1.245,28   |            | 1.245,28   |            |            |        |              | 1.245,28  |              |
| Char                                           |                       |            |            |            |            |           |           |           |            | 321,09     |           |           | 321,09    |            | 321,09    |            |            |            |            |            |            |            |        |              |           |              |
| C <sub>5</sub> H <sub>11</sub> NO <sub>2</sub> |                       |            |            |            |            |           |           |           |            |            |           |           |           |            |           |            |            |            |            |            |            |            |        | 571.828,14   |           | 571.828,14   |
| CH <sub>3</sub> OH                             |                       |            |            |            |            |           |           |           |            |            |           |           |           |            |           |            |            |            |            |            |            |            |        |              |           |              |
| Total                                          | 183.885,57            | 445.018,14 | 445.018,14 | 462.427,11 | 166.475,60 | 64.381,03 | 64.381,03 | 64.381,03 | 206.939,02 | 437.795,65 | 92.913,10 | 92.913,10 | 17.716,57 | 512.992,17 | 17.716,57 | 512.992,17 | 512.829,10 | 512.829,10 | 282.990,54 | 229.838,56 | 282.990,54 | 282.263,23 | 727,32 | 2.248.048,99 | 64.678,66 | 2.413.208,89 |

FLWSHEET PRA RANCANGAN PABRIK METANOL DENGAN PROSES GASIFIKASI DARI LIMBAH BIOMASSA (TANDAN KOSONG KELAPA SAWIT)

DIGAMBAR OLEH :  
1. Muchammad Fahrizal Hanif (22031010003)  
2. Muhandis Akbar Winaji (22031010006)

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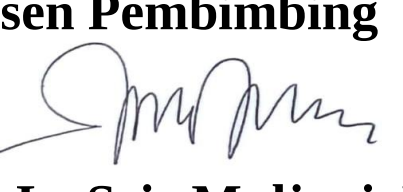
PRA RANCANGAN PABRIK METANOL DENGAN PROSES GASIFIKASI DARI LIMBAH BIOMASSA (TANDAN KOSONG KELAPA SAWIT)

| Komponen                                       | Aliran Massa (kg/jam) |              |              |            |            |            |            |            |            |            |          |              |              |              |           |           |           |           |           |           |          |          |           |          |           |           |
|------------------------------------------------|-----------------------|--------------|--------------|------------|------------|------------|------------|------------|------------|------------|----------|--------------|--------------|--------------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|----------|-----------|-----------|
|                                                | 27                    | 28           | 29           | 30         | 31         | 32         | 33         | 34         | 35         | 36         | 37       | 38           | 39           | 40           | 41        | 42        | 43        | 44        | 45        | 46        | 47       | 48       | 49        | 50       | 51        | 52        |
| H <sub>2</sub> O                               | 1.650.589,82          | 1.650.589,82 | 1.427.766,32 | 222.823,50 | 222.823,50 | 215.824,93 | 6.998,58   |            |            |            | 6.998,58 | 1.650.589,82 | 1.650.589,82 | 1.650.589,82 | 1.742,12  | 1.742,12  | 3.995,87  | 3.995,87  | 3.995,87  | 3.869,61  | 126,25   | 126,25   | 3.869,61  | 3.825,37 | 44,24     | 44,24     |
| C                                              |                       |              |              |            |            |            |            |            |            |            |          |              |              |              |           |           |           |           |           |           |          |          |           |          |           |           |
| H                                              |                       |              |              |            |            |            |            |            |            |            |          |              |              |              |           |           |           |           |           |           |          |          |           |          |           |           |
| O                                              |                       |              |              |            |            |            |            |            |            |            |          |              |              |              |           |           |           |           |           |           |          |          |           |          |           |           |
| N                                              |                       |              |              |            |            |            |            |            |            |            |          |              |              |              |           |           |           |           |           |           |          |          |           |          |           |           |
| S                                              |                       |              |              |            |            |            |            |            |            |            |          |              |              |              |           |           |           |           |           |           |          |          |           |          |           |           |
| Ash                                            |                       |              |              |            |            |            |            |            |            |            |          |              |              |              |           |           |           |           |           |           |          |          |           |          |           |           |
| O <sub>2</sub>                                 |                       |              |              |            |            |            |            |            |            |            |          |              |              |              |           |           |           |           |           |           |          |          |           |          |           |           |
| CO                                             |                       |              |              |            |            |            |            |            |            |            |          |              |              |              | 43.618,15 | 43.618,15 | 436,18    | 436,18    | 436,18    |           | 436,18   | 436,18   |           |          |           |           |
| CO <sub>2</sub>                                | 190.790,93            | 190.790,93   | 20.667,88    | 170.123,05 | 170.123,05 | 4.963,15   | 165.159,90 | 165.159,90 | 165.159,90 | 165.159,90 |          | 25.631,03    | 25.631,03    | 25.631,03    | 5.564,80  | 5.564,80  | 55,65     | 55,65     | 55,65     |           | 55,65    | 55,65    |           |          |           |           |
| CH <sub>4</sub>                                |                       |              |              |            |            |            |            |            |            |            |          |              |              |              | 3.770,89  | 3.770,89  | 3.770,89  | 3.770,89  | 3.770,89  |           | 3.770,89 | 3.770,89 |           |          |           |           |
| H <sub>2</sub>                                 |                       |              |              |            |            |            |            |            |            |            |          |              |              |              | 8.737,43  | 8.737,43  | 1.817,33  | 1.817,33  | 1.817,33  |           | 1.817,33 | 1.817,33 |           |          |           |           |
| C <sub>10</sub> H <sub>8</sub>                 |                       |              |              |            |            |            |            |            |            |            |          |              |              |              |           |           |           |           |           |           |          |          |           |          |           |           |
| H <sub>2</sub> S                               |                       |              |              |            |            |            |            |            |            |            |          |              |              |              |           |           |           |           |           |           |          |          |           |          |           |           |
| N <sub>2</sub>                                 |                       |              |              |            |            |            |            |            |            |            |          |              |              |              | 1.245,28  | 1.245,28  | 1.245,28  | 1.245,28  | 1.245,28  |           | 1.245,28 | 1.245,28 |           |          |           |           |
| Char                                           |                       |              |              |            |            |            |            |            |            |            |          |              |              |              |           |           |           |           |           |           |          |          |           |          |           |           |
| C <sub>5</sub> H <sub>13</sub> NO <sub>2</sub> | 571.828,14            | 571.828,14   | 571.828,14   |            |            |            |            |            |            |            |          | 571.828,14   | 571.828,14   | 571.828,14   |           |           |           |           |           |           |          |          |           |          |           |           |
| CH <sub>3</sub> OH                             |                       |              |              |            |            |            |            |            |            |            |          |              |              |              |           |           | 53.357,47 | 53.357,47 | 53.357,47 | 52.459,67 | 897,80   | 897,80   | 52.459,67 | 104,92   | 52.354,75 | 52.354,75 |
| Total                                          | 2.413.208,89          | 2.413.208,89 | 2.020.262,34 | 392.946,55 | 392.946,55 | 220.788,08 | 172.158,47 | 165.159,90 | 165.159,90 | 165.159,90 | 6.998,58 | 2.248.048,99 | 2.248.048,99 | 2.248.048,99 | 64.678,66 | 64.678,66 | 64.678,66 | 64.678,66 | 64.678,66 | 56.329,28 | 8.349,38 | 8.349,38 | 56.329,28 | 3.930,29 | 52.398,99 | 52.398,99 |

Flowsheet PRA Rancangan Pabrik Metanol dengan Proses Gasifikasi dari Limbah Biomassa (Tandan Kosong Kelapa Sawit)

Digambar oleh :  
1. Muchammad Fahrizal Hanif (22031010003)  
2. Muhandis Akbar Winaji (22031010006)

Mengetahui,  
Dosen Pembimbing

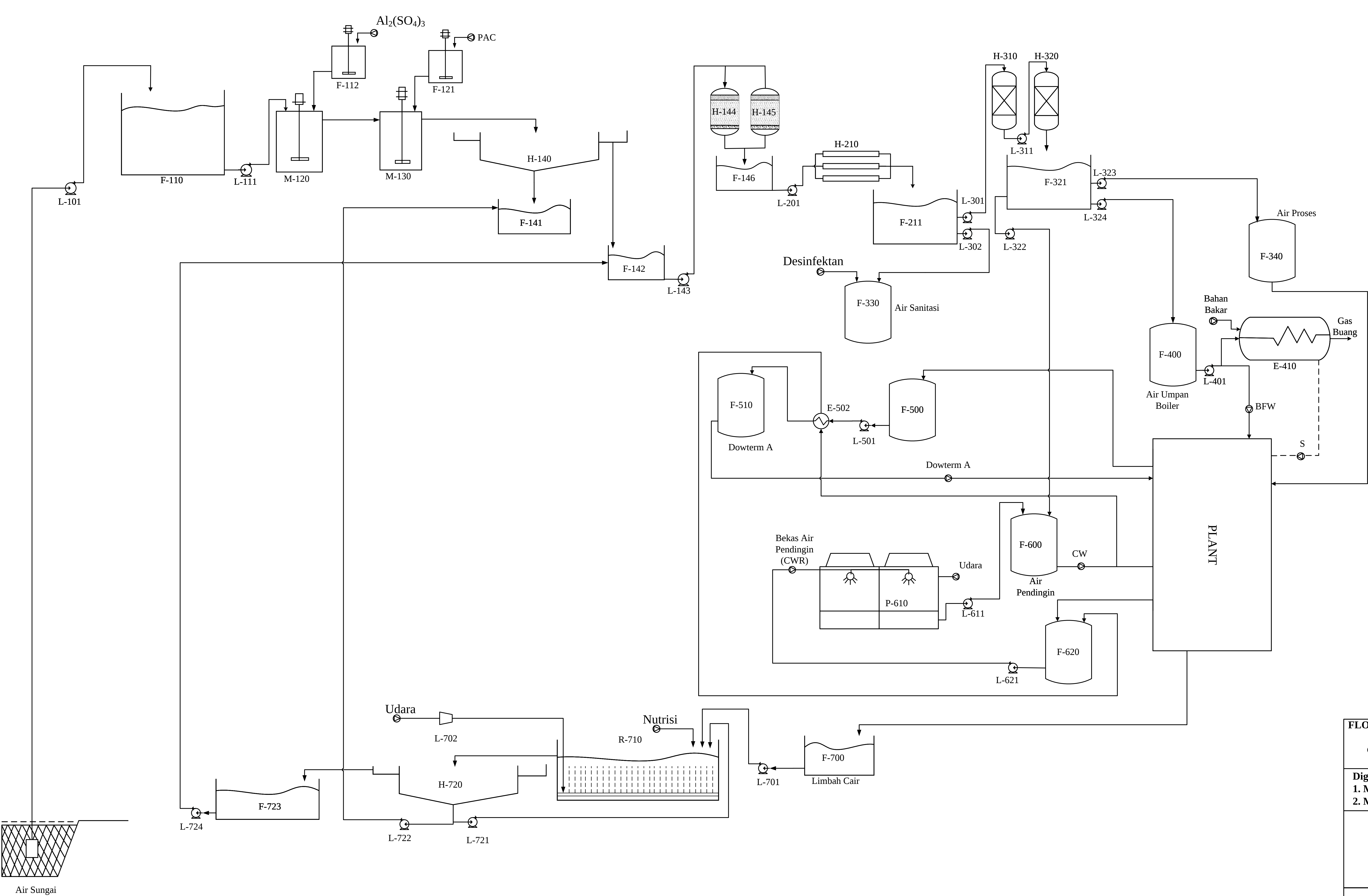
  
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UNIT UTILITAS DAN PENGELOLAAN LIMBAH CAIR

PRA RANCANGAN PABRIK METANOL DENGAN PROSES GASIFIKASI DARI LIMBAH BIOMASSA (TANDAN KOSONG KELAPA SAWIT)



| No | Kode Alat | Nama Alat                       |
|----|-----------|---------------------------------|
| 1  | L-101     | Pompa Air Sungai                |
| 2  | F-110     | Bak Penyimpanan Air Sungai      |
| 3  | L-111     | Pompa Tangki Koagulasi          |
| 4  | F-112     | Tangki Koagulan                 |
| 5  | M-120     | Tangki Koagulasi                |
| 6  | F-121     | Tangki Flokulan 1               |
| 7  | M-130     | Tangki Flokulasi 1              |
| 8  | H-140     | Clarifier 1                     |
| 9  | F-141     | Bak Penampung Flok              |
| 10 | F-142     | Bak Penyimpanan Filtrat         |
| 11 | L-143     | Pompa Sand Filter               |
| 12 | H-144     | Sand Filter 1                   |
| 13 | H-145     | Sand Filter 2                   |
| 14 | F-146     | Bak Air Hasil Sand Filter       |
| 15 | L-201     | Pompa Reverse Osmosis           |
| 16 | H-210     | Reverse Osmosis                 |
| 17 | F-211     | Bak Penyimpanan Air Bersih      |
| 18 | L-301     | Pompa Kation Exchanger          |
| 19 | L-302     | Pompa Air Sanitasi              |
| 20 | H-310     | Kation Exchanger                |
| 21 | L-311     | Pompa Anion Exchanger           |
| 22 | H-320     | Anion Exchanger                 |
| 23 | F-321     | Bak Air Demineralisasi          |
| 24 | L-322     | Pompa Make Up Cooling Water     |
| 25 | L-323     | Pompa Air Proses                |
| 26 | L-324     | Pompa Make Up Air Umpan Boiler  |
| 27 | F-330     | Tangki Penyimpanan Air Sanitasi |
| 28 | F-340     | Tangki Penyimpanan Air Proses   |
| 29 | F-400     | Tangki Umpan Boiler             |
| 30 | L-401     | Pompa Air Umpan Boiler          |
| 31 | E-410     | Boiler                          |
| 32 | F-500     | Tangki Return Dowterm A         |
| 33 | L-501     | Pompa Cooler Dowterm A          |
| 34 | E-502     | Cooler Dowterm A                |
| 35 | F-510     | Tangki Dowterm A                |
| 36 | F-600     | Tangki Cooling Water            |
| 37 | P-610     | Cooling Tower                   |
| 38 | L-611     | Pompa Cooling Water             |
| 39 | F-620     | Tangki Return Cooling Water     |
| 40 | L-621     | Pompa Cooling Tower             |
| 41 | F-700     | Bak Penampung Air Limbah        |
| 42 | L-701     | Pompa Air Limbah                |
| 43 | G-702     | Kompresor Udara                 |
| 44 | R-710     | Bak Aerasi                      |
| 45 | H-720     | Clarifier 2                     |
| 46 | L-721     | Pompa Return Activated Sludge   |
| 47 | L-722     | Pompa Waste Sludge              |
| 48 | F-723     | Bak Air Effluen                 |
| 49 | L-724     | Pompa Air Effluent              |

Flowsheet Unit Utilitas dan Pengelolaan Limbah Cair

Pra Rancangan Pabrik Metanol dengan Proses Gasifikasi dari Limbah Biomassa (Tandan Kosong Kelapa Sawit)

Digambar oleh:

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2. Muhandis Akbar Winaji (22031010006)

Mengetahui,

Dosen Pembimbing

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Program Studi Teknik Kimia

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