**Table 8. Cottonwood and switchgrass ultimate analysis, chemical formula and stoichiometric air**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Biomass** | **C****%** | **H****%** | **O****%** | **N****%** | **Chemical** **formula** | **Stoichiometric air****Pound air/pound biomass** |
| CW- S7C20 | 49.4 | 5.8 | 42.3 | 0.2 | CH1.41O0.64N0.003 | 5.94 |
| CW - ST66 | 49.7 | 5.9 | 43.3 | 0.2 | CH1.42O0.65N0.004 | 5.88 |
| Switchgrass | 47.8 | 5.7 | 39.4 | 0.4 | CH1.43O0.62N0.008 | 6.12 |

**Table 9. Cottonwood and switchgrass weight reduction and net heating value**

|  |  |  |  |
| --- | --- | --- | --- |
| **Biomass** | **Weight** **reduction****%** | **Remaining** **weight****%** | **Net Heating** **Value****BTU/pound** |
| CW- S7C20 | 45.8 | 54.2 | 5,491 |
| CW - ST66 | 66.2 | 33.8 | 4,573 |
| Switchgrass | 63.7 | 36.3 | 4,561 |

**Table 10. Kinetics of cottonwood and switchgrass forestry in nitrogen environment**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Biomass** | **A****1/s** | **E****BTU/mol** | **n****-** | **R2** | **Maximum** **decomposition** **temperature****°F** |
| CW- S7C20 | 5.69E+03 | 68.54 | 0.72 | 0.9 | 707 |
| CW - ST66 | 1.27E+04 | 72.74 | 0.71 | 0.92 | 714 |
| Switchgrass | 4.38E+04 | 77.07 | 0.86 | 0.78 | 691 |

**Table 11. Kinetics of cottonwood and switchgrass forestry in oxygen environment**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Biomass** | **A****1/s** | **E****BTU/mol** | **n****-** | **R2** | **Maximum** **decomposition** **temperature****°F** |
| CW- S7C20 | 1.44E+14 | 167.78 | 1.19 | 0.83 | 568 |
| CW - ST66 | 9.11E+08 | 118.69 | 0.66 | 0.65 | 581 |
| Switchgrass | 6.89E+19 | 224.94 | 1.46 | 0.70 | 558 |

**Table 12. Cottonwood and switchgrass gasification parameters**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Cottonwood** | **Switchgrass** |
| **Biomass feed rate, lb/h (kg/h)** | 1.43 (0.68) | 1.39 (0.65) |
| **Duration, min** | 30 | 30 |
| **Air injection rate, ft3/h (m3/h)** | (0.66) | (0.66) |
| **Gas flow rate,ft3/h (m3/h)** | 32.5 (0.92) | 22.2 (0.63) |
| **Producer gas yield ft3/lb (m3/kg)** | 21.6 (1.35) | 15.5 (0.97) |
| **Char yield, lb/h (kg/h)** | 0.29 (0.13) | (0.33) 0.15 |
| **Char yield, %** | 19.1 | 23.1 |
| **Tar yield, lb/h (kg/h)** | 0.29 (0.13) |  0.24 (0.11) |
| **Tar yield, %** | 19.1 | 16.9 |
| **Gas composition** |  |  |
|  **O2, %** | 0.4 | 0.4 |
|  **CO, %** | 8.3 | 7.4 |
|  **CO2, %** | 18.6 | 19.5 |
|  **CH4, %** | 6.5 | 4.8 |
|  **H2, %** | 5.1 | 5.0 |
|  **N2, %** | 61.1 | 63.3 |
| **Gas Heating value, BTU/ft3 (MJ/m3)** | 110.0 (4.1) | 91.3 (3.4) |