BIORESOURCE TECHNOLOGY (ChBC-82)

B.Tech. 8TH Semester

<table>
<tr><th>S. No.</th><th>Questions</th><th>COs</th></tr>
<tr><td>1.</td><td>Discuss biomass combustion fundamentals along with the basic chemical equation involved with the help of a flow diagram showing two-stage combustion of biomass with primary and secondary air.</td><td>CO3</td></tr>
<tr><td>2.</td><td>What are different pollutants generated during biomass combustion? How can the unburnt pollutants, NOx and particulate emissions be checked? Discuss the conversion of fuel nitrogen into NOx with the help of a diagram.</td><td>CO1</td></tr>
<tr><td>3.</td><td>Why is the global interest increasing towards application of biomass for generation of energy? How can the combustion technology be useful in this direction?</td><td>CO2
CO3</td></tr>
<tr><td>4.</td><td>Discuss the working principle of stationary fluidized bed combustor with staged combustion (Lurgi) with the help of a diagram.</td><td>CO3</td></tr>
<tr><td>5.</td><td>Describe the various biomass combustion technologies available in the market for generation of energy Also discuss their merits and demerits.</td><td>CO3</td></tr>
<tr><td>6.</td><td>Explain co-combustion. Why is there growing interest in co-combustion of biomass?</td><td>CO3</td></tr>
<tr><td>7.</td><td>Discuss the recent trends in biomass combustion technology.</td><td>CO3</td></tr>
<tr><td>8.</td><td>Write a brief note on opportunities and challenges in combustion technology using biomass as a feedstock for generation of energy.</td><td>CO3</td></tr>
<tr><td>9.</td><td>A bioresource (biomass) which contains carbon, hydrogen, nitrogen, oxygen, sulfur and extractives in ultimate analysis is used for generation of heat energy by combustion. Applying the basic stoichiometric equations and making the material balance, develop a general mathematical correlation for minimum quantity of air required for combustion of 1 kg of the bioresource fuel.</td><td>CO4</td></tr>
<tr><td>10.</td><td>How can the same equation (Question-9) be used to determine the amount of excess air required for complete combustion?</td><td>CO4</td></tr>
<tr><td>11.</td><td>The proximate and ultimate analyses results of some of the bioresources are given in the Table below:
<table>
<tr><th>Biomass</th><th colspan="4">Proximate analysis</th><th colspan="5">Ultimate analysis^{daf}</th><th>References</th></tr>
<tr><th></th><th>M</th><th>VM ^{db}</th><th>FC ^{db}</th><th>A ^{db}</th><th>C</th><th>H</th><th>N</th><th>S</th><th>O</th><th></th></tr>
<tr><td>Pine chips</td><td>7.6</td><td>72.4</td><td>21.6</td><td>6</td><td>52.8</td><td>6.1</td><td>0.5</td><td>0.09</td><td>40.5</td><td>Masia (2007)</td></tr>
<tr><td>Poplar</td><td>6.8</td><td>85.6</td><td>12.3</td><td>2.1</td><td>51.6</td><td>6.1</td><td>0.6</td><td>0.02</td><td>41.7</td><td>Miles et al. (1995)</td></tr>
<tr><td>Sawdust</td><td>34.9</td><td>84.6</td><td>14.3</td><td>1.1</td><td>49.8</td><td>6</td><td>0.5</td><td>0.02</td><td>43.7</td><td>Tillman (2000)</td></tr>
<tr><td>Willow</td><td>10.1</td><td>82.5</td><td>15.9</td><td>1.6</td><td>49.8</td><td>6.1</td><td>0.6</td><td>0.06</td><td>43.4</td><td>Moilanen (2006)</td></tr>
</table>
db: Dry basis daf: Dry, ash-free basis, M:Moisture, VM: Volatile Matter, A: Ash, FC:Fixed Carbon
Estimate the amount of air required for complete combustion, if 20% excess air is supplied in each case. Also determine the composition of the flue gases.</td><td>CO4</td></tr>
<tr><td>12.</td><td>The ultimate analysis of rice husk is as follows:
C - 39%, H_2 - 5%, O_2 - 32.7%, S - 0.1%, N_2 - 2.0%, H_2O - 3.6%, and ash - 17.6%
The biomass is subjected to combustion for generation of heat energy. If the molecular weights of air and flue gas is assumed to be 29, estimate the actual air required and flue gas produced per kg of the bioresource, if 25% excess air is used for complete combustion.</td><td>CO4</td></tr>
<tr><td colspan="3">CO1: Fundamental understanding of the bioresources and its applications for attainment of social objectives (energy, environment, product, sustainability).</td></tr>
<tr><td colspan="3">CO2: Acquire knowledge with respect to the properties of the bioresources and the conversion technologies.</td></tr>
<tr><td colspan="3">CO3: Exhibiting knowledge of the systems used for bioresources and bioresource technology.</td></tr>
<tr><td colspan="3">CO4: Understanding about analysis of data and their applications in design of the systems and development of the bioprocess.</td></tr>
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