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| **Figure 9. Effects of torrefaction on the bulk density of cottonwood and switchgrass** |

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| **Figure 10. Effects of torrefaction on the moisture content of cottonwood and switchgrass** |

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| **Figure 11. Effects of torrefaction on the volatile solids of cottonwood and switchgrass** |
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| **Figure 12. Effects of torrefaction on the ash content of cottonwood and switchgrass** |
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| **Figure 13. Effects of torrefaction on the fixed carbon of cottonwood and switchgrass** |
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| **Figure 14. Effects of torrefaction on the pH of cottonwood and switchgrass** |



**Figure 15. Effects of torrefaction on the heating value of cottonwood and switchgrass**

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| Cottonwood - S7C20- N2 | Cottonwood - S7C20- O2 |
|  |  |
| Cottonwood - ST66 – N2 | Cottonwood - S7C20– O2 |
|  |  |
| Switchgrass - N2 | Switchgrass - O2 |
| **Figure 16. Mass fraction and time derivative of Cottonwood and switchgrass as a function of temperature in nitrogen environment** | **Figure 17. Mass fraction and time derivative of cottonwood and switchgrass as a function of temperature in oxygen environment** |