Ash Content

FACT SHEET 5.11

INTRODUCTION

Ash from woody biomass comes from the minerals present in the structure of trees and shrubs in addition to any soil contamination. Properties of wood ash depend on a variety of factors including type of tree or shrub, part of the tree or shrub (bark, wood, leaves), type of waste (wood, pulp, or paper residue), combination with other fuel sources, type of soil and climate and conditions of combustion[1]. Ash management presents both a problem and an opportunity. Removal of ash from the furnace and disposal in landfill areas incurs economic, environmental, and social costs for energy firms/facilities as well as the forest products industry. However, if ash is recycled in forest or agricultural ecosystems or used to reclaim mine spoils, depletion of vegetation nutrients, other than nitrogen, and acidification associated with intensive biomass removal can be radically reduced (*Image 1*).

source: D.E. Wieprecht

Image 1. Ash

Ash as a Problem. Characterization of ash by elemental composition and fusion temperatures, an indicator of the softening and melting behavior of ash, is important when selecting biomass fuels because it provides information on how much ash will be generated requiring disposal. Agricultural residues typically generate significantly more ash than woody biomass. Moreover, characterization by elemental composition and fusion temperatures indicates the potential for slagging and fouling of burners and boilers from ash deposition. When wood, alone, is combusted, ash deposition is not typically a problem because combustion temperatures are likely to be low. However, when biomass is co-fired with coal, combustion temperatures are considerably higher and may reach a level where slagging could occur[2].

Ash as an Opportunity. Ash from woody biomass, in general, stimulates microbial activities and mineralization in the soil by improving both the soil's physical and chemical properties. Improved soil quality from the nutrients found in wood ash can lead to better growing conditions for vegetation. Wood ash has a high alkalinity or neutralizing capacity. Because of this and elevated contents in alkaline earth elements, wood ash is often used to raise the pH of acidic soils[1]. In fact, several studies have shown that wood ash reacts more quickly in raising soil pH than lime[3,4].

In the U.S., wood ash applications are used for potash production, as a liming agent, a source of nutrients, and a tannin-neutralizing agent. Wood ash neutralizes soil acidification caused by whole-tree harvesting as well as acid depositions. Because it is a direct source of phosphorous, calcium, magnesium and potassium, wood ash is also used to correct nutrient deficiencies. Additionally, wood ash is

Cassidy, P.; S. Ashton. 2007. Ash Content. Pages 201–202.
In: Hubbard, W.; L. Biles; C. Mayfield; S. Ashton (Eds.). 2007. Sustainable Forestry for Bioenergy and Bio-based Products: Trainers Curriculum Notebook. Athens, GA: Southern Forest Research Partnership, Inc.

sometimes used to reduce the total carbon and nitrogen in a soil by increasing the solubility of organic carbon and the nitrification rate[1].

Although application of wood ash to forests, agricultural fields, or mine spoils is generally beneficial and an efficient way to dispose of ash from woody biomass, there are several environmental concerns to consider. Any heavy metals tend to vaporize during combustion. The remaining mineral content contributes to ash formation. Should levels of heavy metals be high, recycling of ash as fertilizer is restricted by environmental legislation, since the metals may leach into ground water or be absorbed by crops. More modern furnaces are often equipped with filters to reduce heavy metal emissions. But avoid painted or treated wood waste as a fuel source considering the higher heavy metal concentrations found in these sources. Wood ash used as a soil amendment should originate from burning solely forest residues or untreated wood. In addition, heavy metal loads increase from bottom ash to boiler and fly ash. Therefore, bottom ash should be the only ash used as a soil amendment.

Recycling Ash. Ash, spread either by ground-based equipment or from the air, is recycled either directly or is manipulated into a more localized, site-specific product. Generally, ash is manipulated 1) by the addition or subtraction of select elements and 2) by changing its physical properties via hardening, granulation, or pelletizing. Spreading ash with ground-based equipment is the most cost efficient and precise form of distribution. However, it requires substantial planning because of environmental and logistical concerns. Aerial application is more expensive. However, there are fewer environmental concerns. Application can occur at any time of the year with no soil disturbance.

SUMMARY AND CONCLUSIONS

Ash is a product of the minerals present in the structure of trees and shrubs, any soil contamination, and the various conditions of the conversion process. The presence of ash creates both problems and opportunities. Removal of ash from the furnace and disposal in landfill areas incurs economic, environmental, and social costs for energy firms and facilities as well as the forest products industry. However, if ash is recycled in forest or agricultural ecosystems or used to reclaim mine spoils, depletion of vegetation nutrients, other than nitrogen, and acidification associated with intensive biomass removal can be radically reduced. An understanding of ash management, prudent planning, along with recycling, should alleviate most, if not all, ash-related dilemmas.

For more information, please refer to the Encyclopedia of Southern Bioenergy at http://www.forestencyclopedia.com/Encyclopedia/bioenergy.

ENDNOTES

1 Demeyer, A.; Voundi Nkana, J.C.; Verloo, M.G. 2001. Characteristics of wood ash and influence on soil properties and nutrient uptake: An overview. Bioresource Technology. 77(2001): 287–295.

2 Misra, M.K.; Ragland, K.W.; Baker, A.J. 1993. Wood ash composition as a function of furnace temperature. Biomass and Bioenergy. 4(2): 103–116.

3 Clapham, W.M.; Zibilske, L.M. 1992. Wood ash as a liming amendment. Communi. Soil. Sci. Plant Anal. 23: 1209–1227.

4 Muse, J.K. and C.C. Mitchell. 1995. Paper mill boiler-as and lime by-products-as soil liming materials. Agronomy Journal. 87 (3): 432–438.