Title	Pyrolysis of Agricultural Waste for Bioethanol Production
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Purpose	The purpose of this project is to convert Agricultural waste into a resource
Project Summary/Abstract	The ability to produce ethanol from low cost agricultural biomass will be a key to make it competitive as a petrol additive. Bioethanol can be used directly as fuel in engines as 95% alcohol or it can be blended into petrol. Therefore, a variety of agricultural biomass such as banana peels, straws, plant stalks, stovers and molasses can be utilized for this purpose. Pyrolysis has the potential to convert agricultural waste into a profit center that can: (1) enhance & diversify incomes; (2) moderate fuel prices; (3) provide blended fossil fuels; (4) attract youth into agriculture; and (5) create jobs.

	Key words: Bioethanol, agricultural biomass, agricultural waste, pyrolysis
Country and Specific Location(s)	Uganda
Participating Institutions	Makerere University, NARO and Sokoine University of Agriculture
Start Date	1st July, 2015
End date	30th July, 2017
Budget	USD 59,877

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Noble Banadda, is a professor and the Chair of the Department of Agricultural and Biosystems Engineering, Makerere University Kampala (Uganda). Noble holds a Ph.D. in Chemical Engineering (2006); M.Sc. in Processing Engineering (2001); Post graduate Diploma in Processing Engineering (2000) of the Katholieke Universiteit Leuven (Belgium) and B.Sc. Food Science and Technology (1998) of the Sokoine University of Agriculture (Tanzania). Professor Banadda has special research interests in: Chemical, water, food and biowaste processing Engineering. My proposal entitled, "Pyrolysis of agricultural waste for bioethanol production" has been selected for funding by The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM).

Selected Publications

Nansubuga, I., Banadda, N., Ronsse, F., Verstraete, W., Rabaey, K. (2015). Digestion of high rate activated sludge coupled to biochar formation for soil improvement in the tropics. *Water Research*, Accepted, 2015. DOI: 10.1016/j.watres.2015.05.047

Nansubuga, I., Banadda, N., Babu, M., Verstraete, W., Rabaey, K. (2015) Co-digestion of Primary sludge with cow dung and brewery sludge: the effect on biogas production. *International Journal of Agricultural and Biological Engineering*, 8(4) xx-xx, 2015

Musoke, L., Banadda, N., Sempala, C., Kigozi, J. (2015). The migration of Chemical Contaminants from Polyethylene Bags into food during cooking. *The Open Food Science Journal* (in-press).

Kyagulanyi. J., Banadda, N., Mulamba, P., Kiggundu, N., Muyonga, J. (2015). Estimation of spatial and temporal grain amaranth water requirement using satellite, local and virtual weather stations data sets. *Agricultural and Forest Meteorology*, (in-press).

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Mugisa, D.J., Banadda, N., Kiggundu, N. (2015). Lead Uptake of Water Plants in Water stream at Kiteezi Landll Site, Kampala (Uganda). *African Journal of Environment Science and Technology*, 9(5): 502 - 507, 2015.

Kukeera, T., Banadda, N., Tumutegyereize, P., Kiggundu, N., Asuman, R. (2015). Extraction, quantification and characterization of oil from Pumpkin Seeds. *International Journal of Agricultural and Biological Engineering*, 8(1): 98-102.

Nansubuga, I., Meerburg, F., Verstraete, W., Rabaey, K., Banadda, N., Babu, M. (2015). A two-stage decentralized system combining high rate activated sludge (HRAS) with alternating charcoal filters (ACF) for treating small community sewage to reusable standards for Agriculture. *African Journal of BioTechnology*, 14(7): 593-603.

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Komakech, A.J., Banadda, N.E., Kinobe, J.R., Kasisira, L., Sund-berg, C., Gebresenbet, G., Vinners, B. (2014). Characterization of municipal waste in Kampala, Uganda. *Journal of the Air and Waste Management Association*, 64: 340-348.

Nhapi. I., Wali, U.G., Twagirayezu, B., Kimwaga, R., Banadda, N. (2013). Performance Evaluation of a Hybrid Natural Wastewater Treatment Pond System in Kigali, Rwanda. *Bioinfo Environment and Pollution*, ISSN: 2249-1716 & E-ISSN: 2249-1724. 3(1): 23-28.

Kigozi, J., Byaruhanga, Y., Banadda, N., Kaaya, A. (2013). Characterization of the Physico-chemical properties of selected white sorghum grain and ours for the production of baked sorghum ice cream cones. *The Open Food Science Journal*, 7: 23-33.

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Nakibuuka, M.M., Tashobya, D., Banadda, N., Ayaa, F., Nhapi, I., Wali, U.G., Kimwaga, R. (2012). New method for qualitative determination of Methane Gas at selected sites in Kampala City, Uganda. *The Open Environmental Engineering Journal*, 5: 50-55.

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Nhapi, I., Usanzineza, D., Wali, U.G., Banadda, N., Kashaigili, J.J., Kimwaga, R., Gu-mindoga, W., Sendagi, S. (2012). Heavy metals in flow into Lake Muhazi, Rwanda. *The Open Environmental Engineering Journal* 5: 56-65.

Previous and on-going Funded Research Projects

- 2015: Technical Inspection and Verification of Agricultural Equipment and Machinery for World Vision Uganda / USD 5,000 / Funded by World Vision Uganda. Consulting Team Leader.
- 2015-2017: Solar powered drying systems for Uganda. Funded by The Uganda National Council for Science and Technology (UNCST) under the National Science Technology and Innovation Support Program (NSTIP)/ USD 200, 000. Principal Investigator.
- 2015-2017: Pyrolysis of agricultural waste for bioethanol production and market development. Submitted to the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM)/ USD 59,877. Principal Investigator.
- 2014: Bioenergy from food waste at the Food Technology Business Incubation Centre, Makerere University. Funded by FTBIC / USD 40, 000. Principal Investigator.
- 2013: Promoting community and home-based appropriate postharvest handling and processing of legumes and starchy staples to improve food security in Uganda. Funded by the McKnight Foundation / USD 74,976. Co-Investigator.
- 2013: Capacity Building for Quality Graduate Training in Engineering in African Universities. Funded by the INTRA ACP-EU MOBILITY Programme/ EUR 2,548,800. Lead Partner.
- 2012-2014: Computational fluid dynamic modeling of a municipal solid waste incinerator processes and reactions. Funded by the Belgian Inter-University Council (VLIR-UOS) / Euros 74,993. Principal Investigator.
- 2011-2013: Investigating contamination risks associated with wrapping indigenous foods in plastic bags during thermal processing. Funded by the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM)/ USD 60, 000. Principal Investigator.
- 2008-2012: Modeling of non-point source pollution in the Lake Victoria basin/ Funded by SIDA/SAREC through Lake Victoria Research Initiative/ USD 150, 000. Principal Investigator.
- 2007: Towards process optimization in selected food selling centers in and around Kampala City (Uganda)/ Funded by SIDA-SAREC/ USD 10, 000. Principal Investigator.