Nano Green Floor Stripper

Product Selection and Description

Nano Green mastic remover and floor stripper are two applications in the Nano Green Sciences, Inc. line of janitorial and sanitation products. Nano Green is biobased and biodegradable. It is extracted and blended from U.S. Food and Drug Administration (FDA)-approved food stocks, principally corn, grains, soybeans, and potatoes, and, according the manufacturer, its cleaning capabilities have been shown to be as effective as those of almost any detergent, cleaner, or soap in the marketplace today.

Nano Green falls into two BEES product categories: mastic remover and floor stripper. For the BEES system, the function of mastic remover is removing 9.29 m^2 (100 ft^2) of mastic under vinyl or similar flooring over a period of 50 years. The function of floor stripper in BEES is removing three layers of wax and one layer of sealant from 9.29 m^2 (100 ft^2) of hardwood flooring.

Flow Diagram

The flow diagram below shows the major elements of the production of Nano Green as it is currently modeled for BEES.

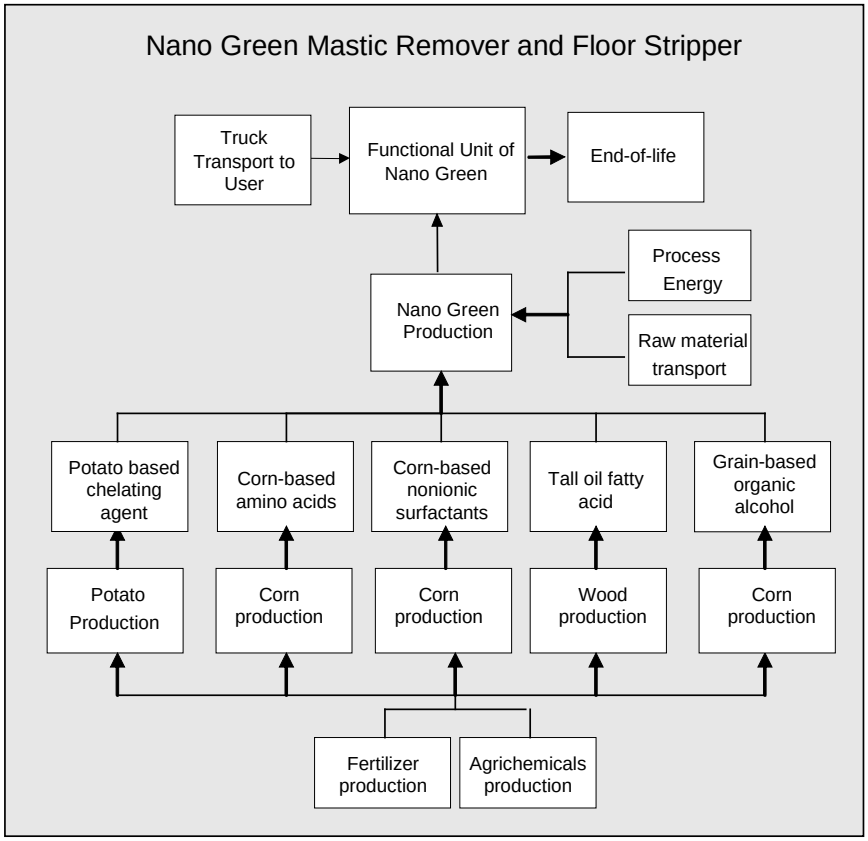

Figure 1: Nano Green System Boundaries

Raw Materials

The materials contained in Nano Green are listed in the Table below. Each is found on the FDA- approved Everything Added to Food in the United States (EAFUS) list.

Table 1: Nano Green Product Constituents

Constituent	*Mass Fraction (%)*
Corn-based amino acids	16
Corn-based nonionic surfactants	32
Tetracetic acid (potato based chelating agent)	16
Grain-based organic alcohol	16
Tall oil fatty acid	2

Corn-based amino acids. No data are available for the production of corn-based amino acids *per se;* corn starch is used as a surrogate since amino acids are often produced via fermentation, with corn starch as the raw material. Corn starch is assumed to be produced by the wet milling process, with ethanol and other coproducts allocated away. Data on wet milling comes from a study by Lawrence Berkeley National Laboratory.[1] Data on particulate matter emissions comes from the U.S. Environmental Protection Agency AP-42 emissions factors.[2] Corn growing and production data comes from the U.S. LCI Database.

Corn-based nonionic surfactant. Nano Green uses a corn-based nonionic surfactant; in the absence of available data on its production, anionic surfactants are used as a surrogate. Specifically, production data for palm kernel oil (PKO) and coconut oil (CNO) based alkyl polyglocosides (APG) from a European life cycle study of detergent surfactants production are averaged.[3] Since corn content is substantial, comprising 33 % and 36 % of the material requirements for APG-CNO and APG-PKO, respectively, these surfactants are judged to be viable surrogates.

Potato-based chelating agent. Potato starch is used as a surrogate for the tetracetic acid constituent, with data for its production coming from the Danish LCA food database.[4] Data for potato production comes from the U.S. LCI Database.

Grain-based organic alcohol. Corn ethanol is assumed to be the basis for the grain-based organic alcohol constituent. Ethanol production is modeled using an average of dry and wet milling operations.[5]

Tall oil fatty acid. Data for tall oil fatty acid is based mainly on data for tall oil alkyd, found in a Finnish LCA study on coated exterior wood cladding.[6] The tall oil fatty acid is modeled as comprising 95 % of the mass of inputs and outputs as it is a precursor to the alkyd.

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[1] Galitsky, C., Worrell, E., and Ruth, M., LBNL-52307 (Ernest Orlando Lawrence Berkeley National Laboratory, July 2003).

[2] U.S. Environmental Protection Agency, "Corn Wet Milling," Volume I: Section 9.9.7, *AP-42: Compilation of Air Pollutant Emission Factors* (Washington, DC: US Environmental Protection Agency, January 1995). Found at: http://www.epa.gov/ttn/chief/ap42/ch09/final/c9s09-7.pdf.

[3] Stalmans, H., et al., "European Life-Cycle Inventory for Detergent Surfactants Production," , Vol. 32, No. 2, 1995, pp. 84-109.

[4] Danish LCA Food Database, found at: http://www.lcafood.dk/processes/industry/potatoflourproduction.htm.

[5] Graboski, Michael S., (National Corn Growers Association, August 2002); Shapouri, H., "The 2001 Net Energy Balance of Corn-Ethanol" (U.S. Department of Agriculture, 2004); U.S. Environmental Protection Agency, "Grain Elevators and Processes," Volume I: Section 9.9.1, *AP-42: Compilation of Air Pollutant Emission Factors* (Washington, DC: US Environmental Protection Agency, May 2003). Found at: http://www.epa.gov/ttn/chief/ap42/ch09/final/c9s0909-1.pdf. Wet milling data sources are cited under Corn-based Amino Acids.

[6] VTT Technical Research Centre of Finland, "Environmental Impact of Coated Exterior Wooden Cladding," 1999.

Manufacturing

Energy Requirements and Emissions. Energy is used in Nano Green production primarily to blend the product using a 0.5 hp motor. Blending 3.785 m^3 (1 000 gal) for approximately four h amounts to 0.002 hp·h/gal. Electricity is modeled using the U.S. average electric grid from the U.S. LCI Database.

Transportation. All materials are transported by diesel truck approximately 805 km (500 mi) to the manufacturing facility. Diesel trucking is modeled based on the U.S. LCI Database.

Transportation

Diesel trucking is used to transport the product from the Nano Green facility to the building site, and is modeled based on the U.S. LCI Database. The trucking distance is a variable in BEES.

Use

When Nano Green is used as a mastic remover, approximately 0.002 m^3 (0.5 gal) is needed to remove 18.6 m^2 (200 ft^2) of mastic from the floor. It is assumed that Nano Green is applied twice to remove mastic over a period of 50 years. The same amount of Nano Green is required to remove several layers of wax and sealant from 9.29 m^2 (100 ft^2) of hardwood flooring, but it is assumed that the floor is completely stripped only once over the 50 year BEES use period. Other data on use are not available.

End of Life

The mass of Nano Green at end of life is accounted for in the landfill modeling for this product.

References

Life Cycle Data

National Renewable Energy Laboratory (NREL): *U.S. Life-Cycle Inventory Database*. 2005. Golden, CO. Found at: http://www.nrel.gov/lci/database.

PRé Consultants: *SimaPro 6.0 LCA Software*. 2005. The Netherlands.

Galitsky, C., Worrell, E., and Ruth, M., Energy Efficiency Improvement and Cost Saving Opportunities for the Corn Wet Milling Industry, LBNL-52307 (Ernest Orlando Lawrence Berkeley National Laboratory, July 2003).

U.S. Environmental Protection Agency, "Corn Wet Milling," Volume I: Section 9.9.7, *AP-42: Compilation of Air Pollutant Emission Factors*, (Washington, DC: U.S. Environmental Protection Agency, January 1995). Found at: http://www.epa.gov/ttn/chief/ap42/ch09/final/c9s09-7.pdf.

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Graboski, Michael S., Fossil Energy Use in the Manufacture of Corn Ethanol (National Corn Growers Association, August 2002).

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VTT Technical Research Centre of Finland, "Environmental Impact of Coated Exterior Wooden Cladding," 1999.

Industry Contacts

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