Spartan Green Solutions Restroom Cleaner

Product Selection and Description

Spartan Chemical Company, Inc. Green Solutions Restroom Cleaner is a natural acid toilet, urinal, and shower room cleaner. It contains 8 % natural citric acid, a hard water scale remover that cleans soap scum, water spots, and light rust from toilet bowls, urinals, and shower room walls and floors. Green Solutions Restroom Cleaner is Green Seal-certified and it meets Green Seal's environmental standard for industrial and institutional cleaners. For the BEES system, 3.8 L (1 gal) of ready-to-use cleaner is studied.

Flow Diagram

The flow diagram below shows the major elements of the production of this product, as it is currently modeled for BEES.

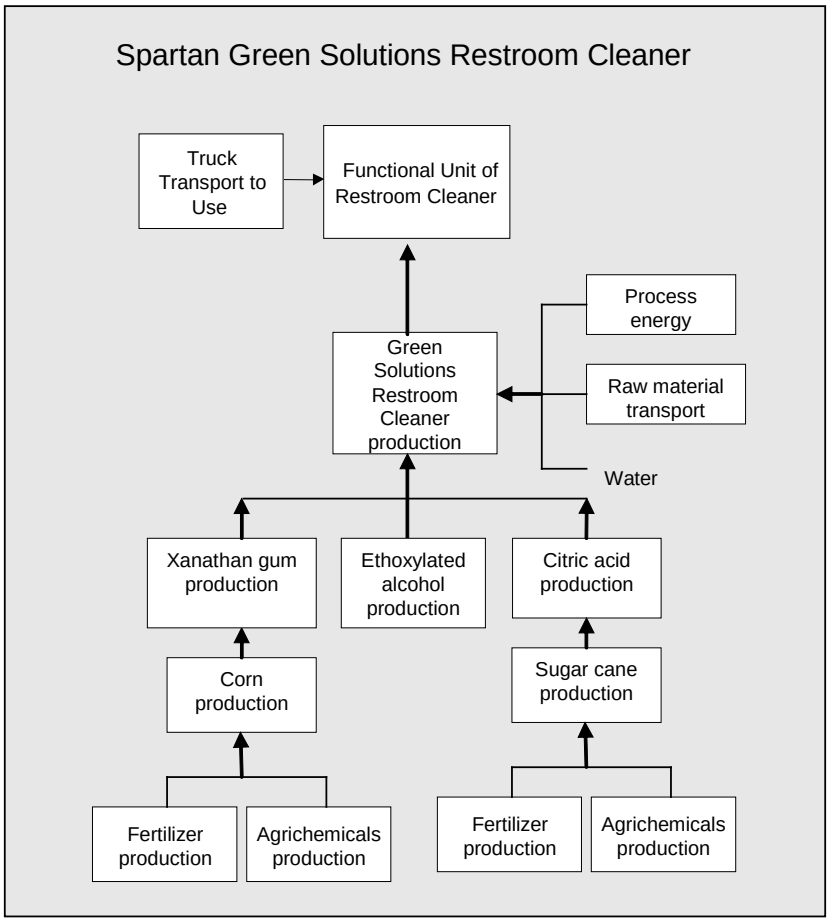

Figure 1: Green Solutions Restroom Cleaner System Boundaries

Raw Materials

Green Solutions Restroom Cleaner is comprised of the following materials.

Table 1: Green Solutions Restroom Cleaner Constituents

Constituent	*Mass Fraction (%)*
Water	91
Citric acid	8
Ethoxylated alcohol	0.1 to 1
Xanathan gum	0.1 to 1

In general, citric acid may be manufactured from several renewable natural resources: citrus fruits, pineapple waste, or crude sugars. The citric acid in this product is modeled as coming from molasses from sugar cane. Citric acid process data comes from a plant in the United States that produces approximately 10 million kg (22 million lb) of crystalline citric acid per year.[1] Both sugar cane production data and data representing molasses extraction from the sugar cane come from the U.S. Department of Agriculture Economic Research Service.[2,3]

An LCA study on detergents[4] provides the data for alcohol ethoxylate. Xanathan gum is a thickening agent produced naturally by bacteria. For BEES, xanathan gum is assumed to be corn sugar based, and as such, corn starch is used as the basis for the sweetener. Corn starch is produced by the wet milling process for which data comes from a Lawrence Berkeley National Laboratory study.[5] Data on particulate matter emissions from wet milling comes from the U.S. Environmental Protection Agency AP-42 emissions factors.[6] Corn growing and production data comes from the U.S. LCI Database.

Manufacturing

Energy Requirements and Emissions. Product manufacturing consists of a simple chemical blending operation with virtually no heat or pressure involved. Items in the formulation are drum or bulk storage materials that are added to the open top mixing vessel via an air-operated drum lift or air actuated valve. The batching water is used at ambient temperature so no heating is required. The quantity of electricity required to blend one gal of the product is 0.0025 MJ (0.0007 kWh). Electricity is modeled using the U.S. average electric grid from the U.S. LCI Database.

Transportation. Materials are transported varying distances to the plant, ranging from 14 km (9 mi) for the ethoxylated alcohol to 805 km (500 mi) for the xanathan gum. Materials are transported by diesel truck, which is modeled based on the U.S. LCI Database.

Transportation

All final product shipping occurs via diesel semi-truck to approximately 450 points of distribution around the country, averaging a distance of 1 207 km (750 mi) to the customer. This default transportation distance may be adjusted by the BEES user. Diesel trucking is modeled based on the U.S. LCI Database.

Use

Green Solutions is VOC-free and can be used both "as is" and diluted. According to the manufacturer's customer use data, most of the time it is not diluted; when it is, a 1:10 dilution ratio is the average. For BEES, the product is assumed to be used in undiluted form. Other data on use, such as application rates and frequencies, are neither available nor uniform among users.

End of Life

No end-of-life modeling is required since the product is fully consumed during use.

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.

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[1] Petrides, Demetri(Intelligen, Inc.), 2001.

[2] U.S. Department of Agriculture Economic Research Service, : http://ers.usda.gov/Data/sdp/view.asp?f=specialty/89019/&arc=C; http://www.ers.usda.gov/briefing/sugar/data.htm.

[3] Resource Economics Division of the Economic Research Service(Washington, DC: U.S. Department of Agriculture, 1997).

[4] Dall'Acqua, S., et al. , Report #244 (St. Gallen: EMPA, 1999).

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

[6] U.S. Environmental Protection Agency, "Corn Wet Milling," Volume I: Section 9.9.7(Washington, DC: US Environmental Protection Agency, January 1995). Found at: http://www.epa.gov/ttn/chief/ap42/ch09/final/c9s09-7.pdf.

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Industry Contacts

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