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Analysis of Material and Energy Effects of Tofu Industry on Environmental Quality Using OpenLCA 1.103 Software (Case Study: Sari Murni Tofu Factory, Kampung Krajan, Mojosongo, Surakarta, Central Java, Indonesia)

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A R T I C L E I N F O

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ABSTRACT

The problem faced by the tofu industry is waste management. So efforts need to be made so that the waste does not cause pollution. One of them is identifying the components of environmental pollution using the life cycle assessment principle with the openLCA application. The results of this study are divided into five impact categories, namely, abiotic depletion potential which mainly affected by soybean production of 0.263 kg of antimony and a direct contribution based on the Sankey diagram of 85.953%. Land competition is influenced by soybean production of 1148 m2a and a direct contribution of 99.982%. The depletion of the ozone layer is affected by the energy of 0.000719 kg of CFC-11 and the direct contribution of 76.468%.

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INTRODUCTION

One of the soybean industry centers in Surakarta City, precisely in Jebres District, Mojosongo Village. In that area there are many home industries and small industries that process soybeans into processed tofu products. According to data from the Surakarta City Trade and Industry Office in 2018, the number of soybean processing industries in Jebres District reached 54 Small and medium enterprises. The data confirms that the district is the center for soybean processing in the city of Surakarta. In Krajan Village, Mojosongo, Surakarta, there are about 120 tofu-making businesses on a household scale (Pambudi et al., 2022).

The tofu industry, which is part of the Sumber Agung Krajan cooperative, Mojosongo, still uses conventional methods to make tofu. The technology used is still very simple and relies heavily on human labor, so the process is less effective, and there is no system that regulates the disposal of waste from tofu production. The majority of tofu producers do not process tofu waste due to the relatively high cost and lack of knowledge in waste management. (Bara Yudhistira, Martina Andriani, 2016)

Tofu waste is material or waste material resulting from the tofu production process, which is no longer used. Tofu waste is in the form of solid and liquid waste. Solid waste in the form of soybean dregs, liquid waste in the form of residual water from soaking, clumping and also grayish yellow liquid waste which if left unchecked will turn black and smell bad. (Bara Yudhistira, Martina Andriani, 2016). The tofu industry produces liquid waste and solid waste in the form of tofu dregs. If liquid waste is discharged into the river, it will have an impact on the quality of river water, which will cause odor, the color of the river will turn white and reduce the amount of dissolved oxygen in the water. In addition, the tofu industrial wastewater has the characteristics of having high BOD, COD, TSS and pH values. (Karamah et al., 2019). The parameter values for BOD, COD, TSS and pH of tofu industrial wastewater are high because they contain a lot of residue. Organic matter in large quantities. (Irmanto & Suyata, 2009). The largest portion of tofu industry liquid waste comes from viscous waste water which undergoes separation from tofu lumps called whey or whey. Tofu industrial waste water also comes from the soaking and washing process of soybeans and tofu cooking water (Vitari & Nurika, 2016). Tofu industry waste water that is discharged into rivers can cause a pungent odor due to the decomposition of organic matter, especially during the dry season. (Wardani et al., 2020)

So we need a concept that needs to be used by every manufacturing industry including the tofu industry, namely the concept of sustainable value. Sustainable value can be seen in Figure 1 below.

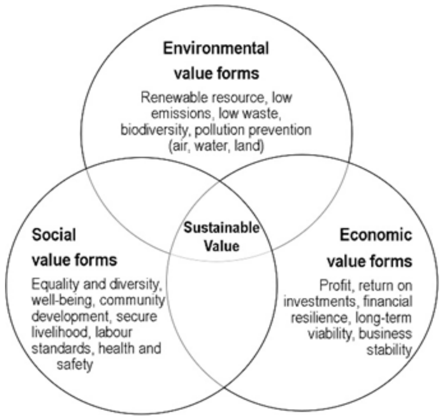


Figure 1. Concept Sustainable Value)(Hart & Milstein, 2003)

Figure 1 explains the principle of sustainable value, namely the sustainable value of an industry must integrate economic, social and environmental values.Sustainable value then represents not only environmental sustainability but also social and economic value(Ueda et al., 2009). Sustainability drivers, such as footprint reduction, povertyalleviation, fair distribution, waste reduction and transparency, and their associated business strategies–under-stood as clean technology, sustainability vision, pollution prevention and product stewardship–can take forwardthe creation of sustainable value for the business (Hart & Milstein, 2003)

One of the concepts adopted in sustainable value is for every industry in its production process to carry out the principle of life cycle assessment. With LCA, the industry seeks to reduce environmental impacts, starting from extracting raw materials from nature, production, packaging, product distribution, consumer use, to waste disposal.

Therefore, in 2018, the Indonesian government added new industrial PROPER assessment criteria through the Ministry of Environment and Forestry. The new criterion is the Life Cycle Assessment (LCA). The addition of these criteria was launched after the revision of the Minister of Environment Regulation No. 3 of 2014 was issued. One of the assessment criteria developed by the Ministry of Environment and Forestry is the use of Life Cycle Assessment (LCA). The purpose of implementing Life Cycle Analysis (LCA) is to identify and calculate the sustainability of natural resource use and environmental disposal, as well as to evaluate and implement opportunities for environmental improvement. (Ditjen PPKL KLHK, 2018)

The tofu industry in Krajan Village, Mojosongo, Surakarta, has not carried out the life cycle assessment concept in its production process. This can be seen from the inefficient use of energy, solid waste that has not been handled properly and waste water containing high organic matter, causing river pollution. On that basis, the researcher wanted to conduct a study entitled: Analysis of the Influence of Material and Energy of the Tofu Industry on Environmental Quality Using OpenLCA 1.103 Software (Case Study: Sari Murni Tofu Factory, Krajan Village, Mojosongo, Surakarta, Central Java, Indonesia).

THEORETICAL REVIEW

Life Cycle Assesment

Life Cycle Assessment according to SNI ISO 14040: 2016 and SNI 14044: 2017 is a collection and evaluation of inputs, outputs and potential environmental impacts on product systems in all their life cycles. LCA is an approach from upstream to downstream or Cradle to grave to assess a product system quantitatively. There are seven main points in LCA, namely the life cycle perspective, goals for the abiotic and biotic environment, relative approaches and functional units, data that is transparent, comprehensive, iterative approaches and preferably scientific approaches. LCA consists of four stages, namely goal and scope determination, life cycle inventory, life cycle impact assessment and interpretation.(Hanafi et al., 2021)

Goal and Scope

Goal and scope determination must be made so that environmental impact assessments can always be consistent.

Inventori Daur Hidup

After setting the goals and scope of the study, the second stage is determining the life cycle inventory. In this process, the collection and calculation of inputs and outputs on the product during its life cycle is carried out. Inputs are raw materials, supporting materials, water, energy and transportation that go into the process. Outputs consist of products, by-products, co-products, air pollution, water pollution, soil pollution. The model and type of data, the calculation stages are conveyed in the inventory stage transparently

Life Cycle Impact Assessment /LCIA

At the LCIA stage, all inputs and outputs in the life cycle inventory process are associated with potential environmental impacts to assess the magnitude of the potential environmental impacts during the product life cycle under study. Each type of environmental impact has its own category of indicators

Interpretasi

In this process, discussions about analysis of results, causes of impact, identification of important things, drawing conclusions, conveying limitations of studies, recommendations and evaluations are made in a transparent manner.(Hanafi et al., 2021)

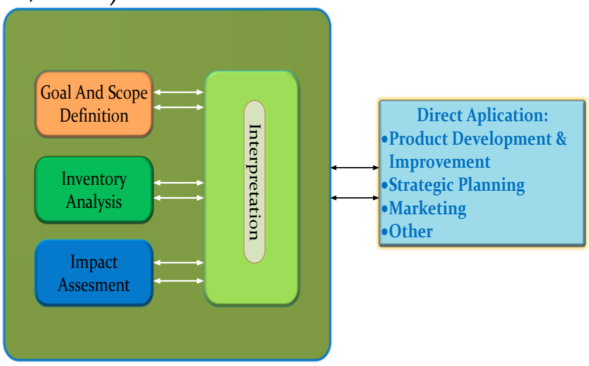


Figure 2. Life Cycle Assessment Framework / LCA(ISO 14044: 2006, Environmental Management,Life Cycle Assesment-Requirements Guidelines, 2006)

Time and Place of Research
Time and Place This research was carried out in January -May 2021. Research location: Sari Murni Home Industry, Krajan Village RT.3/RW.3, Mojosongo, Surakarta, Central Java.

Figure 3. Sari Murni Tofu Industry Research Site, Krajan Village, Mojosongo, Surakarta

Software OpenLCA

This OpenLCA 1.103 software is one of the latest generation software from Greendelta. OpenLCA software is open public software that can be accessed free of charge. Where this software is able to help analyze environmental aspects of products and services in a systematic and consistent manner.

According to (Dr A. Ciroth, C. Di Noi, T. Lohse, 2019). The processes and features available in the OpenLCA software can be broadly described as follows:

1. Flows, is the input and output of all products, materials and energy in the production process of a product. The types of flows contained in OpenLCA are (a) elementary flows, materials or energy from the environment that enter and exit from/to the production process; (b) product flows, material or energy exchanged during product processing; (c) waste flows, material or energy that comes out of the product process, as shown in Figure 4 below.

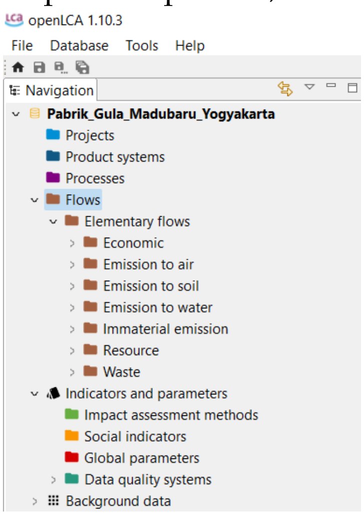


Figure 4. Features available in OpenLCA (Anonim, 2013)(Dr A. Ciroth, C. Di Noi, T. Lohse, 2019)

2. Database, in this study the databases used were: ELCD database 3.2, Agribalyse v3.0.1, and Bioenergidat-18 which are free on openLCA Nexus.(Greendelta, 2019)

RESULTS AND DISCUSSION

Goal And Scope The process of making tofu.

The goal in the life cycle assessment is to find out what things are and how much impact on the environment results from the use of materials and energy when carrying out the tofu-making process. The scope of the research is that the analysis is carried out only on process inputs (materials) and energy at each stage in The process of making tofu starts from the production of soybeans, sending soybeans to consumers, the process of making tofu at the Sari Murni Pak Aco tofu factory, to delivery to consumers, in this case to traditional markets, restaurants and households. So in this case the scope used is cradle to gate.

Life Cycle Inventory (LCI)

The process of making tofu is carried out for 8 hours per day until it is sent to the consumer. The researcher determines that the scope of this research is included in the cradle to gate category because the analysis is carried out starting from the processing stage and the use of raw materials to the production process. This can be explained in the image below. In this figure it can be seen that the processing of Sari Murni's tofu is divided into three parts, namely, the input begins with the preparation of soybean raw materials, the use of energy and the addition of acetic acid. Then the soybean processing process is carried out through several stages, starting from soaking the soybeans, grinding the soybeans, boiling the soybean pulp by adding acetic acid (CH3COOH), filtering, and molding the tofu and sending it to consumers.

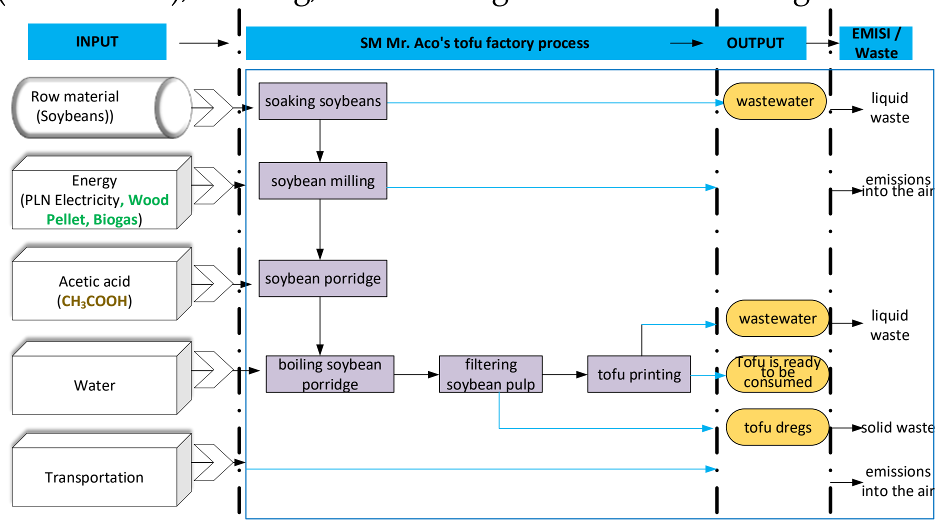


Figure 5. Processing of Sari Murni Tofu, Krajan, Mojosongo

Table 1. Inventory Data of Sari Murni Tofu Factory, Krajan, Mojosongo

No	Material	Amount	Information
1	Soya bean	350 Kg	Average 300-400 kg in 1 day, produce 250 kg of tofu

2	Water	210 liter	For all processes in 1 day
3	Transportation	14.969 km=5239,15 t*km	Company Address: Global Agro Inc., 708 Lotus Blossom St., 92024, ENCINITAS, USA.
4	Electricity		
a	Soybean milling machine	3,04 kwh	380 watt (8 hours per day)
b	Water pump machine (GrunDfos)	2.6 KWh	0,65 KW (4 hours per day)
c	Sawdust	12 kwh	4 drums of sawdust of 10 kg = 40 kg. The calorific value of wood = 18 KJ/gram.
d	Biogas	2,975 KWH	The calorific value of biogas from tofu liquid waste = 138.59 KJ for 36 liters of tofu liquid waste. 138.59/36 liters = 3.57 kJ. The amount of liquid waste from the Sari Murni Pak Aco tofu factory=50 liters=3.57x 50=178.5 KJ
5	Asam cuka/acetic acid/CH_3COOH	2 liter	in 1 day

Life Cycle Impact Assessment (LCIA) Tofu Making Process.

The Life Cycle Impact Assessment (LCIA) is the third stage which aims to classify and assess how big the impact is on the environment based on input data in stage two, namely LCI. This impact research uses openLCA software with the CML 2001 method, ecoinvent. The input data corresponding to the life cycle inventory is then entered into openLCA which will produce a "sankey diagram" depicting the supply chain activities of the tofu making process. This Sankey diagram describes the overall system to be studied and how much impact each process has on the system.

The impact categories assessed using the CML 2001 ecoinvent method are as follows:

Table 2. Impact of the Sari Murni Tofu Factory Category with OpenLCA

No	Impact category	Reference unit	Result
1	Abiotic depletion - CML 2001 (all impact categories)	kg Sb eq	0,30603
2	Acidification - CML 2001 (all impact categories)	kg SO2 eq	27,92294
3	Eutrophication - CML 2001 (all impact categories)	kg PO4 eq	1,987027

4	Global warming 20a - CML 2001 (all impact categories)	kg CO2 eq	4026,078
5	Human toxicity 20a - CML 2001 (all impact categories)	kg 1,4-DB eq	436,9892

Based on table 2 above, the impact of materials and energy on the environment and humans can be explained as follows:

1. Depletion of natural resources (abiotic depletion potential)

Abiotic depletion potential/ADP is defined as the ratio of annual production and the square of main reserves (based on crust content) for a resource divided by the same ratio for reference resources represented by antimony (Sb). Abiotic resources are natural resources such as iron ore, nickel, crude oil, LNG, wind energy and others. The basic equation can be explained as follows:

$$ADPi = \frac{Pi}{R_i^2} \bigg/ \frac{P.ref}{R_{ref}^2} = \frac{Pi.R_{ref}^2}{R_i^2.P.ref}$$

From the above formula it is known that Pi is the world's annual production (kg/year) of resource i, and Ri is the main reserve (kg). ADP of resource i is the ratio for resource i divided by the reference resource, shown as a reference usually, this is represented by antimony (Sb).(Lauran van Oers, 2020). Figure 6 below shows that the greatest potential for ADP reduction is from soybean production of: 0.263 kg of antimony, then vinegar of 0.039 kg of antimony, shipping of soybeans in containers of 0.003759 kg of antimony, and shipping of soybeans by ship from United States to Indonesia in the amount of 0.000007222 kg of antimony.

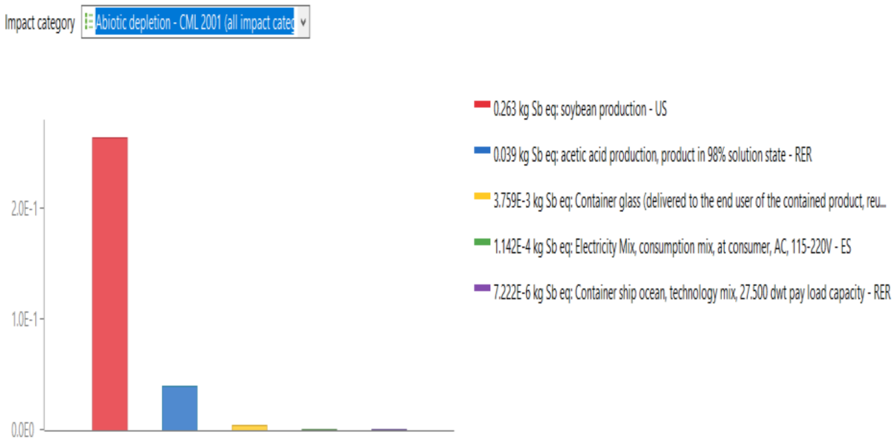
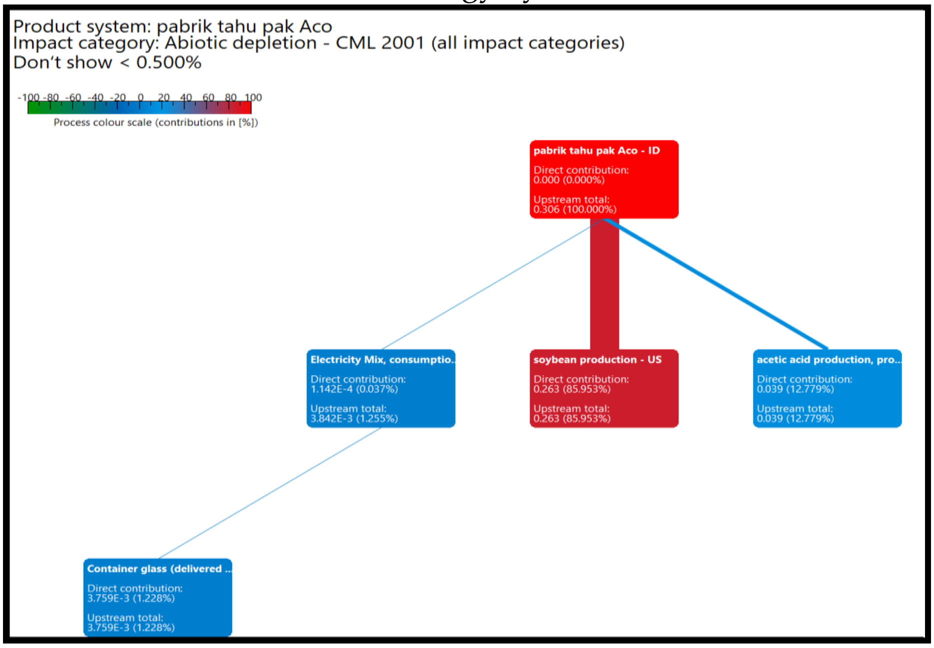


Figure 6. Graph of Impact Category Abiotic depletion potential

From Figure 7 below, the Sankey diagram shows that the production of soybeans when planted and harvested has the highest contribution of 85.953%, where the materials that affect abiotic depletion are: crude oil, natural gas and coal. then acetic acid production of 12.779% where the materials that affect it are natural gas, crude oil, and coal. Glass containers when shipping soybeans amounted to 1.228%, where the influencing materials were chromium, colemanite, lead, barite, nickel and energy by 0.0039%.



Gambar 7. Sankey Diagram Impact category abiotic depletion potential

2. Impact of land use (Land competition)

This category relates to the reduction of land as a natural resource, so that temporarily it cannot be used. From Figure 8 below, it can be seen that soybean production is the biggest factor that has an impact on land use of 1148 m2

Figure 8. Graph of Impact Category land Competition

From Figure 9 below, the Sankey diagram shows that soybean production has the highest contribution of 99.982%, with arable land for growing soybeans of 1147.74014 m2

Figure 9. Sankey Diagram Impact category land competition

3 Global Warming Potential /GWP

GWP (Global warming potential) is the total potential contribution to global warming due to the emission of one unit of gas, relative to one unit of reference gas, namely CO2, which is given a value of 1. The impact of global warming is climate change. Climate change can be defined as a change in global temperature caused by the greenhouse effect resulting from human activities. Currently, increased emissions can have a significant effect on climate change. Climate change is one of the most difficult environmental effects of economic and social activities to address because the scope is too broad. The types of gases that have an influence on climate change are methane and CO2. (Achmad Arba'i, Raden Faridz, 2019).

Figure 10 below shows that the energy consumption factor is the biggest factor contributing to global warming with a potential of 2195 kg CO2, followed by glass containers for shipping soybeans of 1619 kg CO2, production of soybeans on agricultural land of 13.73 kg of CO2, shipments of soybeans by ship of 70.955 kg CO2 and acetic acid production of 3.381 kg CO2.

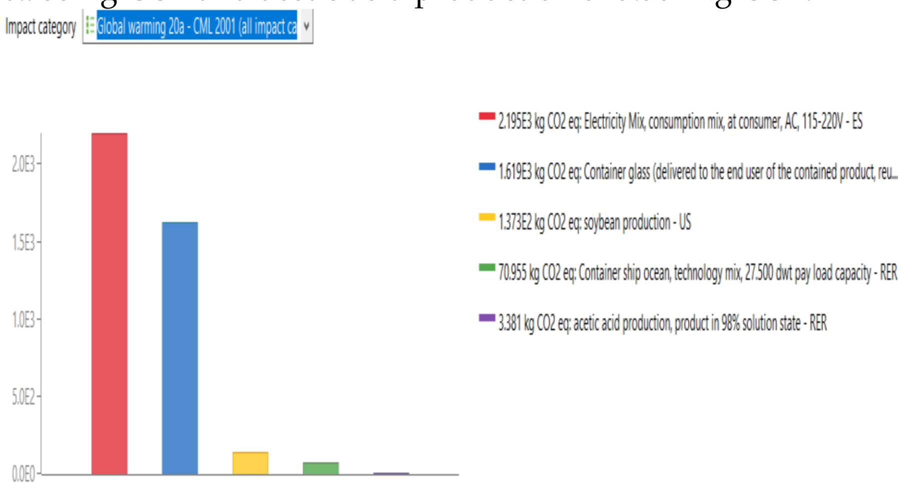


Figure 10 Graph of Impact Category Global warming potential

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From Figure 11 below, the Sankey diagram shows that the energy used to produce tofu has the greatest contribution, namely 54.342% with the influencing compounds, namely: carbon dioxide and methane. Then the glass container when shipping soybeans to Indonesia was 40.054% with compounds that affected them, namely: CO2 and CH4. Soybean production on agricultural land is: 3.709% with compounds that affect it, namely: N2O, CO2. And shipping soybeans by ship with a contribution to global warming of 1.826% with compounds that affect them are: CO2 and CH4

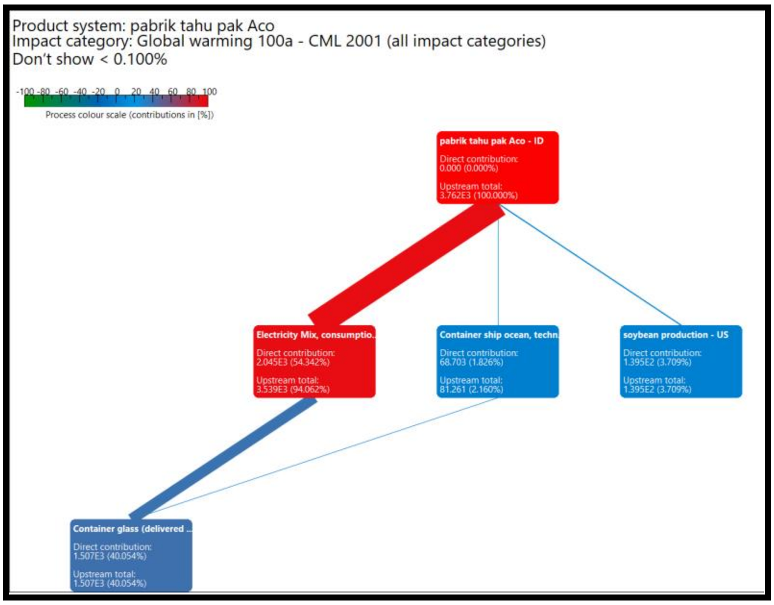

Figure 11 Sankey Diagram Impact category global warming 100a

4. Depletion of the ozone layer (ozone layer depletion)

The depletion of the ozone layer in the stratosphere is related to the results of human-caused (anthropogenic) emissions. This results in an increasing fraction of solar UV-B radiation reaching the Earth's surface, and this has the potential to have adverse effects on human health, animal health, terrestrial ecosystems, aquatic ecosystems, biochemical cycles, and materials.

From Figure 12 below, the energy used in tofu production consisting of biogas from tofu liquid waste, wood sawdust, electricity for soybean grinding machines, water pumping machines and lighting lamps has the greatest impact, namely 0.0001719 kg CFC11, then container for delivery to users of 0.00004682 CFC11, soybean production of 0.000005333 CFC11, acetic acid of 0.0000007035 CFC11 and finally shipping soybeans by ship of 0.00000005337 CFC11.

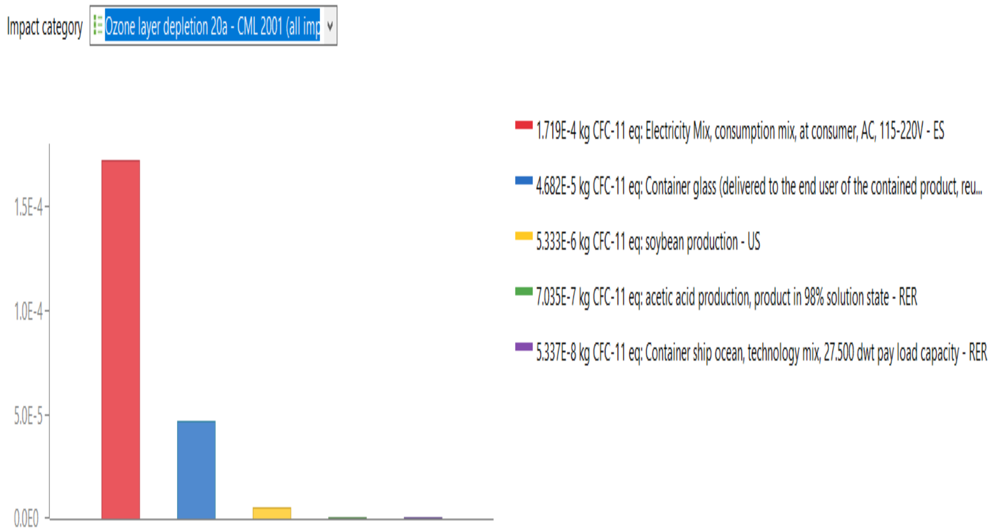

Figure 12 Graph of Impact Category ozone layer depletion

From Figure 13 below, the Sankey diagram shows that the energy used to produce tofu has the greatest contribution to ozone layer depletion, which is equal to 76.468% with compounds namely: CFC-11 and HCFC-22. Then the glass container when shipping soybeans to Indonesia amounted to 20.823% with compounds that affect them, namely: CFC-11 and HCFC-22. Soybean production on agricultural land is: 2.372% with compounds that affect it, namely: Halon 1.301, Halon 1211, HCFC-22.

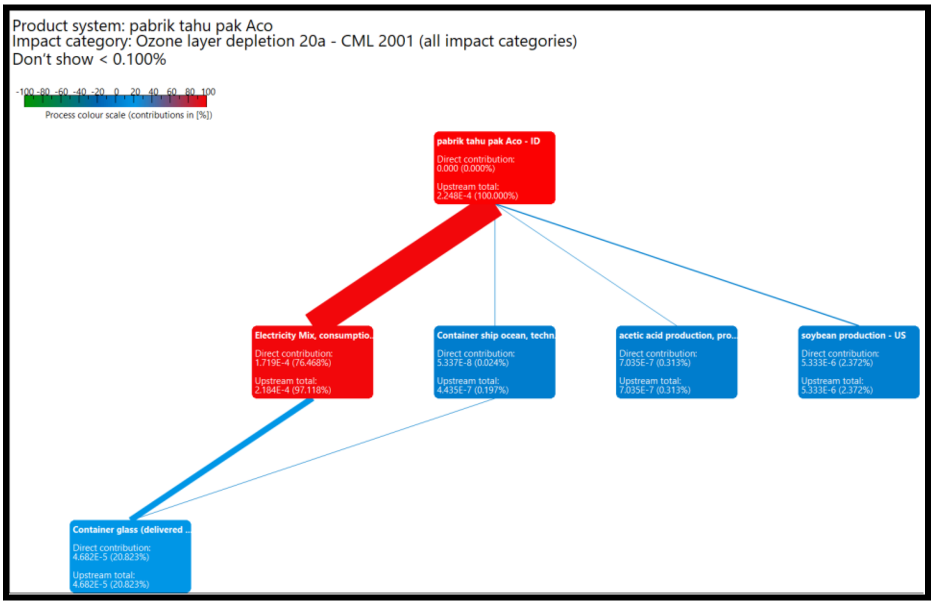

Figure 13 Sankey Diagram Impact category ozone layer depletion

5.Human Toxicity Potential

Human Toxicity potential (HTP) is a quantitative toxic equivalent potential (TEP) that has been introduced to express the potential hazard of a chemical unit released into the environment. This impact is related to the impact on human health of hazardous materials present in the environment. (Hertwich , 2001).

Emissions of some substances (such as heavy metals) can impact human health. Toxicity assessment is based on tolerable concentrations in air, water, air quality guidelines, tolerable daily intake and acceptable daily intake for humans. For each toxic substance, HTP is expressed using a reference unit, equivalent to kg 1,4-dichlorobenzene (1,4-DB).(Anonymous, 2020a). From Figure 14 below, the biggest cause of human toxicity is the container sending soybeans to consumers: 2187 kg 1,4-dichlorobenzene, energy: 1686 kg 1,4-dichlorobenzene, soybean production 45,411 kg 1,4-dichlorobenzene, shipping soybeans by ship: 2973 kg of 1,4-dichlorobenzene and acetic acid production of: 1336 kg of 1,4-dichlorobenzene.

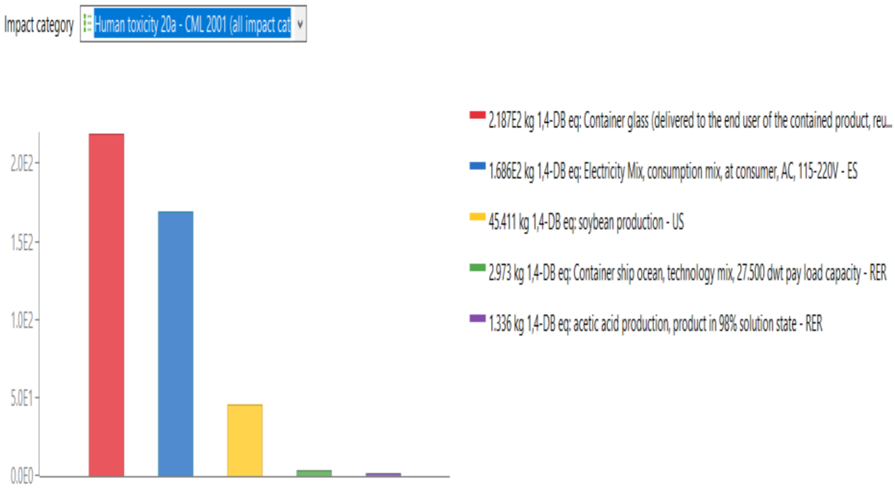

Figure 14 Graphic Impact Category human toxicity 20a

From Figure 15 below, the Sankey diagram shows that the energy used to produce tofu has the greatest contribution to human toxicity, namely 38.584% with compounds namely: arsenic, PAH, Cadmium, Nickel. Then the glass container when shipping soybeans to Indonesia was 50.038% with compounds that affected, namely: arsenic, PAH, Cadmium, Nickel. Soybean production on agricultural land is: 10.392% with compounds that influence namely: arsenic, Polycyclic Aromatic Hydrocarbon/PAH, Cadmium, Nickel, Benzene, Arsenic, Chromium VI and NO2

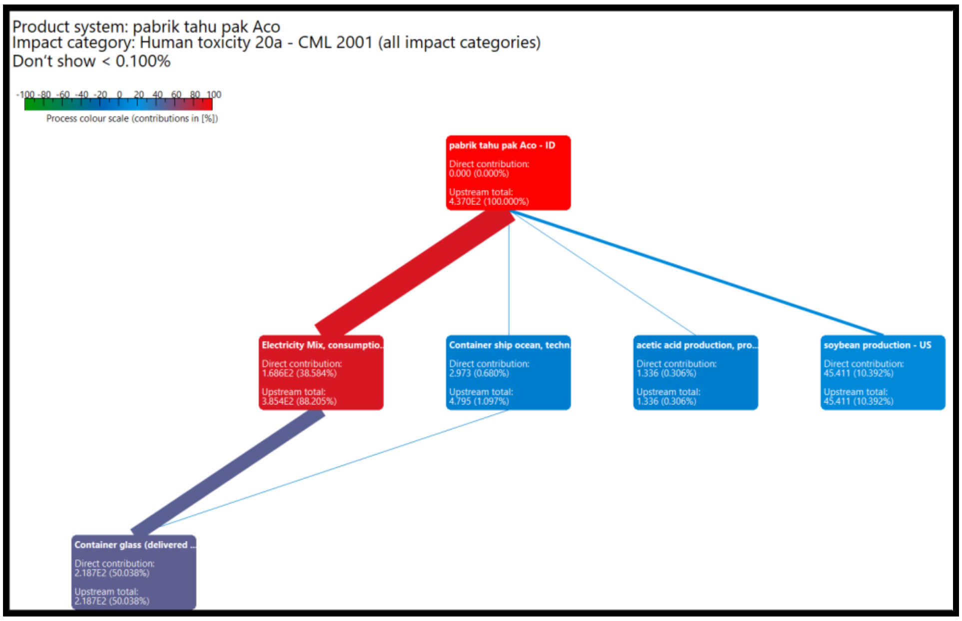

Figure 15 Sankey Diagram Impact category Human toxicity potential 20a

4. Interpretation of Result and Improvement Stage

Interpretation is the last stage in the scope of LCA. In LCA, the industry must apply the Resource efficiency and Cleaner Production (RECP) program or resource efficiency and Cleaner Production, namely the integrated and sustainable concept of implementing environmental practice prevention and all productivity techniques in processes, products and services to increase efficiency and reduce risks to humans and the environment. RECP includes several things, namely, clean production/Cleaner Production, Eco-Efficiency/ production concepts that minimize the use of raw materials, water, energy and environmental impacts per product unit, minimize waste/Waste Minimization, environmentally friendly industry/Green Productivity, pollution prevention/Pollution Prevention, and Toxics Use Reduction. (Anonymous, 2020b). According to PERMEN of environment and forestry No. 1 of 2021 concerning PROPER, one thing that must be done by the industry in its production process is to apply the concept of clean production, namely: good housekeeping / layout management carried out in the workplace which includes equipment, documents, buildings and rooms for making the workplace clean, neat, safe and comfortable so as to increase work productivity and reduce hazards in the workplace, control the process better/better process control, change the technology used/technology change, use by-products for production/production of useful by product, changing product raw materials/input change, modifying industrial equipment/equipment modification, on-site reuse and recycling and product modification, (Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 1 of 2021 concerning the Appraiser Program a Ranking of Company Performance in Environmental Management, 2021). Interpretation is carried out to identify hotspots that have the greatest contribution to environmental pollution resulting from the Sari Murni Tofu Factory, Krajan, Mojosongo, Surakarta by implementing cleaner production and making improvement efforts. Hotspots that have an impact on the environment and the improvements made include:

a. From the results of the life cycle assessment modeling with the openLCA application, it can be seen that the biggest environmental problem hotspot is the energy consumption during the tofu production process, among others, PLN electricity to drive the water pump and the machine to grind soybeans into tofu pulp.Improvements made include:

- ❖ efficient use of water during the production process for 8 hours in the tofu-making process, for example a steam boiler needs to be scraped off the crusts in the steam boiler to increase the volume of steam it produces, so water use is more efficient.
- ❖ The use of water for the process of soaking soybeans, boiling tofu porridge, filtering tofu porridge, pressing tofu, and boiling tofu does not use a small bucket but uses a water faucet so that water use is more controlled and efficient.
- ❖ To save water and energy, using a stove for boiling tofu should only use one stove with a larger volume, so that the volume for cooking tofu porridge is more and saves water.
- ❖ Apart from that, it is necessary to make simple work instructions (IK), for all workers in the pure tofu factory, to comply with when finished using water, they must immediately turn off the water faucet and turn off the water pump if the water in the reservoir is full, and turn off the soybean milling machine when finished grinding soybeans.
- ❖ In addition, during the rainy season, in the production process you can use rainwater to reduce electricity consumption with a water pump. For this reason, it is necessary to examine the quality of rainwater if it meets the quality requirements for clean water and can be used.
- ❖ Water pumps and soybean milling machines that have been used for a long time, should be considered to be replaced with new machines so that the volume of water pumped is faster and more in a short duration of time. Likewise, the pipes for distributing water vapor from the steam boiler need to be replaced with new ones if scale has reduced the diameter of the pipe. Pipes that have experienced corrosion need to be replaced to reduce the health impact on tofu consumers.
- ❖ Replacing the use of sawdust and wood waste in heating boilers to boil tofu porridge using biogas from tofu liquid waste, thereby reducing CO2, SO2, NO2, CH4 and dust particles into the Sari Murni Pak Aco factory environment.
- ❖ To control smoke and dust particles resulting from burning sawdust and used wood, the chimney needs to be higher than the current condition, with the aim of reducing the impact on the surrounding community and Sari Murni tofu factory workers

b. The next hotspot for environmental problems is transportation, where soybeans are used in the process of making tofu using soybeans from the United States. So that it requires sea transportation and long distances to Indonesia. So that by sea transportation and long distances this requires large amounts of fossil fuels and produces exhaust emissions into the air in the form of CO2, NO2 and SO2 gases.

The proposed improvement is the need to consider the use of Indonesian domestically produced soybeans for Sari Murni's tofu production.

c. Furthermore, the problem of soybean production is at the farmer or plantation level, where to produce soybeans requires the opening of agricultural land. The opening of large-scale agricultural land requires agricultural machinery, large amounts of water, pesticides, herbicides and irrigation systems which require large amounts of water. Then the use of pesticides and herbicides can cause soil and groundwater pollution.

Use of agricultural land by not cutting down primary forest but using land specifically for soybean farming and in collaboration with local farmers. In addition, the improvements made are using environmentally friendly pesticides and herbicides, thereby reducing the impact on groundwater and soil pollution.

d. The tofu dregs resulting from filtering the first stage of tofu pulp can be processed in the second stage, to get a lot of tofu.
e. Then another improvement from the production process is that the acetic acid (CH3COOH) used to coagulate tofu is replaced with natural ingredients, including using sea water extract (SAL), which is healthy and environmentally friendly.
f. Handling of tofu dregs can be used to make products that have high economic value, for example to make oncom, loose tempeh, animal feed, crackers, shredded meat, and tofu dregs bread.

FURTHER STUDI

For further research, it can be investigated using KAN-standard air quality laboratory equipment to obtain air quality data from sawdust burning chimneys, namely the parameters of dust, CO2, CO and SO2.

CONCLUSIONS AND RECOMMENDATIONS

The results of the LCA calculation show that there are 5 categories of environmental impacts, with the following results: abiotic depletion 0.30603 kg Sb eq, Acidification 27.92294 kg SO2 eq, Eutrophication 1.987027 kg PO4 eq, Global warming 4026.078 kg CO2 eq , Human toxicity 436.9892 kg 1.4-DB eq. The results of research at the Sari Murni tofu factory, using a life cycle assessment (LCA) show that electricity, transportation and containers of soybeans contribute the most to environmental pollution. All stages in the Sari Murni tofu production process, Krajan, Mojosongo produce waste, both liquid waste and emissions. air and solid waste and there needs to be efforts to continuously improve these hotspots so that in the future the tofu factory can develop more and become an environmentally friendly tofu industry.

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