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ENVIRONMENTAL MANAGEMENT IN THE "ATTIEKE" MANUFACTURING PROCESS AT ABOBO-BAOULE IN THE MUNICIPALITY OF ABOBO (CÔTE D'IVOIRE)

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ABSTRACT

"Attieke", a partially dehydrated fermented manioc root semolina (Manihot esculenta grantz) cooked in steam and agglomerated in appearance, undergoes a preparation process. This preparation uses hereditary or sometimes mechanised artisanal techniques, which do not sit well with current environmental principles. The aim of this study is to carry out an in-depth analysis of the environmental aspects, index and results associated with the activities, products and services involved in the manufacture of attieke in Abobo-Baoulé. The backbone of the methodology used to achieve this was made up of documentary research, observation of production sites, a field survey based on the ISO 14001 version 2015 standard and the Heineken procedure for assessing the environmental problems identified. This procedure was used to calculate the Environmental Hazard Coefficient (EHC) for each environmental aspect. A threshold of 26.66 was also calculated, at which point the significant aspects were determined. At the end of this process, five significant environmental aspects were selected. These were: the proliferation of cassava skins and storage of waste (CDE=36); the discharge of waste water from washing, humidification of the workplace, stagnation and run-off of waste water (CDE=60); unhygienic conditions and crushed cassava debris (CDE=36); waste water from pressing, etc. (CDE=36).

Keywords: Abobo-Baoulé, Analysis, "Attieke", Environment, Standard

1. INTRODUCTION

Cassava is one of the major food crops produced and processed in Côte d'Ivoire Affessi (2017) It is processed in several ways, the most popular of which is attieke Kacou (2000). "attieke" is a fermented, partially dehydrated manioc root meal (Manihot esculenta grantz) cooked in steam and agglomerated in appearance. It is a primary food product of the Ivorian lagoon peoples, slightly sour, similar to wheat couscous. It was originally produced and consumed by families for their own consumption for a long time, before spreading throughout Côte d'Ivoire and the

West African sub-region with the migration of populations until it reached the level that characterises it today Sotomey et al. (2001). It accounts for around 5% of food expenditure and 20% of calories in the diets of many Ivorians and is the main source of income-generating activity for women Akely (2012) cited by Trazié (2019). Its appeal lies in the fact that it is a fast food that can be eaten hot or cold with meat or fish Assanvo et al. (2006) and is adapted to population growth, which has the immediate effect of exponential demand for food products. Its preparation is a slow process, sometimes using traditional artisanal techniques, which is justified according to some producers, or sometimes mechanised, which can take 2 to 3 days with the use of traditional ferment made from fresh cassava roots Assanvo et al. (2006). For most women, attieke is the main source of income-generating activity, enabling them to be self-sufficient and meet their family needs. Annual production is estimated at between 18,365 and 40,000 tonnes, with consumption varying between 28 and 30 kg per inhabitant FAO (2001). The Abidjan conurbation is the largest production and consumption area for attieke.

Abobo-Baoulé is an essential location for the supply of attieke to the city of Abidjan, to countries in the sub-region and even to some European countries. This high demand for attieke means that huge precautions have to be taken to satisfy customers and maintain this privileged status with consumers.

Despite the dynamism of the players in the attieke sector in this village, the environmental conditions for production and hygiene are still precarious. The aim of this study is to highlight the environmental aspects and impacts of the various activities carried out there. To carry out this study, the following methodological apparatus was adopted.

2. METHOD AND STUDY AREA

2.1. OVERVIEW OF THE STUDY AREA

The village of Abobo-Baoulé lies between 3°58'38'' West Longitude and 5°27'20'' North Latitude Service technique Mairie d'Abobo (2014). The village is bordered to the north by the Belle-ville district, to the south by the Abobo-Té and Sans Manquer districts, to the east by the Cocody commune and to the west by the Kennedy district Figure 1.

Figure 1

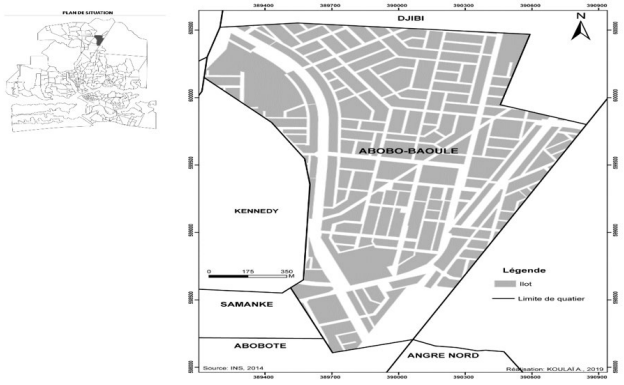

Figure 1 Map showing the location of the study area

Topographically, the study site is on a plateau with slight gradients, which obviously poses a problem for wastewater and rainwater run-off. The elevation is around 125 metres.

The village of Abobo-Baoulé is subject to a humid tropical climate. The village receives an average of 2,200 mm of rain per year, spread over 7 months. Abobo-Baoulé is an area of depressions. The development of the site has created a green space within the village. It is a space for games, dances and various ceremonies.

It is worth noting that in Abobo-Baoulé, the construction models show the first facilities symbolising the transformation from rural to urban. In the village, housing is varied and modern. It is characterised by the presence of several buildings on the same plot of land, commonly known as a concession. Very often, several couples or adult children from the same family build next to their father's building. They build in these locations either because they lack the financial means to buy land or simply out of family solidarity.

Abobo-Baoulé has a number of facilities and infrastructures. These facilities and infrastructures are speeding up the transition from rural to urban. The village has a health centre and an urban first aid centre. There are also two private dispensaries and a pharmacy in the village. Some streets are well.

2.2. DATA COLLECTION TOOLS

The working materials used for this study were the questionnaire sent to production managers and the village customary authorities. The study also required cartographic data for drawing up the maps, a camera for taking images in the field, a recorder for voice-recording the interviews and a notepad for taking notes.

2.3. METHOD OF DATA COLLECTION

The methodological approach used to achieve the objective was based on documentary research, interviews and a field survey. The first phase of data collection involved using documentation from libraries, the Institut de Recherche pour le Développement (IRD) and the Centre de Recherche et d'Action pour la Paix (CERAP).

The second phase involved interviews with managers and agents from the various departments responsible for managing environmental quality, as well as the heads of the Abidjan district departments in charge of managing the abattoir and the surrounding households.

The third phase was the field survey, which took place in September 2023. In the absence of a database, the principle of information saturation, a non-probabilistic method developed by Pires (1997), was used to establish the sample. At the end of this methodological approach, the results obtained are structured as follows: identification of activities, environmental aspects and impacts, and determination of significant environmental aspects.

3. RESULTS AND DISCUSSION

3.1. ENVIRONMENTAL ANALYSIS

This phase of the study was devoted to an in-depth analysis of the environmental aspects of the index and the environmental results associated with attieke production activities. The initial step was to observe the immediate environment, in particular the neighbourhood, the village and the various facilities.

This observation made it possible to determine the activities involved in the field of application. Women attieke producers in Abobo-Baoulé benefit from a delimited area reserved for production activities Figure 2, from the collection of fervents through to drying, in order to improve organisation and reduce the harmful effects of production. All the activities involved in the production of attieke in Abobo-Baoulé fall within this scope.

Figure 2

Figure 2 Presentation of the "attieke" production area
Author Dakouri, 2023

The activities included in the scope of application are:

Peeling: Peeling is a manual operation that consists of removing the peel from cassava tubers. Peeling removes more than half of the indigestible carbohydrate, leaving only the ideal part for the rest of the process.

Washing: The final wash before grinding to limit the browning induced by contact with air. The tubers are then washed with water in aluminium or plastic basins. A measuring basin is used to measure the quantity of water used. The cost of a basin is 200 FCFA, which comes to 400 FCFA, so two basins for half a tarpaulin load of cassava and 800 FCFA, or four basins for a full tarpaulin load Figure 3.

Figure 3

Figure 3 Washing Cassava Beans in Abobo-Baoulé
Author: Dakouri, 2023

Grinding: This consists of transforming the cassava, cut into pieces, into a paste using a grinder.

Fermentation: The cassava paste obtained after grinding is mixed with ferment and packaged in polyethylene bags in a basin, covered with plastic thread, then fermented in ambient conditions for 18 to 24 hours. During fermentation, the

fermenting micro-organisms develop, breaking down the starch into simple sugars and then lactic acid, acetic acid and aromatic compounds.

Pressing: The washed paste is placed in double bags and then pressed using a handmade screw press Figure 4.

Figure 4

Figure 4 Pressing cassava paste
Author Dakouri, 2023

The water runs off as pressure is exerted on the bag. Pressing removes some of the water and starch from the dough. Above all, it regulates the moisture content to make sieving and cooking easier.

Sieving: Sieving makes the compact mass resulting from pressing crumbly and above all eliminates fibres and fragments of pulp that have not been properly crushed. This operation consists of taking clumps of pulp and, using a circular movement of the hand, rubbing them against the mesh of a sieve.

Drying: Drying involves spreading the granules obtained in this way out in the sun on tarpaulins, plastic tablecloths or tables covered in plastic film. This operation allows some of the water to evaporate. It also prevents the granules from becoming smeared during cooking.

Cooking: This stage is carried out using steam in a device consisting of a pot containing water supported by a perforated aluminium bowl. The pot is tightly fitted to the perforated bowl to prevent steam leaks.

Activities not included in the scope of action are:

Collecting cassava fervents or weighing: This consists of collecting fervents from various origins depending on the availability of the resource. Weighing is carried out using a rather unconventional method, although it does meet the needs of the producers.

3.2. ENVIRONMENTAL ASPECTS AND IMPACTS OF ATTIEKE PRODUCTION ACTIVITIES

3.2.1. ENVIRONMENTAL ASPECTS OF THE PEELING PROCESS

Peeling is a manual operation that consists of removing the peel from the cassava tubers Figure 5. This activity generates waste that is spread all over the ground in the area reserved for this activity. These uncollected cassava peelings, in regular and irregular shapes, litter the ground and affect the cleanliness of the site. Observation of the site revealed the presence of cassava peelings over a large part of the site, even though measures have been taken.

Figure 5

Figure 5 Peeling Cassava in Abobo-Baoulé
Author Dakouri, 2023

The site is not kept clean by any cleaning structure; this task falls to the various people who reuse the waste for other purposes. After peeling, the cassava waste is collected, stored and put into bags Figure 6 for transhipment off the site. The time taken for evacuation depends on the demand and need for cassava skins by re-users. Apart from these re-users, no other measures have been put in place to anticipate the evacuation. Failure to collect these peelings, which invade the site, leads to their decomposition and fermentation, and alters the condition of the soil.

Figure 6

Figure 6 Dumping and Storage of Cassava Skins in Abobo-Baoulé
Author Dakouri, 2023

3.2.2. ENVIRONMENTAL IMPACTS OF PEELING ACTIVITIES

All the environmental aspects described above have significant repercussions on the environment, particularly the proliferation of cassava skins, followed by unhealthiness, air pollution and soil pollution.

All this accumulation and exposure of waste leads to reactions under the effect of atmospheric conditions, which are a threat to the soil and also to the air, as the accumulation of skins produces an unpleasant odour over time.

3.2.3. ENVIRONMENTAL ASPECTS OF WASHING ACTIVITIES

Investigations carried out on the site revealed a number of factors that undermine the operation of this activity on the site. In fact, washing is carried out in an area that does not comply with current hygiene principles, not only once, but above all with utensils that are in a poor state of cleanliness Figure 7. The water used

for washing is poured over and mixed with the sandy soil, creating a muddy, unsuitable environment. Added to this is the dampness of the soil and the stagnation of the water, which is a real channel for the development of disease and the proliferation of bacteria. In addition, this situation sometimes makes the site difficult to access when it rains, as one grower put it: 'our site is not really suitable, it's very difficult to get in here when it rains, the area is completely covered in water and mud, sometimes the water reaches up to our knees, making it difficult or impossible to move around, even with boots on'.

Figure 7

Figure 7 Instruments used for Washing and Presentation of the Washing Area
Author Dakouri, 2023

The washing area is also littered with solid waste, sometimes plastic, which makes it unsuitable for this activity. A makeshift gutter allows waste water to drain into the shallows adjacent to the site. The seepage of this water has enormous consequences for the water table and the soil Figure 8. Once washed, the cassava pieces are placed either in sacks or in basins exposed to the open air in front of the mill chamber before grinding.

Figure 8

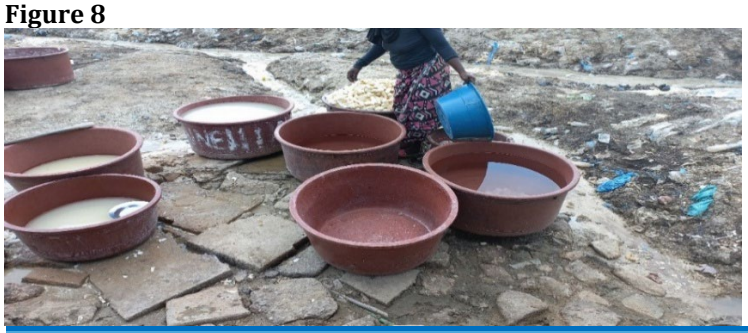

Figure 8 Routing liquid Waste in the Lowland
Author Dakouri, 2023

3.2.4. ENVIRONMENTAL IMPACT OF WASHING ACTIVITIES

The environmental impact of washing activities on the site is not negligible. The discharge and run-off of untreated wastewater pollutes the Ebrié lagoon. In addition to polluting the lagoon, this wastewater also pollutes the ground (water table) and the air, as it stagnates and gives off suffocating odours. In addition, the moistening of the soil combined with the preponderance of sludge is a source of microbial propagation, giving rise to a health risk that can affect the health of producers upstream and even consumers downstream. In Sancey's work (2011), he argues

that wastewater is laden with various elements from domestic, commercial and industrial activities. It is likely to pollute the receiving environments into which it is discharged. As Ghadbane (2003)states, this wastewater therefore plays a major role in the degradation of the receiving environment and is likely to be the main cause of water shortages and public health problems in the future.

3.2.5. ENVIRONMENTAL ASPECTS OF THE PREPARATION OF "MAGNAN" (FERMENT) AND RED OIL

In the area where the ferment and red oil are prepared, the presence of smoke disturbs the quality of the air. In fact, wood fires are used to prepare the ferment and the red oil, which explains the presence of smoke in the preparation area Figure 9. In addition to this aspect, the presence of solid waste from the means used for the fire is noticeable, in particular the residues of partially consumed wood and the waste obtained from peeling the prepared cassava.

Figure 9

Figure 9 Preparation of the Ferment “magnan” and the Red Oil
Author Dakouri, 2023

3.2.6. ENVIRONMENTAL IMPACTS ASSOCIATED WITH THE PREPARATION OF FERMENT AND RED OIL

In this area, smoke is a constant source of air pollution due to the methods used to cook and prepare the oil. Recent episodes of forest fires in North America have drawn attention to their danger, with the number of deaths attributable to them estimated at over 300,000 per year, corresponding to the emission of two billion tonnes of carbon into the atmosphere Masse& Boudène (2013). It is the ultrafine particles generated by combustion that are of greatest concern. Their signature can be determined using various tracers: levoglucosan, C14, crystallography, spectrometry; their toxicity is at least equal to that of the fine carbon particles polluting the atmosphere. Added to this is the degradation of soil composition as a result of direct contact between fire and the soil.

3.2.7. ENVIRONMENTAL ASPECTS OF THE GRINDING ACTIVITY

The room in which the mill is set up is an awkward environment. The walls of the room, which are filthy with cassava paste, are covered with the dirty clothes of the workers. The terrace on which the cassava basins are stored is poorly cleaned and in a state of disrepair, causing water to stagnate in the room. In addition, the

poorly maintained mill is rarely overhauled by a mechanical specialist, even though some of its parts are old and rusty. What's more, the mill works non-stop all day, from Monday to Friday, and has never been disinfected.

3.2.8. ENVIRONMENTAL IMPACT OF GRINDING ACTIVITIES

Cassava grinding operations generate a flow of wastewater and pulp debris dumped here and there on the ground inside the hall. This wastewater, drained in the traditional way, is discharged untreated into the Ebrié lagoon.

What's more, the cassava grinding process in the mill does not comply with current standards, nor does it take hygiene into account. This can lead to the spread of germs and health risks. In other words, the attieke produced by this process does not comply with any of the principles of quality, which according to ISO 9000 is defined as the ability of a set of intrinsic characteristics to satisfy requirements. In concrete terms, according to Sawadogo (2004), quality exists when the nature of the service offered corresponds to the requirements. The cramped and unventilated grinding room sometimes causes breathing problems, forcing workers to stay outside once the cassava is in the grinder.

3.2.9. ENVIRONMENTAL ASPECTS OF FERMENTATION AND PRESSING

Fermentation takes place in polyethylene bags Figure 10 placed in basins, which are either laid out on the ground or placed on the floor.

Both the fermentation and pressing areas are very unsuitable. In fact, the unmade ground is wet with the juice extracted from the pulp and filled with waste of all kinds, creating a sludge that gives off a very bad smell. The tanks and the storage area for the fermentation bags are dirty and covered in this mud. What's more, the staff do not wash their hands regularly and wear dirty clothes when handling the dewatered dough.

3.2.10. ENVIRONMENTAL IMPACT OF FERMENTATION AND PRESSING ACTIVITIES

The state in which these operations are carried out is very harmful to the smooth running of the activity and the preservation of a quality product. The liquid extracted from the pressing process contains elements that are very harmful to the environment, leading to the degradation of the chemical composition of the soil. Added to this is the proliferation of waste at the site, making it unhealthy. Finally, poor handling due to neglect of good hygiene practices leads to contamination of the paste.

3.2.11. ENVIRONMENTAL ASPECTS OF THE SIEVING PROCESS

Sieving Figure 10 makes the compact mass resulting from pressing crumbly and, above all, eliminates fibres and fragments of pulp that have not been properly ground. This operation consists of taking clumps of pulp and, using a circular movement of the hand, rubbing them against the mesh of a sieve. This is a manual operation carried out using a sieve with large meshes 2 to 3 mm in diameter when the pulp is very well pressed, a little water is added to make the operation easier.

This stage is carried out using several sieves. Different sieves are used depending on the quality of attieke required. There are three qualities of attieke: coarse-grained attieke, commonly known as Abodjama, medium-grained attieke and fine-grained attieke, known as 'garba'. The wrung-out paste is placed in sieves of different mesh sizes, which are then placed on aluminium or rubber basins. The operation is usually carried out with bare hands under cover. Sitting on stools, they sift the paste - plastic sheeting is used on the floor to reduce the risk of sand seeping in. The handling staff are of all ages (children, young people and the elderly) and sometimes wear inappropriate clothing.

Figure 10

Figure 10 Sieving cassava paste
Author Dakouri, 2023

3.2.12. ENVIRONMENTAL IMPACTS OF THE SIEVING PROCESS

Handling the paste with bare hands is a real threat, as it contaminates the paste because the hands are not protected. In addition, the paste is spilled on the floor, which affects the cleanliness of the area reserved for this activity.

3.2.13. ENVIRONMENTAL ASPECTS OF THE DRYING PROCESS

After the sieving stage, the cassava granules obtained are spread out on plastic tarpaulins on the ground and exposed to the sun, as shown in Figure 11, in order to be dried. The environment is inadequate, with the atmospheric wind laden with dust and various particles constituting a huge source of physical and microbiological contamination of the cassava granules. The drying area presents risks of contamination due to the abundant presence of sand on the ground.

Figure 11

Figure 11 Open-Pit Drying of Granulated Pulp
Author Dakouri, 2023

3.2.14. ENVIRONMENTAL IMPACTS OF THE DRYING PROCESS

Exposing cassava granules to the open air and on the ground constitutes a real risk of contamination and may affect the quality of "attieke", as it is easier in such a situation to contaminate the granules with sand. It is also easy to notice the presence of debris from the granules spilled on the ground. At a glance, this proliferation makes the ground unhealthy.

3.2.15. ENVIRONMENTAL ASPECTS OF THE COOKING PROCESS

Cooking is carried out using steam in a device consisting of a pot containing water supported by a perforated aluminium bowl Figure 12. The pot is tightly fitted to the perforated bowl to prevent steam leaks. The whole thing is placed over a fireplace using butane gas as fuel. The fresh "attieke" granules are poured into the colander as soon as the steam appears. During cooking, the granules are turned from time to time with a wooden spatula. Cooking takes around 15 to 30 minutes, depending on the intensity of the heat and the quantity of semolina to be cooked. The cooked product is poured into a bowl, where the grains are removed with a spatula. "attieke" is mainly cooked in the homes of the various women producers in Abobo-Baoulé. At this stage of preparation, the observation made remains at the level of the environmental state of each course. In general, however, it has been observed that the granules ready for cooking are packed in plastic bags and placed on the ground.

Figure 12

Figure 12 Preparing "attieke" at home
Author Dakouri, 2023

3.2.16. ENVIRONMENTAL IMPACTS OF COOKING ACTIVITIES

With regard to the production site representing the first stage in the process, the decision to prepare "attieke" at home remains a solution that could limit or even avoid environmental risks to a lesser extent. However, the findings are clear and point to a number of shortcomings, even though the precautions are predefined. It should be noted that "attieke" can be contaminated through regular contact with the ground and handling with bare hands without any means of protection. Also, unsanitary conditions can lead to the presence of certain species, such as cockroaches, which come into contact with the product, causing contamination and a risk of illness.

3.2.17. ENVIRONMENTAL ASPECTS OF THE CASSAVA TUBER COLLECTION ACTIVITY

Cassava is supplied in its raw state to Abobo-Baoulé, mainly from the localities of Alépé, Bonoua and Aboisso. This is the most important stage in attieke production, as it determines the entire production chain. The quantity and quality of attieke produced depends on the quantity of cassava available. When the cassava arrives at the site in the mini car Figure 13, it is unloaded, measured and grouped in piles on the ground according to the order requested by each producer. A pushcart is used as a measuring instrument.

Figure 13

Figure 13 Unloading cassava beans
Author Dakouri, 2023

It has been observed that the unloading of cassava tubers takes place in the ground, which is full of mud. After the orders have been shared out, there are residues of cassava on the ground that cannot be used. This decomposes and pollutes the soil. The space set aside for this activity is inadequate because it is sometimes difficult to practise, especially in rainy weather.

3.2.18. ENVIRONMENTAL IMPACTS OF COLLECTING CASSAVA OR WEIGHING IT

In view of the aspects mentioned above, this activity has two types of impact on the environment. Firstly, the unsanitary conditions resulting from the waste that swarms around the site after the tubers have been unloaded, as well as the pollution resulting from the non-assembly of unusable residues.

3.2.19. EVALUATION OF ASPECTS AND IMPACTS

These aspects and impacts were measured and given a score in order to rank them.

As no method is imposed by the ISO 14001 standard, the evaluation of the environmental aspects referred to the Heineken procedure, which is based on a weighting of two defined criteria:

- The Criticality (C) of the aspect. This depends on two factors: the Frequency (F) of occurrence or Probability of occurrence (P) of the environmental aspect and the Gravity of the aspect (G) likely to have an impact on the environment.

Criticality formula: $C = G \times F$

- The company's Mastery (M) over the management of the environmental aspect through the implementation of systems, procedures, instructions or training aimed at reducing or eliminating the aspect.

  The criteria are defined as a function of the normal situation (including start-up, shutdown and maintenance) and the abnormal situation (including breakdown, incident, fire and explosion, etc.). These criteria are rated with numbers from 1 to 5. Depending on the importance attached to certain criteria, such as Gravity (G) or Mastery of aspect (M) linked to aspect, the rating will differ from the others.

- The company's Mastery (M) over the management of the environmental aspect by implementing measures, procedures, instructions or training aimed at reducing or eliminating the aspect.

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4. SCORING THE CRITERIA

According to the Heineken procedure with a content adapted to the slaughterhouse's activities, the scoring grid is as follows for each criterion:

- Frequency (normal situation) or probability (abnormal situation) is rated according to the duration of the appearance of an aspect or the impact on the environment and according to the site's working conditions.
- Aspect Gravity (G) rated according to the aspect area concerned and the extent of the impact on the environment.

Table 1

Table 1 Scoring the Frequency (F)

Frequency	Rating
Never	1
Uncommon	2
Occasional	3
Very common	4

Source Dakouri et al, 2024

Table 2

Table 2 Aspect Severity Rating

Gravity	Cote
No or beneficial impact	1
Slightly serious	2
Grave	3

Very serious	4

Source Dakouri et al, 2024

Mastery of the aspect is rated according to the availability and implementation of technical devices and all existing organisational and human measures.

Table 3

Table 3 Rating of Control (M) of the Aspect

Mastery of the company	Rating
Total mastery	1
Partial mastery	2
Little mastery	3
No mastery	4

Source Dakouri et al, 2024

For each aspect identified, an Environmental Hazard Coefficient (EHC) is determined, which is the product of the Criticality (C) of the aspect and the means of Mastery (M) implemented by the company in relation to this aspect.

Formula: $EHC = C \times M$

Table 4

Table 4 Extract from the Assessment of Environmental Aspects by Activity

Activities	Environmental aspects	Environmental impact	Activity situation	Evaluation of criteria			EHC
				Gravity	Frequency	Mastery	
Peeling	Solid waste, proliferation of cassava skins, storage of waste bags	Air pollution	N	1	4	3	12
		Increased volume of waste and unhealthy conditions	N	3	4	3	36
		Soil pollution	N	2	4	3	24
Washing	Spillage of waste water from washing, wetting the workplace, stagnation and run-off of waste water	Soil and groundwater pollution	Ab	3	4	5	60
		Air pollution	N	1	4	3	12
Preparation of ferment and oil	Abundant smoke production	Air pollution	Ab	2	3	3	18
Grinding	Energy consumption, unsanitary	Soil pollution, risk of infection	Ab	3	4	3	36

	conditions and crushed cassava debris						
		Air pollution	N	1	4	3	12
Fermentation and pressing	Wastewater from pressing cassava legs and unpleasant odours	Air pollution	N	4	3	5	60
		Soil pollution	N	4	3	5	60
Screening	Contamination of the paste,	Risk of cholera	Ab	3	4	3	36
	Spillage of paste on the floor	Insalubrity	N	1	4	3	12
Drying	Bad location	Insalubrity	N	1	4	3	12
Cooking	Poor condition, poorly maintained space	Risk of infection	Ab	4	3	1	12

Source Dakouri et al, 2025

N: Normal; Ab: Abnormal; EHC: Environmental Hazard Coefficient

4.1. DETERMINATION OF SIGNIFICANT ENVIRONMENTAL ASPECTS (SEA)

For all these scores, a threshold has been chosen above which all the aspects and impacts will be worked on with a view to lowering their score and therefore their impact on the environment.

4.1.1. METHOD FOR CALCULATING THE SIGNIFICANCE THRESHOLD FOR ASPECTS

Having determined the environmental hazard coefficient for each aspect, a significance threshold (S) was then defined for identifying significant aspects. To do this, the average of the maximum scores for the three criteria was calculated.

Soit: $$S = \frac{Max\ (G) * Max\ (P) * Max\ (M)}{3}$$

$$S = 26.666$$

In fact, all aspects whose environmental hazard coefficient (EHC) is greater than or equal to the threshold set are significant, and those whose EHC is less than the threshold are insignificant. Once all the environmental aspects had been assessed, only the significant environmental aspects were extracted. The calculation of the threshold value highlighted five (05) significant aspects to be improved as a priority. Table 5 below shows the significant environmental aspects identified.

Table 5

Table 5 Significant Environmental Aspects and Impacts

Activities	Significant environmental aspects	Significant environmental impact	Significance score for the AES / IES combination
Peeling	Proliferation of cassava skins and storage of waste bags	Increased volume of waste and unhealthy conditions	36
Washing	Spillage of waste water from washing, wetting the workplace, stagnation and run-off of waste water	Soil and groundwater pollution	60
Grinding	Insalubrity and crushed cassava debris	Soil pollution, Risk of infection	36
Fermentation and pressing	Wastewater from pressing cassava leg and unpleasant odours	Soil pollution Air pollution	60
Screening	Poor conditioning of granules	Contamination of granules (risk of cholera)	36

Source Dakouri et al, 2025

These results on the assessment of environmental aspects have made it possible to give a clearer picture of the level of environmental management of aspects at Abobo-Baoulé. It is on the basis of the environmental assessment of the site's aspects that the significant environmental aspects with negative impacts on the Soil, Water, Air, Resource and Health domains were highlighted, the causes and consequences of which will be analysed. However, the most significant environmental problems are anticipated to be soil pollution, air pollution and groundwater pollution.

5. CONCLUSION

At the end of this study, the environmental analysis of the "attieke" manufacturing process at Abobo-Baoulé highlights five (05) significant aspects due to the activities of peeling, washing, grinding, fermentation, pressing and sieving, which have considerable impacts on the soil, water, air, resources and health. These are generally identical to the risks commonly experienced in the course of the attieke manufacturing process at other sites. The most significant environmental problems are soil, groundwater and air pollution, with an environmental hazard factor of 60. Finally, for each aspect and significant impact identified, mitigation and improvement measures must be taken in an environmental action programme.

CONFLICT OF INTERESTS

None.

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