Development proposal for a sustainable sanitary pad

Ana Maria Martins Siqueira[1], Tamires Machado Peres[2] and Patrícia Deporte de Andrade[3]

[1] *Federal Institute of Santa Catarina, Mechanical Metal Academic Department IFSC, ana.burnys@gmail.com*
[2] *Federal Institute of Santa Catarina, Mechanical Metal Academic Department IFSC, tamiresmperes@gmail.com*
[3] *Federal Institute of Santa Catarina, Mechanical Metal Academic Department IFSC, patricia.deporte@ifsc.edu.br*

Abstract. *This article presents a cutout of the development process of a sustainable sanitary pad, analysing the life cycle, production methods, and waste disposal. The analysis improved a proposal, initially developed to try and decrease the environmental impact caused by the excess of disposable residue. The menstrual pad retains menstrual flow, has a significant polymer reduction in its product and packing, and also raises awareness about the ideal disposal, so the product does not lose its biodegradable properties.*

Keywords. *Sustainability, Pads, Biodegradable.*

1 Introduction

Issues involving the environment always raise discussion and debates. Amongst the most common approaches is the appropriate destination of residues produced by people, including the ways to decrease the impacts caused by waste that can not be recycled.

Among such residues are the sanitary pads. According to eCycle (2016), considering all the discarded items in dumps and landfills, it is estimated that about 2% of these territories are occupied by diapers and disposable pads, certainly one of the major problems when it comes to consumption and disposal.

The commercialization of pads started during the First World War, and since then its use has popularized, consequently increasing its disposal, producing a huge amount of waste of components that take up to 100 years to decompose. Even with the global popularization of pads, it is estimated that fertile-aged women living in India's rural areas are about 50 days absent of school or work due to the difficulty in acquiring the product, according to Your History website (2015). This happens due to the geographical distance or financial status of these women, since there are many isolated communities and the pads represent an extra investment for those who already earn very little.

Many of the components used on the manufacturing of sanitary pads, as for example the polyethylene (PE), the polypropylene (PP), the thermoplastic adhesives, and the super-absorbent polymer come from a non-renewable source: the petroleum. A large portion of it would be recyclable, but due to the fact that the product is in contact with the menstrual flow, it is then considered hospital waste.

To give an idea about the dimension of this product's use, it is estimated that a woman throughout her fertile period uses about 11.000 sanitary pads, according to an article (Revista Época, 2014). These disposable pads get to landfills and dumps forming a large volume of waste. Besides the product itself, there is still the disposal of packaging. Even though these are recyclable, in most cases they have an incorrect destination, being discarded in the toilet trash.

In this sense, was realized the necessity of making users aware about the disposal of such products, since when they are not correctly disposed, they create a large amount of trash in landfills and dumps. On the other hand, there is no interest of the responsible companies to share information on the subject, causing a lack of commitment towards the environment. Along with that there is the economic factor, a very important issue for the industrial manufacturing, since measures should be taken towards a more sustainable production.

Based on that, the current project has as objective the development of a product focused on sustainability, not only of the sanitary pad itself, but also of its packaging, aiming a solution that goes beyond the

[a] Ana Maria Martins Siqueira: *ana.burnys@gmail.com*

selection of materials, an awareness about the impacts caused by the use of conventional pads. Therefore, this article proposes to raise a discussion about themes such as recycling, biodegradability and correct residue disposal, with the idea of offering the right path to diminish the environmental damages and reflexes caused by wrongful doing.

Even existing relevant research carried out by important organizations around waste disposal, when it's about sanitary pads in particular, nothing is specified as should be, maybe because of a certain taboo or even a neglect. The available information revolves around superficial studies and constraints about production.

2 Theoretical Foundation

2.1 Sanitary Pads: Historical Context

The reports on the use of sanitary pads started between the years of 400 b.C. and 370 b.C. in Greek Doctor Hypocrites' manuscripts, who mentioned a type of primitive pad that should be inserted in the vagina. As the years went by, belts was developed (Figure 1 – I), consisting in straps that held pieces of fabric. There was also washable underpants (Figure 1- II). Advancing a little bit over time, up until the First World War, the use of washable hygienic fabric towels was common (Figure 1 – III).

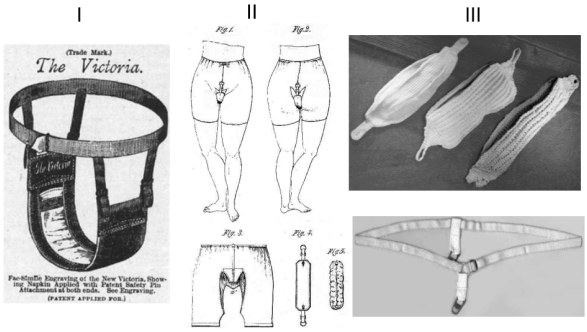

Figure 1. The first sanitary pads.

The first disposable marketable sanitary pad was launched by Kimberly in the 19th Century. It was inspired on a thick bandage projected to save soldiers with gun shot wounds. Later, nurses started using it for other means. The material used for its manufacturing was cellucotton, a cellulose-based material, five times more absorbent than cotton, as well as cheaper. The company then redesigned the product, transforming it into the disposable sanitary pad that women wear up to now.

2.2 Sanitary Pads: Analysis of life cycle, materials, and processes

The production, commercialization, and usage of the sanitary pads cause an environmental impact of large proportions. At first, there is the cut of pine and eucalyptus. After that, the wood is taken by trucks for the production of a cellulose pulp, which will then be turned into flutt – a softer material that composes the internal layer of the pads.

Concomitantly, there is the petroleum extraction, which is refined before its sub-product is taken to the plastic industries, where it is turned into a low-intensity polyethylene film. After that the flutt is added to the polyethylene, the silicone paper, the odor-controlling agent, the super-absorbent polymer, and the thermoplastic adhesive. After these processes, the multi-layered sheet goes through a cutting process, acquiring the product's final format.

The pad is packed in a low-intensity polyethylene film with heat welding on the lateral and inferior extremities, forming a cover for the product, which is closed with a tape on its extremity, forming the product's primary packaging. After that, there is the junction of a given quantity of pads – which varies in accordance to the model, going from packages with 6 up to 80 units of sanitary pads. This amount is involved by a new polyethylene layer, which is then sealed, isolating the product from the external environment, forming the product's secondary packaging. The last step of this packaging process is the allocation of individual packages for the transportation of the batches towards their final destination.

The sanitary pad itself is divided by layers of distinct materials (Figure 2). The first layer is formed by a thin non-woven polypropylene, followed by a second protective layer. The third layer is formed by cellulose fibers, added to a super-absorbent polymer, forming the nucleus. The last, fifth, layer serves to avoid leakage, and is formed by a waterproof polymer.

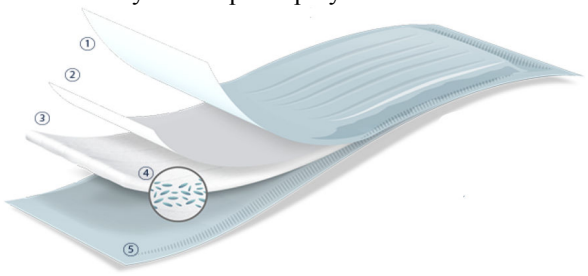

Figure 2. Layers of the sanitary pad

After the pad is used, usually it is thrown into the trash. In most cases, the packaging and the sanitary pad are thrown into the toilet bin, even though the external packaging could be recycled (information printed on the product). As per research carried out for

this project, when the packaging in incorrectly discarded, it goes to the same destination as the non-recyclable residue – into the garbage truck, and posteriorly to landfills and dumpsters. To exemplify this while cycle, was developed the image below (Figure 3):

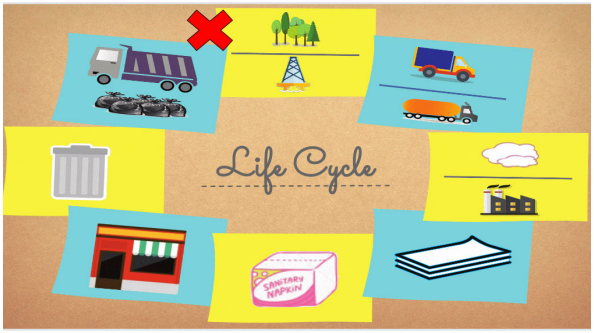

Figure 3. Disposable sanitary pads' life cycle.

Lastly, in accordance to eCycle:

> "The main environmental impact caused by such products starts on the extraction and the processing of the raw-material, which are based on the production of plastic (petroleum) and cellulose (trees). Since the plastic production demands a lot of energy and generates long-duration residues, it is a product with increased environmental impact. [...] Not only the production of the sanitary pad itself, but also its extra components, as the packaging and services, the transportation of the raw-material and the product, cause impact on the product's life cycle."

The analysis of the life cycle demonstrates a large amount of non-renewable materials on the composition of the product, and all its packaging. In all, there are five different polymers used on the manufacturing of a disposable sanitary pad.

3 Methods

To support the data collection, as well as the remaining stages of this project, was adopted two main methodologies, since none of them alone contemplated the project satisfactorily. The Packaging Orientation and Development Guidelines (MERINO et al., 2009) would not be able to respond to all the necessities for the development of a product on its own, since the main focus is sustainability, and the guidelines do not include such theme. Due to its crucial importance, was added Design for Sustainability (Joachim H. Spangenberg, 2013) to the methodology.

3.1 Data Collection

For the research's data collection, was realized there is a latest information gap about the subject, since the newest data found are from INMETRO (1998), stating that only 40% of women on the fertile period wear industrialized sanitary pads. Trying to obtain more data for the necessary research background, was applied a questionnaire that, as well as supplying the more recent data need related to the usage of disposable sanitary pads, has also tried to understand the way the pads are used and discarded.

The questionnaire was made available online, with 130 accesses, therefore only 50 users replied to the questions completely, demonstrating a possible discomfort in answering certain questions. This behavior could be linked to a menstrual taboo.

The questionnaire was formed by 5 questions, with the first one allowing multiple choice, and the remaining ones being open questions. The first question was: What kind of sanitary pad do you wear?, with the following options for answers: sanitary pads with flaps, daily pads, night pads, menstrual collector, fabric, tampons, sponge, and others. The graphic below presents the results obtained to this question (Figure 4).

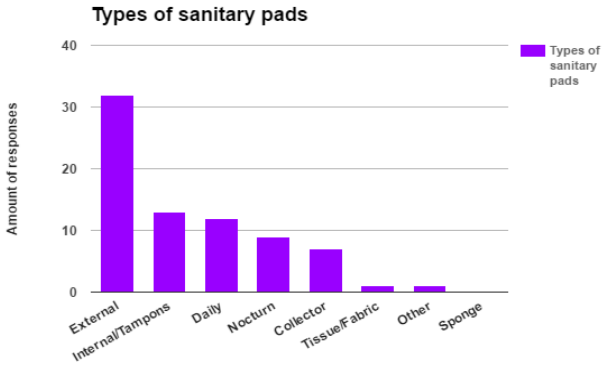

Figure 4. Graphic representation of the types of sanitary pads worn.

For being a multiple-choice question, analysing the individual responses is possible realize that many of the users who opt for the external pads wear more than one type during the same menstrual cycle. For example, the daily sanitary pad, as well as being adopted during low-intensity cycles, is also adopted during the absence of menstrual flow. Therefore, the external pads with flaps are worn in increased-flow cycles.

The second question of the questionnaire was: If you wear a disposable kind of sanitary pad, how many do you usually wear per menstrual cycle? For being an open question, the minimum amount was between 3 and 4, and the maximum amount was 30 – the average amount answered was 20 (with 8 answers).

The third question was: Why do you opt for this type of sanitary pads instead of others? Was observed that many women had wrongful ideas about certain models, as per example the use of the menstrual collector. Some of them still have doubts about the use of tampons when they are still virgins. The menstrual collector is a great solution for the amount of waste generated, as well as for women's health, since tampons can loosen Rayon fibers (synthetic fabric that composes the body of tampons), increasing the chance of developing toxic shock syndrome (TSS).

The fourth question was: Do you know the menstrual collector? What is your opinion about it? By analyzing the answers given, was realized there is a great divergence between users, some of them wrong, as for example the ideas they have about the product's sanitation. Manu users, even though they are in favor of the collector, still hold some discomfort related to the product. One of the participants reported that she had her doubts regarding the collector's sanitation, since she works long hours. She also stated she feels uncomfortable about cleaning the item in the same bathroom the family uses for brushing their teeth. Based on that, was realized that the majority of users still holds prejudice, many times unfounded, about the menstrual collector, not giving up of the traditional disposable sanitary pads.

The questionnaire's last question was: How do you discard the packaging? This question was realized to discover how the users usually throw the packaging of the pads away, based on a hypothesis that the discard would be done in the toilet's trash can, along with the disposable pad, instead of the recyclable bin. The majority of answers (13) said that the sanitary pad was involved with toilet paper and thrown in the garbage along with its packaging, confirmed the initial hypothesis, and characterizing a lack of knowledge regarding the ideal waste separation.

By analyzing the results in a broad scale, was reached the conclusion that the majority of women still wear disposable external pads for several reasons, going from insecurity to tradition and hasty ideas related to others. It's possible to conclude that the disposal of the product and its packaging is not ideally made, since both as discarded into the regular trash can.

Was concluded that the menstrual cycle still being a taboo for many women, in some more extreme cases preventing them for leaving the house, and in some simpler cases the feeling of discomfort when talking about it. This happens throughout the world. Proof of that is the story of Kiran Gandhi, who decided to run the London Marathon without wearing a sanitary pad – not only stating her discomfort, but also as a form of manifestation, showing that the period should not be seen by anyone as a taboo, since it is a natural occurrence, and therefore should be seen as such. In her personal website, Kiran Gandhi posted the following sentence: "I ran with blood dripping down my legs for sisters who don't have access to tampons and sisters who, despite cramping and in pain, hide it away and pretend like it doesn't exist. I ran to say, it does exist, and we overcome it every day."
This questionnaire was relevant for presenting clearly the type of sanitary pads adopted by women, and their personal reasons for choosing one over the other, as well as focusing on a sustainable alternative that can be tailored to the current female needs.

4 Results

Based on the questionnaire analysis and the researches on the subject, the project focused on the development of an external pad (for currently being the most accepted by women). For the manufacturing of this new sustainable pad, was considered several aspects. It's possible to see that the menstrual collector would be capable of solving almost completely the environmental problems, but is still seen by many as a taboo, leading them to keep wearing the standard external disposable pads..

4.1 Development of the final proposal

Based on the bibliographical data collection and on the questionnaire applied, was established requirements to guide the concepts, such as level of menstrual flow, possibility of recycling or biodegradation, awareness of environmental problems related to the traditional sanitary pads and their ideal disposal, and selection of alternative eco-friendly materials.

After this alternative-listing process, combined with creativity methods including the mental map and the morphological matrix, was realized a comparison with the previously established requirements, and noted a better fitness of the alternative below.

F

igure 5. Final alternative.

The alternative is formed by a double-packaging kit, along with underwear plus refill. Through a compilation of data, was realized the necessity of an external alternative – that was when this kit came through, which allows an easy exchange, hygiene, and all the practicality that could not be left aside.

The first packaging (Figure 5 – I) would have two distinct options: one of which with the underwear plus 10 refills; and the other with 12 refills with no extra underwear. The closing of the packaging is made with a card-paper glove, involving the four sides of the package. The second packaging (Figure 5 – II) would be mainly destined to the underwear's individual sale, since the user needs more than one per cycle, and would adapt the quantity according to her needs. This alternative brings the underwear along with the refills attached to it, without the necessity of glue, currently used by many brands, forming the following solution (Figure 5 – III).

The visual identity for the product would be a packaging with saturated colors, highlighting the dark background, simulating a blackboard, emphasizing the choice of colors and fonts selected for the information throughout the packaging.

None of the alternatives uses glue, since a hook system was developed (Figure 6) to close the packages – this is positive because it allows the entire recycling of the packaging, avoiding the use of glue, originated from petroleum. The system works in a way that the triangles on the extremities of the hook are folded, and the hook goes through the hole on the opposite side of the packaging.

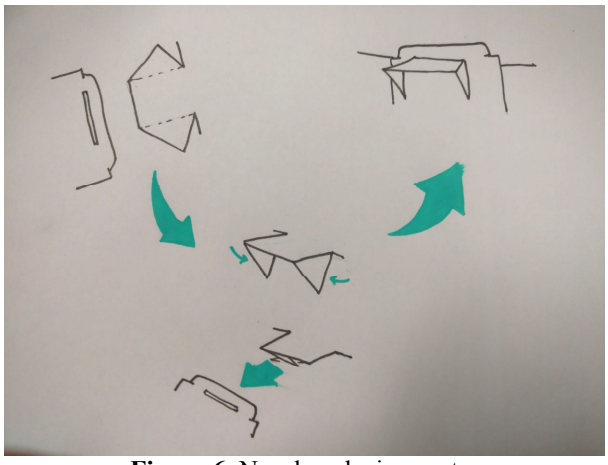

Figure 6. No-glue closing system

The package containing only the underwear was shaped in accordance to the female curves, with a see-through window so the user can see the product inside it. The sizes available for the underwear go from small to extra large, which can be verified on the front. Internally (Figure 7), there is an explanatory text about the ecological benefits of this type of sanitary pad, raising awareness for the discarding of the product. In order for reading all the information, the users need to open the whole box. This was not developed just so the user had greater interaction with the packaging, but rather to facilitate its discard. The internal texts presents a brief illustration stating the benefits of flutt, and the ill effects caused by non-renewable plastic materials present in regular sanitary pads.

Figure 7. Source: Planning of the internal part.

4.2 Materials and processes

To complement the interior developed to raise the user's awareness regarding the environment, was worked on a selection of alternative materials. The process was

divided in two different parts: the product, and the packaging.

For the first part, was used cotton and banana flutt. In search for alternative materials to replace the cellulose flutt, that due to polymer addition avoids the pad's biodegradation, was found fibers from banana trees in projects in Africa and India. The solution came from the necessity of developing an alternative sanitary pad to be used during the menstrual flow, since many women did not leave their homes for not having access to pads. The choice for the banana is due to the absorption of fibers from banana trees, since these trees produce fruits only once in their lives. Besides, bananas are produced in over 125 countries, being the planet's second most consumed fruit.

Regarding the industrial processes, the flutt's production process is similar to the production of cellulose flutt, therefore without the whitening phases and with the reuse of water, as is possible to see on the scheme below (Figure 8).

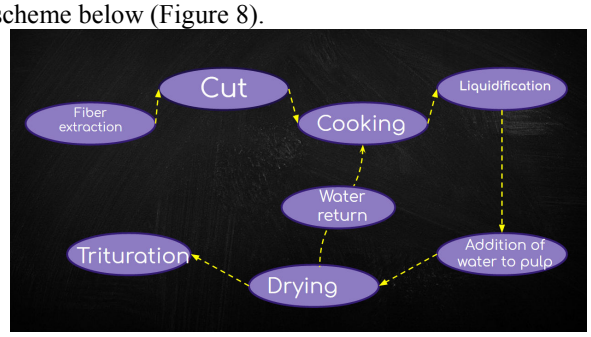

Figure 8. Production system.

After the flutt's production process, the material is covered by a thin fabric, with small permeations, made out of cotton with banana fibers.

Besides the changes in the product's materials, there are also changes in the materials composing the package, such as paints and varnishes. In search for a solution that would not go against the environment, was found a Brazilian company that supplies several colors for natural pigments. The paints from this company have the goal to replace the traditional ones.

The company's paints are oil-based, and they can be used by several offset printers without going through any kinds of alterations or special cleansing agents. The available colors are similar to the ones offered by the traditional printers.

To add a greater finish and durability to the packaging, is suggested the usage of sustainable varnishes. Another different aspect of such varnishes is the dispensability of the use of violet blue emission lamps, since these consume a great amount of energy and free Ozone within the atmosphere. In accordance to a national manufacturer of sustainable varnishes, "the prints made with sustainable paints and varnishes have their recyclability increased, since they allow that the paper is recycled with a decreased percentage of new fiber, and the one produced has mode elasticity and resistance."

In the end, was opted for using these paints over the card-paper, since other types of paints may present petroleum derivatives in their composition. Also, the card-paper is 100% recyclable, causing low environmental impact, and aggregating positive points to the sustainability offered by the product.

5 CONCLUSION

The project has reached the conclusion that the conventional sanitary pads significantly contribute to an increased production of solid residue in the world, since they are not biodegradable, not to mention the increased petroleum extraction they cause. This study created a proposal approaching the main prejudicial matters to the environment, such as the usage of plastic, glue and petroleum-based pigments, offering a solution without compromising the practicality of the female pads.

As previously mentioned, the amount of non-renewable materials used for the manufacturing of external sanitary pads represents an unnecessary waste of ever rarer sources. The packaging is still subjected to transportation, with its format easily fitting, easing the product's logistic.

Another environmental gain is the use of the banana tree fiber as a replacement for the traditional cellulose flutt present in the traditional pads. Its production does not demand great adaptations within the manufacturing system, and its extraction is facilitated due to the popularity of the fruit in Brazil.

To complement this ecological thinking, was developed a packaging that would raise the awareness of its users not only regarding the disposal of the sanitary pads, but also of their packaging, since many women discard the packaging along with the pads in the toilet garbage instead of recycling it.

Concluding, the proposal raised in this study may not solve all the problems related to the generation of residues related to the use of the traditional sanitary pads, but inserts and gives relevance to the environmental thinking on the development of products and the role of the designer when it comes to more sustainable solutions.

NOTE: The product presented hereby was developed as the Integrator Project's Packaging Module from the Product Design degree course offered by Santa Catarina's Federal Institute – Florianopolis, Brazil, being guided by the professors: Prof.ª Msª. Patricia Deporte de Andrade, Prof. Ms. Roberto Pistorello, and Prof. Heitor Eckeli.

References

Absorventes descartáveis: história, impactos ambientais e alternativas. Available in: <www.ecycle.com.br>. Access on: 23/09/2016.

Absorventes ProSec. Available in: <http://www.protfral.com.br/absorventes.html>. Access on: 08/03/ 2017.

Como um absorvente ecológico e hipoalergênico protege a saúde da mulher. Available in: <http://www.lohasstore.com.br/blog/absorvente-organico-e-ecologico-saude-da-mulher-e-planeta/>. Access on: 08/03/2017.

ÉPOCA, Globo. Testamos o absorvente ecológico. Vale a pena trocar? Available in: <http://epoca.globo.com/vida/vida-util/saude-e-bem-estar/noticia/2014/11/testamos-o-babsorvente-ecologicob-vale-pena-trocar.htm>. Access on: 25/10/2016.

HEALDOVE. Sanitary Napkins and Menstrual Pads of the Past and Present. 30/12/2016. Available in: <https://healdove.com/reproductive-health/Overview-of-menstrual-pads>. Access on: 07/02/2017.

INMETRO, Normas para absorvente. Available in: <http://www.inmetro.gov.br/consumidor/produtos/absorventes.asp#normas>. Access on: 27/09/2016.

LEOGRAF. Ecoline. Available in: <http://www.leograf.com.br/>. Access on: 05/12/2016.

Métodos para sustentabilidade: Revisão e síntese conceitual. Available in: <https://pt.slideshare.net/profjung/mtodos-para-sustentabilidade-reviso-e-sntese-conceitual>. Access on: 09/03/2017.

SINHA, Snigdha. Eco-friendly sanitary pads made of banana fibre: Saathi pads's solution to menstrual waste. 2015. Available in: <https://yourstory.com/>. Access on: 30/11/2016.

Sisterhood, blood and boobs at the London marathon 2015. Available in: <https://madamegandhi.blog/2015/04/26/sisterhood-blood-and-boobs-at-the-london-marathon-2015/>. Access on: 08/03/2017.

SPANGENBERG, Joachim H. Design for Sustainability (DfS): Interface of Sustainable Production and Consumption. Available in: <https://link.springer.com/referenceworkentry/10.1007/978-1-4020-8939-8_63>. Access on: 08/03/2016.

The New Victoria menstrual pad holder & belt. Available in: <http://www.mum.org/victor1.htm>. Access on: 09/03/2017.