RECEIPTS 2022 - TOXIC FOR AQUATIC ORGANISMS?

ENTRY TO THE STOCKHOLM JUNIOR WATER PRIZE 2023

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Abstract

Chemicals are constantly present in daily life and are found in thermal paper such as receipts. Through littering and contamination of the recycling cycle, chemicals frequently end up in ecosystems. Specifically, they can be found in lakes and streams. The purpose of this study was to analyze whether receipts distributed 2022 were toxic for aquatic organisms. The method was to study the mortality of the model organism, *Daphnia magna*, when exposed to receipts from various stores. The short-term effect, of the exposure, on the mortality of the model organism was studied. Additionally, the study analyzed whether the thermal papers contained phenol by performing the Molisch's test. The result of the model study indicated the existence of a relation between mortality and exposure to receipts. A higher mortality became apparent with a larger area of receipt. The result also confirmed the presence of phenol in all analyzed thermal papers. The conclusion that could be drawn was that further research was necessary to confirm the toxicity of receipts. Thereby the study can be used as a guideline for future research that can enhance further protection of the environment and the biological diversity.

Keywords: ‧receipt‧phenol‧toxicity‧*Daphnia magna*‧Molisch's test

Abbreviations and Acronyms

‧BPA (Bisphenol A)‧BPS (Bisphenol S)‧HBG (Helsingborg)

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1 Introduction

1.1 Purpose

The purpose of the study was to research whether receipts distributed in 2022 were toxic for aquatic organisms, studied with a quantitative method. The mortality of the model organism, *Daphnia magna*, was studied when exposed to receipts. In addition the study aimed to analyze whether thermal paper contained phenol.

1.2 Background

Chemicals appear everywhere in daily life, some more harmful than others. Bisphenol A, also known as BPA, is a chemical that has been used diligently in a quantity of products such as in plastic bottles, preserving tins, and in thermal paper.[1] Over the past few years the use of BPA has been limited since it has been concluded that the chemical is an endocrine disruptor and also affects the reproductive capacity in animals. For example, the use of BPA in thermal paper has been drastically restricted in the EU since January 2020.[2] Prohibited chemicals are often replaced

[1] Livsmedelsverket. Bisfenol A. *Livsmedelsverket*. 2022.
[2] Karolinska institutet. Bisfenoler. *Karolinska institutet.* 2022.

by substituents with similar characteristics. BPA has therefore been widely replaced by the chemical analog BPS, Bisphenol S, since the EU-Commission's decision to prohibit BPA in higher percentages than 0,002 % in thermal paper.[3]

Thermal paper can not be recycled due to the lack of methods to separate the base paper from it's thermal layer containing the chemicals.[4] Earlier the risk of contaminating the paper recycling process with BPA was vast, as a result of receipts often ending up the paper recycling. Currently there is instead a risk of BPS contaminating the paper recycling and creating a toxic flow in the recycling process.[5]

Receipts are constantly circulating in society. Consumers always have the right to a receipt upon purchase according to Swedish law and receipts can be offered either digitally or in paper form.[6] In 2022, the majority of receipts were physical, which resulted in consumers receiving a great number of paper receipts that could not be recycled. Receipts that despite this end up in the paper recycling contaminates the recycling cycle.[7] Similarly to this the receipts that end up in nature, as a result of littering, will expose organisms to chemicals. This could in turn affect ecosystems.

1.3 Research questions

- Are receipts distributed in 2022, containing BPA substituents, toxic for aquatic organisms studied with the model organism *Daphnia magna*?
- Do receipts distributed in 2022 contain phenol?

1.4 Delimitations

The study was delimited by only studying the toxic effects of receipts on aquatic organisms using the model organism *Daphnia magna,* see 2.4. A geographic delimitation was also made by only analyzing receipts from three chain stores located in HBG, Sweden. Receipts from both a nationally large store (Ica Maxi Stormarknad HBG) and international stores (Zara Väla HBG and

[3] Maria, Backman. Nytt giftigt ämne misstänks ersätta förbjudet ämne i kvitton. *Sveriges Natur.* 2018.
[4] Katherine, Martinko. The Right Way to Dispose of Paper Receipts. Treehugger. 2021.
[5] RISE. Bisfenol S har ersatt bisfenol A i kvitton. *RISE*. 2020.
[6] SFS 2011:1244. *Skatteförfarandelag*.
[7] Katherine, Martinko. The Right Way to Dispose of Paper Receipts. Treehugger. 2021.

McDonald's Väla HBG) were used. Additionally, the study was time-limited and overall the daphnia were studied for 60 minutes.

2 Theory

2.1 Thermal paper

Thermal paper is a certain type of paper used in receipts, labels, and tickets. Substances in thermal paper are easily loosened and transferred to fingers or other materials at physical contact.[8]

The thermal paper is printed with heat from thermal printers, resulting in text appearing on the surface. Thermal printers are widely used by stores as they do not require much maintenance. Thermal paper is composed of a base paper, a precoat layer, and a thermal layer. The purpose of the thermal layer is to produce text on the paper. The development of the text or images on the thermal paper occurs through a thermal reaction where thermal energy is transferred. It is therefore the transfer of energy that causes the coating on the paper to change color into black.[9]

Both BPA and BPS are chemicals that are used during the heat-activated printing process and are found in the thermal layer of thermal paper. Therefore, it is the surface of receipts that contains BPA, BPS, or other substituents.[10] Thus, it is appropriate to use the surface area when comparing thermal paper with regard to the thermal layer.

2.2 Substitution of BPA

Bisphenols are substances classified as phenols. Several bisphenols are categorized as reproductive and endocrine disruptors. Despite these established facts, bisphenols still find numerous areas of application.[11]

[8] Carl-Axel Fall. Farliga kvitton. *Sveriges Natur*. nr 1, 2011.
[9] Jujo Thermal Kauttua. Thermal paper technology. *Jujo Thermal Kauttua*. u.å.
[10] Minnesota Pollution Control Agency. BPA and BPS in thermal paper. *Minnesota Pollution Control Agency*. u.å.
[11] Stockholms stad. Bisfenoler. *Miljöbarometern*. 2021.

The use of BPS and BPA substitutes in thermal paper has increased. The prohibition of BPA in thermal paper has compelled manufacturers to transition to alternative options. Consequently, the prevalence of BPA-based thermal paper in Europe declined from 71% in 2014 to 26% in 2019. Conversely, the usage of BPS in thermal paper increased by 80% during the corresponding period. The prognosis suggests that BPA-based thermal paper will either be entirely replaced by BPS-based alternatives or substituted with a combination primarily consisting of BPS, alongside other substitutes.[12]

BPS has emerged as the predominant substitute for BPA in thermal paper. However, the structural analog BPS has been reported to possess detrimental health effects and demonstrated negative impacts on humans and rodents. It has been ascertained that, in the absence of a clearly defined substitution plan, there is a substantial risk of resorting to harmful alternatives to BPA. Consequently, researchers propose that the regulation of substitutes in thermal paper should be implemented concurrently with the expansion of restrictions on BPA.[13]

2.3 BPS

It has been established that different analogues of bisphenols operate in various ways, on different systems in the body and possess different characteristics in regards to toxicity. BPS has been proven to be a more toxic phenol than BPA, affecting the reproductive system. Regulating the use of BPS in the same way as BPA could therefore be considered necessary.[14]

2.4 *Daphnia magna*

Daphnia magna is a genus within the crustaceans.[15] The lifespan of *Daphnia magna* is between 10-30 days.[16] The aquatic organism is a frequently used model organism to research the toxicity

[12] European Chemical Agency. *The use of bisphenol A and its alternatives in thermal paper in the EU during 2014 - 2022*. 2020.
[13] Kostyantyn Pivnenko, David Laner, Thomas F. Astrup. Dynamics of bisphenol A (BPA) and bisphenol S (BPS) in the European paper cycle: Need for concern? *Elsevier*. Vol. 133, 2018: 278-287.
[14] Michael Thoene, Ewa Dzika, Slawomir Gonkowski, Joanna Wojtkiewicz. Bisphenol S in Food Causes Hormonal and Obesogenic Effects Comparable to or Worse than Bisphenol A: A Literature Review. *Nutrients*. Vol. 12, nr. 2, 2020.
[15] Livet i havet. Daphnia. *Livet i havet.* 2022.
[16] Carrie Miller. Daphnia pulex. *Animal Diversity Web*. 2000.

of various products.[17] The reason *Daphnia magna* is often used as a model organism is because they are sensitive to changes in the chemical composition of the water they are in.[18]

Daphnia has a significant role in the marine food chain since they are an important source of nutrition for fish and other aquatic animals.[19] Thus, it leads to other organisms further up in the food chain accumulating toxins that daphnia have been exposed to, so called bioaccumulation.[20] Daphnia are found in freshwater, but some species can also be found in other marine environments. The aquatic organism is commonly encountered in lakes, bays, ponds, and also in the northern parts of the Baltic Sea.[21]

2.5 Ethanol

Ethanol is an alcohol with low toxicity to daphnia and other aquatic organisms in lower concentration. Larger amounts of ethanol can however result in poisoning.[22]

2.6 Printer paper

Printer paper consists of paper pulp in the form of cellulose fiber, water, and other filling materials.[23] The printer paper is therefore comparable to the base paper of thermal paper.

2.7 Molisch's test

Molisch's test is a chemical test used to detect the presence of a carbohydrate in an analyte, which is the substance being analyzed. The reagent uses a solution of a phenol in ethanol and then the analyte and a few drops of concentrated sulfuric acid are added. The possible carbohydrate forms an aldehyde with sulfuric acid. The aldehyde is in turn condensed by the phenol and forms a colored complex. Therefore, the formation of a colored complex demonstrates the presence of a carbohydrate.[24] Molisch's test can also be used to analyze the

[17] Angelika Tkaczyk, Adam Brownik, Jaroslaw Dudka, Krzysztof Kowal, Brygida Ślaska. *Daphnia magna* model in the toxicity assessment of pharmaceuticals: A review. *Science of The Total Environment.* Vol. 763, 2021.
[18] Environmental Inquiry. Why *Daphnia*? *Cornell University & Penn State University.* u.å.
[19] Ibid.
[20] Livet i havet. Daphnia. *Livet i havet.* 2022.
[21] Ibid.
[22] VWR International AB. Etanol odenaturerad [Faktablad]. 2006.
[23] SkogsSverige. *Papperstillverkning*. SkogsSverige. 2021.
[24] Mohanlal Sukhadia University. Molisch's Test. *Mohanlal Sukhadia University*. u.å.

presence of a phenol, a bisphenol for example. By adding a carbohydrate, glucose for example, it is ensured that a red complex is formed if a phenol is present.[25]

3 Materials

Aquarium water, concentrated sulfuric acid, denatured ethanol, dry yeast, ethanol, glass beaker 100 ml, glass beaker 250 ml, glass pipette, glucose, marking pen, plastic bags, plastic container made of propylene plastic 65 l, plastic gloves, plastic pipette, printer paper, ruler, scale, scissors, spirulina powder, starter culture of *Daphnia magna*, test tube, test tube rack, thermal paper from Ica Maxi Stormarknad HBG, thermal paper from McDonald's Väla HBG, thermal paper from Zara Väla HBG, and tweezers.

4 Methodology

4.1 Collection of receipts

The collection of receipts was carried out to create the needed conditions for the model test. Plastic gloves were used to collect unwritten receipts from cash registers at chain stores; Ica Maxi Stormarknad HBG, McDonald's Väla HBG, and Zara Väla HBG. All receipts were collected on the same day. The receipts were placed in separate plastic bags for keeping.

4.2 Cultivation of *Daphnia magna*

The purpose of the cultivation of *Daphnia magna* was to create a population of model organisms. Acclimatization was performed by gradually acclimating a starter culture of *Daphnia magna* to aquarium water. The daphnia were stored in a 65-liter polypropylene container filled with 30 liters of aquarium water. The *Daphnia magna* were fed with a mixture of spirulina powder and dry yeast, which was blended with the aquarium water. The cultivation was carried out until the population reached approximately 200 daphnia, ensuring a sufficiently large population for the model test.

[25] Stockholms universitet. Bisfenol i vardagen. *Kemilärarnas resurscentrum*. 2020.

4.3 *Daphnia magna* exposed to receipts and printer paper

The purpose was to expose *Daphnia magna* to receipts collected from various chain stores, collected in 4.1, as well as printer paper. The exposure was conducted using receipts and printer paper with different surface areas. Therefore, the steps outlined in sections 4.3.1 and 4.3.2 were repeated three times with each respective area: 4 cm^2, 64 cm^2, and 136 cm^2. The study was conducted with two control groups to ensure a more reliable outcome. A positive control which was expected to result in high mortality and a negative control where low mortality was anticipated.

4.3.1 Preparation before exposure

Twelve 250 ml glass beakers were filled with 50 ml of aquarium water each, taken from the container in which the daphnia were cultivated. Three beakers were labeled “Maxi,” three were labeled “McDonald's,” three were labeled “Zara,” and the remaining three were labeled “Printer paper” using a marking pen. For each beaker, paper from the specified source was prepared. Receipts and printer paper were cut using a ruler and scissors. The surface areas were predetermined and varied according to the information provided above. Five daphnia were placed in each beaker.

4.3.2 Exposure

The determined area of the receipt or printer paper from each source was placed in the beaker marked with the name of the source. The daphnia were exposed to the paper for 30 minutes. When the time expired the papers were removed using tweezers.

4.3.3 Analysis of mortality

The mortality of the daphnia was noted after the incubation period. 15 minutes after the removal of the papers, any new deaths were noted, and this process was repeated after an additional 15 minutes.

4.3.4 Positive control

For the positive control, three 250 ml beakers were prepared with 50 ml of aquarium water each.

Five daphnia were placed in each beaker. 2 ml of ethanol was added to the aquarium water using a plastic pipette. The mortality of daphnia was noted after 60 minutes.

4.3.5 Negative control

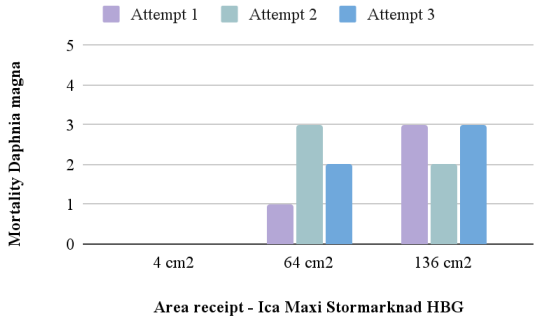
Three 250 ml beakers were filled with 50 ml of aquarium water each. Five daphnia were placed in each respective beaker. The mortality of the daphnia was noted after 60 minutes.

4.4 Detection of potential phenol in receipts

Molisch's test was used to investigate the presence of phenol in the papers to which *Daphnia magna* was exposed. Five test tubes were labeled according to the specified sources: “McDonald's”, “Zara”, “Maxi”, “Printer paper”, and “Control” with a marking pen and placed in a test tube rack. 0,1 g of glucose was weighed on a scale and 7,5 ml of denatured ethanol was measured using a glass pipette. In a 100 ml glass beaker, 0,1 g of glucose was dissolved in 7,5 ml of denatured ethanol. 1,5 ml of the ethanol and glucose solution was pipetted into each test tube. A 2 cm^2 area of the corresponding paper was placed in each test tube. No paper was added to the control. 1 ml of concentrated sulfuric acid was pipetted into all test tubes. The results were analyzed and noted down.

5 Result

5.1 *Daphnia magna* exposed to receipts and printer paper



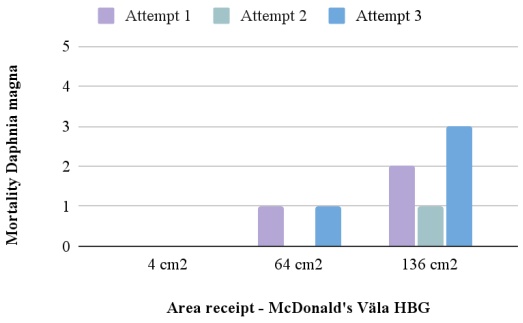
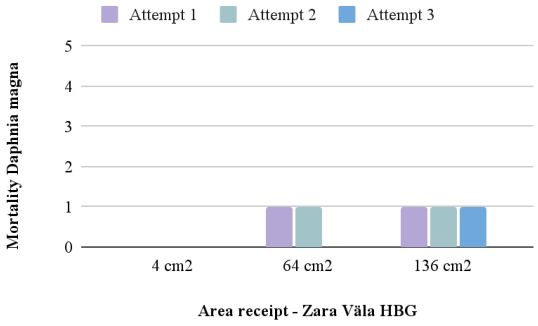


Figure 1: *Mortality of five Daphnia magna when exposed to receipt from Ica Maxi Stormarknad HBG with the area 4 cm², 64 cm², and 136 cm². Three attempts were performed for each corresponding area.*

Figure 2: *Mortality of five Daphnia magna when exposed to receipt from McDonald's Väla HBG with the area 4 cm², 64 cm², and 136 cm². Three attempts were performed for each corresponding area.*



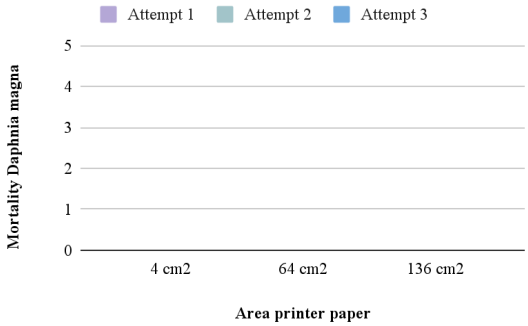


Figure 3: *Mortality of five Daphnia magna when exposed to receipt from Zara Väla HBG with the area 4 cm², 64 cm², and 136 cm². Three attempts were performed for each corresponding area.*

Figure 4: *Mortality of five Daphnia magna when exposed to printer paper with the area 4 cm², 64 cm², and 136 cm². Three attempts were performed for each corresponding area.*

The result in Figure 1 shows that no daphnia died when exposed to 4 cm^2 receipts from Ica Maxi Stormarknad HBG. However, when the daphnia were exposed to 64 cm^2 receipts from the source an average of 40 % died while an average of 53 % died when exposed to 136 cm^2 receipts.

The result in Figure 2 shows that no daphnia died when exposed to 4 cm^2 receipts from McDonald's Väla HBG. However, when the daphnia were exposed to 64 cm^2 receipts from the source an average of 13 % died while an average of 40 % died when exposed to 136 cm^2 receipts.

The result in Figure 3 shows that no daphnia died when exposed to 4 cm^2 receipts from Zara Väla HBG. However, when the daphnia were exposed to 64 cm^2 receipts from the source an average of 13 % died while and an average of 20 % died when exposed to 136 cm^2 receipts.

Figure 4 shows the mortality of the daphnia when exposed to printer paper. Mortality was absent when exposed to printer paper with the areas 4 cm^2, 64 cm^2, and 136 cm^2.

5.2 Positive control and negative control

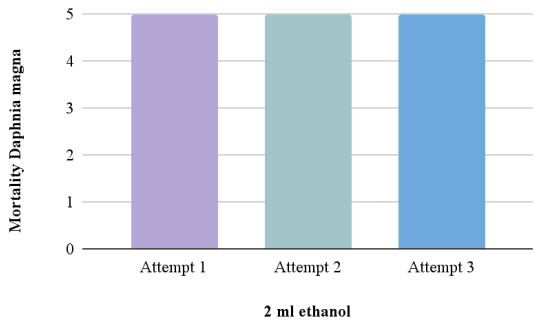


Figure 5: *Mortality of five Daphnia magna when exposed to 2 ml ethanol.*

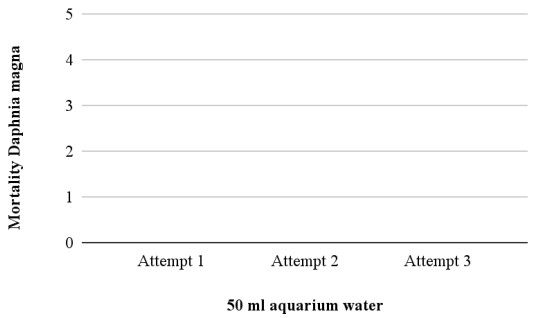


Figure 6: *Mortality of five Daphnia magna when exposed to 50 ml of aquarium water.*

Figure 5 shows that the mortality of the daphnia, in the positive control, was 100 % in all exposures. Figure 6 shows that the mortality of the daphnia, in the negative control, was 0 % in all exposures.

5.4 Detection of potential phenol in receipts

With all receipts, a red complex was formed when performing Molisch's test, while the complex was absent with printer paper and the control, see Appendix 1.

6 Discussion and conclusion

6.1 Evaluation of results

The result shows that all tested thermal papers contained phenol. This could be concluded due to the appearance of a colored complex when performing Molisch's test, see Appendix 1. Printer paper did not contain phenol unlike all thermal papers as no colored complex appeared when performing Molisch's test, see Appendix 1. The result indicates that either one or more phenols,

possibly bisphenols, were present in the thermal paper from McDonald's Väla HBG, Ica Maxi Stormarknad HBG, and Zara Väla HBG which were not present in the printer paper. However, Molisch's test only concluded if there was a phenol in the receipts and what phenol they contained could therefore not be determined.

As previously mentioned, it could be ensured that printer paper did not contain phenol whilst all thermal papers did. When daphnia was exposed to the thermal papers a mortality became apparent, see Figures 1, 2, and 3. Although, when the organism was exposed to printer paper the mortality was absent, see Figure 4. This indicates that the mortality of *Daphnia magna* was caused by the thermal layer, containing a potential phenol. Because of the already existing information that bisphenols are hazardous to health and also used to a high extent in thermal paper it is very conceivable that the phenol found in the thermal paper is a bisphenol. Since BPA was prohibited in thermal paper during 2020, other BPA-analogues have substituted the chemical. BPS is a substitute to BPA that has overtaken BPA's place to a high extent. Thus, there is a high probability that the phenol detected in the thermal papers was BPS.

A parallel between the mortality of the daphnia and exposure to receipts containing phenol could be drawn. The increase in mortality with an increase in the area of thermal paper indicates a connection between the area and the mortality. With an increased area of receipt, a greater number of daphnia died. However, no mortality was observed when daphnia was exposed to thermal paper with an area of 4 cm^2, as seen in Figures 1, 2, and 3. Thermal paper with an area of 4 cm^2 had no visible impact on the daphnia. An assumption is that the concentration of chemicals on receipts with an area of 4 cm^2 was too low to affect the daphnia. Note that further research needs to be conducted to confirm this assumption.

The mortality varied among the different receipts that were studied. The most distinct result was obtained when the daphnia were exposed to receipts with an area of 136 cm^2. In Figure 1, it is shown that on average 53 % of the daphnia died when exposed to receipts with the area 136 cm^2 from Ica Maxi Stormarknad HBG. Figure 2 shows that on average 40 % of the daphnia died when exposed to a receipt with an area of 136 cm^2 from McDonald's Väla HBG. At the same

time Figure 3 shows that on average 20 % of the daphnia died when exposed to a receipt with the same area from Zara Väla HBG. The mortality was the highest when the daphnia were exposed to receipts from Ica Maxi Stormarknad HBG, while it was the lowest when the daphnia were exposed to receipts from Zara Väla HBG. The observed difference in percentage could have been caused by the different properties and toxicities of bisphenols, assuming that the detected phenol was a bisphenol. Additionally, different concentrations of chemicals on the various thermal papers may have resulted in different effects. It is also possible that other chemicals were present, contributing to the mortality of the daphnia.

The results of the positive and negative controls provided a basis for a more reliable result. 100 % of the daphnia died in the positive control, as shown in Figure 5, and 0 % of the daphnia died in the negative control, as shown in Figure 6. These results can be used to strengthen, analyze, and explain the results regarding the mortality of the daphnia, when exposed to thermal paper. Therefore, the controls serve as quality strengthening for the study.

6.2 Sources of error

One of the potential sources of error that may have occurred during the study was that the daphnia could have been in different stages of life at the time of exposure. Due to the lifespan of *Daphnia magna* being between 10-30 days, they could have died from natural causes. However, this potential source of error was minimized as the negative control did not show any deaths. Additionally, only short-term mortality was studied, within a 60-minute timeframe, which reduced the likelihood of natural causes of death.

Furthermore, the daphnia varied in size which could have resulted in different responses to the exposure. The variation in size of the daphnia may have led to smaller daphnia being exposed to a higher concentration of chemicals relative to their size. Consequently, they may have been affected differently by the chemicals, which could have been a contributing source of error. The daphnia could thereby have been affected by the thermal papers even if it did not result in their death.

Since the cause of death was not investigated, the mortality of the model organisms could be caused due to various reasons. The daphnia may have died as a result of stress or because of other factors during the transfer to the test beakers. The populations in the test beakers that were examined consisted of only five daphnia, which makes this source of error significant. However, no deaths were observed in the negative control, which can minimize this potential source of error.

6.3 Laboratory improvements

For a broader result, a laboratory improvement could be to examine receipts from a larger number of chain stores located in HBG. This could contribute to a more comprehensive result, which in turn could answer the research question more thoroughly. The conclusion would thus be more extensive.

A more reliable result could be obtained by increasing the number of daphnia in the beakers. During the exposure, only five daphnia were tested in each beaker. A laboratory improvement would therefore be to use a higher quantity of model organisms to obtain a more reliable result. Any deaths caused by natural causes would then be less significant for the outcome.

Molisch's test only confirmed the presence of phenol in the receipts and did not identify whether they contained bisphenol. Further investigation is necessary to examine whether receipts distributed 2022 contain bisphenol specifically, rather than any other phenol. The method could have been improved by conducting additional tests to identify the specific phenol that was detected.

By examining the daphnia population over a longer period of time, results on their long-term effects of the exposure could be obtained. During the exposure, the mortality of the daphnia was only analyzed for 60 minutes. This is a relatively short time compared to the duration of time receipts spend in aquatic environments. Additionally, a wider range of receipt areas would lead to a more diverse result. This would create conditions for a more specific connection between

area and mortality. Thereby, a more precise conclusion regarding the toxicity of receipts distributed in 2022 could be drawn.

6.4 Conclusion

The conclusion that can be drawn from the results is that receipts distributed in 2022 indicate to have a negative impact on *Daphnia magna*. The mortality differed between exposure to receipts and printer paper. This confirms that the receipts were likely toxic to the population of daphnia. However, it cannot be determined what specifically caused their death. Due to the characteristics of the model organism *Daphnia magna*, it is likely that the receipts also could affect other aquatic organisms. Nonetheless, the extent of their impact cannot be confirmed. Therefore, the research question regarding the toxicity of receipts distributed in 2022 cannot be fully answered.

Further research is required to ascertain whether receipts distributed in 2022 were toxic to *Daphnia magna* and other aquatic organisms, as well as to confirm the harmful effects of receipts. Additional research is also needed to investigate the long-term effects. However, the research question regarding phenol in thermal paper was confirmed through Molisch's test. The conclusion that could be drawn is that all thermal papers contained phenol.

6.5 Reflection regarding sustainable development

Receipts consist of thermal paper with a thermal coating treated with chemicals. The chemicals used can be toxic. As a result of receipts and their chemicals entering the environment through littering, for example, they could potentially impact entire ecosystems and consequently the environment.

The aim of this study was to investigate whether receipts distributed in 2022 are toxic to aquatic organisms. In doing so, this research study can contribute to advancements in several of the 17 Sustainable Development Goals. Goal 12, concerning sustainable consumption, Goal 14, regarding oceans and marine resources, and Goal 15, concerning ecosystems and biodiversity, are all relevant to this study. Mapping the toxicity of receipts distributed in 2022 can serve as a guide for determining the necessary measures to improve sustainable development.

The safest solution to prevent negative effects on ecosystems and aquatic organisms is therefore to transition to digital receipts. Digitalization can be used as a tool to protect the environment and biodiversity. Risk reduction can thus be achieved through the phase-out of physical receipts.

7 Evaluation of resources

The sources in this study fulfilled the criteria of tendency, proximity, dependence, context and authenticity. If the criteria could not be met, the source was excluded.

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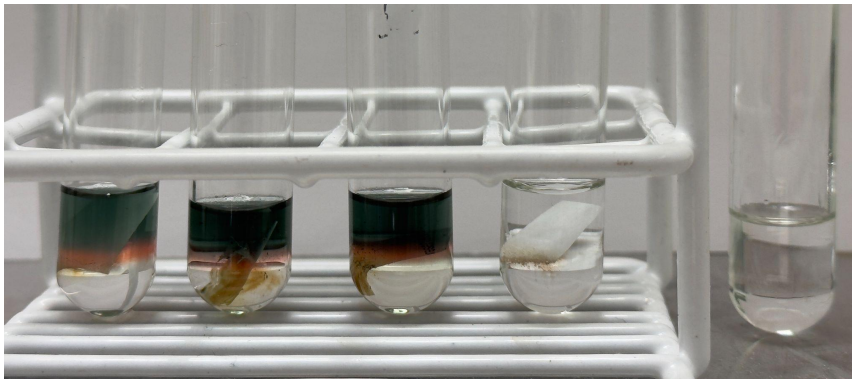
9 Appendix



Appendix 1: The result for the detection of potential bisphenol in receipts. From left to right: McDonald's Väla HBG, Ica Maxi Stormarknad HBG, Zara Väla HBG, printer paper, and control.