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ARE THE PAPER WASTE DEBRIS VERY HARMFUL TO HUMANITY? A SHORT REVIEW

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The review considers the issues related to the environmental problem of paper production, its consumption and paper wastes generated. The main risks of paper production, immoderate consumption of paper materials, formation of paper waste and its recycling are highlighted. The necessity of responsible and sparing attitude to the environment when using paper waste is emphasised.

Keywords: paper production, paper wastes, recycling, environmental risks, responsibility

ЯВЛЯЕТСЯ ЛИ ПАНДЕМИЯ ОТХОДОВ БОЛЬШОЙ УГРОЗОЙ ДЛЯ ЧЕЛОВЕЧЕСТВА? КРАТКИЙ ОБЗОР

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В обзоре рассмотрены вопросы, связанные с экологической проблемой получения бумаги, ее потребления и образующихся отходов бумажной макулатуры. Отмечены основные риски производства бумаги, неумеренного потребления материалов из бумаги, образования бумажных отходов и их переработки. Подчеркнута необходимость ответственного и щадящего отношения к окружающей среде при использовании бумажных отходов.

Ключевые слова: производство бумаги, бумажные отходы, переработка, экологические риски, ответственность

Waste is one of the most pressing problems of mankind. In this brief overview, we will only cover one type of waste - paper waste, as an example. However, everything that will be presented can be fully applied to numerous other biological and industrial wastes as well. In today's electronic age, people are starting to consider going paperless. But there's still a long way to go before we lose our dependence on this very important human product. While the paper has many benefits - renewable resources, biodegradability and versatility - it also has its drawbacks [1].

Where the paper products come from ? What are paper and paper materials? [2]

Paper comes from forests and is made from cellulose – forests being the main source of cellulose fibre (or woodpulp). From 2001 to 2019, a total of 386 million hectares of forest were lost globally (in all forest types combined). This loss represents an almost 10 % decrease in tree cover since 2000. From our newspapers to our paper wrappings, paper is still everywhere and most of them are ending up in our landfills creating a staggering amount of paper waste. There was a time when paper was a rare and precious commodity. Now it fills our planet. It was initially invented as a tool for communication, but today, paper is used more for packaging. From 2010 to 2060, the global consumption of pulp, paper and paperboards is expected to double. The same will be the amount of paper waste. An increased paper production will also add further to the pressure on the world's forests that are already in a critical state - and constantly getting worse. Besides woodpulp, paper can be made from other materials such as cotton, flax, esparto, straw, hemp, manilla and jute. This was simply and expressively articulated in the paper. Paper is an aqueous deposit of any vegetable fibre in sheet form [3].

A paper-based products typically contain 90–99 % cellulose fibres, which are the most essential component impacting end-use qualities and the principal structural element. The majority of paper grades are made up of both organic and inorganic materials. The organic fraction, which consists of cellulose, hemicellulose, lignin, and/or different lignin compounds (Na-lignite, for example), can range

from 70 to 100 % sometimes including filling and loading materials. The inorganic fraction of the paper, which consists primarily of filling and loading materials such as calcium carbonate, clay, titanium oxide, and so on, may range from 0 to 30%. [4].

What is paper waste? [5]

Paper waste is any form of paper that's no longer usable and needs disposing. It's essentially the kind of material we'd class as 'scrap paper'. For example it could be old newspaper, bills, or letters. It needs to be free from contaminants to be recyclable. For businesses, printing errors, junk mail, and packaging are some of the main paper waste types. Used cardboard also refers to waste paper. According to the Confederation of European Paper Industries (CEPI) definition reads, "Paper is usually called board when it is heavier than 220 g/m²". What paper and paperboard have in common is that they both consist primarily of cellulose fibres. But there are really points that set them apart from each other [6].

The macrodistinctions between the different types of paper waste?

Some specific features distinguish paperboard compared to paper:

- Paperboard can be made in a single ply or, more commonly, in multiple plies (multi-ply).
- Paperboard contains a higher proportion of long fibres than paper.
- Paperboard does not usually contain fillers.

Thus, paperboard is a heavier paper product with a multi-ply structure. [6]

Impact of paper production and waste paper on the environment

Everything takes energy to produce. To produce paper takes twice the energy used to produce a plastic bag. Paper manufacturing used up to 40% of all global wood. The process of manufacturing paper releases nitrogen dioxide, sulfur dioxide, and carbon dioxide into the air, contributing to pollution such as acid rain and greenhouse gases [7]. Deforestation is the primary effect of our mindless use of paper. Conservation groups have made an admirable headway in protecting ecologically rich forests and limiting commercial access. This is great progress for mankind! Just imagine how long a tree will grow to its full size... We are only just realizing the wasted use of our trees - trees that give off oxygen and protect the planet from further Global Warming. Another problem arises from everyone's much-needed paper consumption.

Environmental impact of toilet waste paper

Producing 42 million tons of toilet paper requires:

- 712 million trees
- 1,165 millions tons of water
- 78 million tons of oil

There are three different types of paper waste one can recycle [7]:

- *Mill broke* – any paper scrap or trimmings produced when manufacturing paper. It's generally recycled internally by the paper mills.
- *Pre-consumer waste* – paper sent away from the paper mill but discarded before a consumer uses it.
- *Post-consumer waste* – paper material received and used by a consumer and then discarded, such as newspapers, packaging, and printing paper.

What is the danger of waste paper? [8]

The life cycle of paper is damaging to the environment from the beginning to end. It starts off with a tree being cut down and ends its life by being burned – emitting carbon dioxide in the atmosphere. Paper production uses up lots of water. For instance, an A4 paper requires 10 liters of water per sheet.

As already mentioned, paper is obtained from the wood pulp. If we keep on cutting trees for a long period they will eventually vanish and finally, we have lots of environmental threats due to loss in balance in the ecosystem. The manufacturing process of paper can lead to deforestation, water pollution, and chemical use, as well as generate large amounts of waste. Hence, we should not waste paper.

Paper pollution is another effect of paper waste and it's a serious problem. It is estimated that by 2020, paper mills will be producing 500,000,000 tons of paper and paperboard each year! We obviously need this product and a reduction of use is not in the horizon. Pulp and paper is the 3rd largest industrial polluter of air, water and soil. Chlorine-based bleaches are used during production which results in toxic materials being released into our water, air and soil. When paper rots, it emits methane gas which is 25 times more toxic than CO₂. Pulp and paper mills contribute to air, water and land pollution and

discarded paper and paperboard make up roughly 26% of solid municipal waste in landfill sites. Pulp and paper generate the third largest amount of industrial air, water, and land emissions in all over the world. From the above, it follows that the most important challenges for humanity to preserve our environment and to reduce paper consumption and paper waste as well.

One example for comparison. *Is paper waste worse than plastic? Does paper pollute more than plastic?* [9]. Plastic bags generate 39% less greenhouse gas emissions than uncomposted paper bags and 68% less greenhouse gas emissions than composted paper bags. Plastic bags consume less than 6% of the water needed to make paper bags. [10]. This brief overview shows that the ever-increasing production of paper is having an extremely negative impact on the environment, and its continued unrestrained use is becoming another pandemic and a global problem for all mankind.

How can one help to reduce paper pollution and waste?

There are several ways to minimise the environmental impact of paper waste. The most important one is *recycling*. Recycling is the total system by which recovered materials are collected, separated, processed, and reused or returned to use in the form of a marketable product [5].

What is the chemical composition of paper waste?

In order to recycle any material, one need to know its composition. Paper is created mainly from organic compounds such as oxygen, carbon, hydrogen. This organic portion consisting of cellulose, hemi-cellulose, lignin and/or various compound of lignin (Na-lignate etc.) may be 70 to 100%. Paper has non-organic compounds also for improving the properties. Inorganic portion consisting of mainly filling and loading material such as caolin ($\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$), calcium carbonate (CaCO_3), clay ($\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$), titanium oxide (TiO_2) etc. may be 0 - 30% of paper. Information on the composition of waste paper is very diverse and often contradictory. Here are the data of the most reliable source. Waste paper is consisting of 37-62% cellulose, 3-20 % of hemicellulose, and 2-34% of lignin [11].

Recycled paper: Paper that is produced entirely from recovered paper.

How is paper recycled and what is it used for? [12]

The first steps of recycling are collection of paper from different sources, sorting and removing of contaminants. After transporting to a paper mill where recycling process really begins, the paper is mixed with water and other ingredients in a pulper, then heating the mixture churned the paper and breaks down. From this re-pulping, the slurry of cellulose fibers is screened for further cleaning and deinking. The next steps are refining and bleaching. The first one is realised by beating to make the recycled fibers swell following to the second step bleaching with hydrogen peroxide, chlorine dioxide, or oxygen to make it whiter and brighter. The papermaking is made by mixing the pulp with water and chemicals and this watery pulp comes the papermaking mashine and then is sprayed to wire screen where water is gained from the pulp. The obtained recycled fibers bond together to form a watery sheet. The remaining waste is removed on the press roller by squeezing. As it dries, it is formed into rolls of paper — *newly recycled paper - which is returned to use in the form of a marketable product.*

Recycled paper become a valuable secondary raw materials. It is used to make new products such as paper bags, toilet paper and all different kinds of boxes.

How many times can paper be recycled?

Waste paper made up of long fibers, so every time paper is recycled, those fibers will be shortened, making it harder to be recycled the next time. The average number of times your printer paper can be recycled is about five to seven times.

What is the main disadvantage to recycling paper?

Recycling can also have negative environmental impacts. For example, the process of recycling paper requires the use of chemicals and large amounts of water and energy. Similarly, recycling plastic can release harmful pollutants into the air and water [13]. Thus, to the question posed in the title of this short review "Are the paper waste debris very harmful to humanity?", the answer is as follows: YES, dangerous. Thus, the problem *How can one help to reduce paper pollution and waste?* has the following answers: less consumption, less waste, more recycling and reus.

Let us note that only with high personal responsibility of people can we achieve this and not drown in the debris of waste.

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