

Short-Review Article

An Overview of the Paper Recycling Process in Iran

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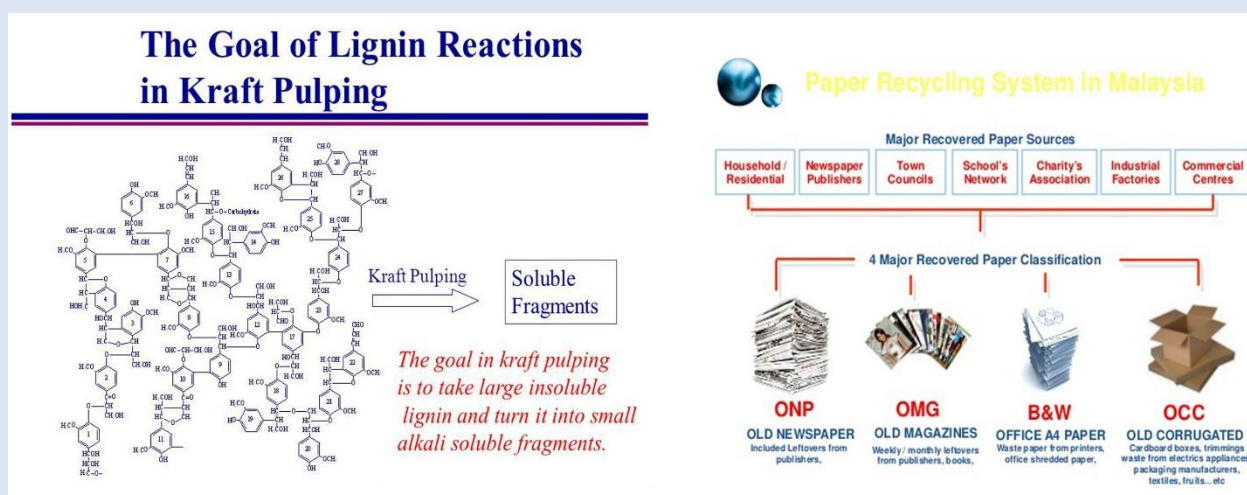
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Abstract: In the present article, the process of paper recycling and bleaching of this process has been studied. Due to the spatial and temporal dispersion and the need to find appropriate mechanisms, especially in metropolitan areas, the collection of waste paper and cardboard is economically and environmentally inevitable. In industrialized countries, the process of collecting waste paper is organized in such a way that the waste paper is prevented from entering the waste cycle from the very beginning. But in third world countries, despite sufficient technical knowledge, for various reasons, including the lack of regulatory organizations, lack of sense of responsibility of professionals in the field of recycling, public ignorance, the process is economically, health and biologically the environment does not work well and it is necessary to pay attention to the correct collection of waste paper. Due to the presence of valuable materials in the composition of municipal solid waste, which is sometimes referred to as dirty gold, unfortunately, the municipality costs a lot of money to collect them (75 to 80%) and often this waste, which They can be recovered and buried in the ground by applying correct and technical planning based on accurate and reliable information. The results of this study showed that the most important factors affecting paper recycling are: economic factors, the most important of which are inflation, environmental factors, consumption patterns, raw materials, technology, Products. Also, the best way to collect waste paper for recycling is to separate it from the source.

Key words: Loading, Paper, Bleaching, Environmental, Waste

Graphical Abstract:



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Introduction

Paper and cardboard are among the needs of advanced and industrial human societies. The two main functions of paper are the transfer of information and the protection of goods during the transfer and distribution of paper products [1]. The transfer of information is the type of printing and writing paper, newspapers, magazines, books, labels, letters and invoices. Packaging products include cardboard boxes, cans, envelopes, bags, sacks and baskets. Often the use of information and packaging coincide. Therefore, the scope of application of paper products is very wide. Six categories of cardboard and paper are produced, which are:

- Printing and writing
- Plain cardboard and congressional cardboard
- Newspaper
- Cardboard cardboard
- Packaging paper and cardboard
- Types of toilet paper (such as paper towels)

According to 1989 statistics, more than 65 million tons of printing and writing paper have been produced and consumed. This category includes printing papers for books, magazines, papers, computer paper, and personal correspondence. About 60 million of these papers are produced annually in the world. More than 18 million types of cardboard are produced in the world. Their main use is packaging. Most dry foods (such as roasted cereals) and household goods are packed in cardboard boxes [2-4]. It is a kind of cardboard with wax or plastic coating for packaging. Cardboard packaging paper is in the form of envelopes, bags, baskets, bags that are consumed daily and more than 20 million tons are produced and consumed annually. The use of paper as a raw material for the production of these products competes with certain materials such as plastics [5-7]. Sanitary paper includes paper towels, toilet paper, towels, and industrial and household hygiene products. Sanitary paper is one of the few paper products that the end consumer chooses and buys. The production of sanitary paper at a rate of 13 million tons per year is astonishing [8]. The most interesting and often the most valuable paper products are in the category of other materials. Examples in this category include paper bag printing, filters, securities, compressed paper, insulating paper, cigarette paper. Waste paper is used in the production of all types of paper except precious paper. Even in the case of precious paper, recycled materials such as waste cotton are often used. Waste paper is the main raw material in developed countries that are themselves producers and consumers of paper [9]. Currently, approximately 85 million tons of waste paper are collected and recycled

worldwide. It is clear that the world paper industry is the major recycler and supplies 1.3% of its raw materials from waste paper. What is waste paper labeled and where does it come from? What effect it will have on processing and its potential application in the future is considered.

The use of waste paper depends on the method of production of the first-hand dough. Regardless of quality considerations, paper recycling can never reach 100%. Paper is used to store information in archives or as a book and magazine in libraries. Most toilet paper is disposable. Recycling such papers poses health risks and is not acceptable.

Recycled Paper

If we want a clear definition and general knowledge of this matter, we must know that a clear definition cannot be made from recycled paper. Due to the problems of recycling printed paper and writing, recycling bins are more interested in good quality to the customer who did not reach the waste paper [10]. As I will explain later, this problem does not exist with wrapping paper. In 1987, the UK Office of Commerce and Industry commissioned a team to do this, which defined recycled paper. Paper from fibers derived from paper or cardboard machines, but this definition was not convincing too many environmentalists, paper makers and consumers. For example, Brandsair, a major UK recycling paper distribution company, has called for a redefinition of recycled paper. Many factories claim to produce recycled paper, but this claim is not true. Our feeling is that it is positively recycled with the environment and should really contain a lot of waste paper. Woodless waste paper is made from chemical pulp and mechanical waste paper is made from mechanical pulp. The raw material is the production of pulp and there are quick and easy chemical tests to determine the amount of wood. The advent of the UK paper and cardboard industry has also defined factory process papers as follows:

- 1- Pre-formed loops of paper that have been opened and are being opened for reuse in the same production line.
2. Conversions obtained from conversion that are returned for use in the same production line in the same production operation in other operations.
3. Fragments and papers obtained from the paper machine or conversion operations elsewhere in the factory cement with an affiliated factory that are returned to the original production line. Other waste and waste paper that should be discarded if not used to make up another 50% of recycled paper are as follows:

1. Process papers from a paper machine or conversion operation used in other factories to produce another product.

2. Process papers obtained from another paper machine or other conversion operations that are used in factories elsewhere to produce another product.

3. All other types of waste paper.

Currently, 85 million tons of waste paper are consumed worldwide. Most of the collected waste paper becomes a type of packaging paper and is used less for the production of printing, writing and newspaper papers. More than half of waste paper is used in the production of the least value-added products - cardboard and wrapping paper [11]. These papers are types of waste before and after consumption. The use of waste paper in the production of cardboard and low quality paper is for two reasons:

1- Proportion of the product with its application

2- Cheaper production and processing

The main function of these products is to protect the goods during transportation and distribution. For this purpose, waste paper responds well because the appearance of the paper is not very important. If appearance is important in some cases, recycled paper can form inner layers, and high-quality paper or recycled paper can be used for the top layer. Consumption of waste paper for the production of cardboard and wrapping paper is constantly increasing. And in some European countries it has reached about one hundred percent [12].

Printing paper must be free of any stains and imperfections. As a result, the cost of production is high and the production process is complex. In this regard, more than half of the global production of soft tissue paper is based on recycled paper. Due to the increasing demand of consumers, this ratio is increasing. The use of waste paper to produce newsprint is on the rise in North America [13]. In the past, only mechanical pulp and waste paper were exported to Southeast Asia for this purpose. But consumer demand and the passage of new laws have changed that, and waste paper waste is on the rise in North America.

Collection and Classification of Waste Paper

The use of waste paper depends on the efficiency and continuity of the waste paper collection and classification system. Recycling plants must ensure that they continue to supply their raw materials with the desired quality. Therefore, two more steps need to be added to the paper mentioned earlier; Collection of waste paper and their classification. There are various methods for collecting waste paper. As mentioned earlier, in the United Kingdom, out of 2.4 million tonnes of waste paper used in 1988, 1.4 million tonnes

of cardboard paper processing industries and the rest from department stores, voluntary institutions and other was obtained. Thus, more than half of the collected paper has never reached the final consumer. Regardless of the type of waste paper and who collects it, factories procure the waste paper they need from traders. Large recycling plants usually have a paper collection company that collects and supplies the factory raw materials. This method ensures the management of the factory. Figure 1 shows the Malaysia Paper Industry 2012.



Figure 1. Malaysia Paper Industry 2012

These companies are so powerful that even for other factories, they can have raw materials for the waste paper trade in the permanent market, and the profits of some large companies working in this sector are significant.

In order for the waste and used paper to reach the factory from waste, the following steps must be solved.

- 1- The buyer contacts the waste paper manufacturer and coordinates with him
- 2- Collection of waste paper and by the manufacturer of waste paper
- 3- Collection of this paper by the buyer
- 4- Transportation, sorting and transport of waste paper to the factory by the buyer Sometimes waste paper manufacturers may collect waste paper directly and sell it to the factory.

Contact waste paper manufacturers

Big waste paper merchants have factors that act as intermediaries. These intermediaries contact waste paper manufacturers in person, by telephone, or by mail. At the same time, they take care of the continuity and quality of the collected waste paper. Waste paper producers, including shops, offices, chain stores, small and large printing presses, paper and cardboard processing industries, and other groups of volunteers,

are fed by source methods. And they can be divided into categories:

- 1- Industrial and commercial waste papers
2. Office waste papers
- 3- Household waste paper

Production of dough

Several processes can be used to turn wood into paste. Wood is basically a network of dough production operations, separating these fibers from each other. Sodium fibers can form hydrogen bonds together [14]. With the release of water from the fibers, the number of bonds increases, but this phenomenon is reversible. The process of pulp production can be divided into two major categories: mechanical processes and chemical processes, in mechanical processes to separate fibers from each other, the presence of water is used. In chemical processes, chemical energy is used to separate the fibers from each other and to remove the lignin. split. The fibers separate irregularly, resulting in a large number of breaks. The pulp produced is suitable for the production of newsprint and draft writing papers [15]. The most important mechanical pulping processes are: milled wood (SGW), refined mechanical (RMP), mechanical mechanical (TMP) and mechanical chemical (CTMP). These methods differ in the details of the operation and the properties of the resulting product. Mechanical processes of dough production (methods of alphabetic kneading) are sometimes called. Because it is often abbreviated with a few letters of the alphabet. One limitation of the SGW method is that the vigor group is required and the waste from sawmills and sawdust is not applicable.

There is no such limitation in the refining mechanical method. RMP Small wood chips and chips with dimensions of 1-2 inches are consumed, and small pieces of wood and waste from sawmills can be consumed. The chips are injected into the gap between two rotating grooved discs and separated into fibers. Usually in one refining, the fibers separate well and two or three refining steps are required. Compared to milled wood paste, the strength of refined mechanical paste (RMP) is higher due to the higher percentage of healthy fibers in it. But their uses are similar, and RMP paste is also used to make tuber board.

The method of mechanical thermal kneading is similar to the RMP method, except that the TMP method raises the temperature by injecting steam. The heat softens the wood and makes it easier to separate the fibers. In this method, the fibers produced are healthier and the strength properties of the resulting dough and paper are better.

By choosing the right wood species, more diverse and desirable products can be produced. In the mechanical method of Thermochemistry (CTMP), it is closer to

chemical treatment to soften wood and cause chemical changes. As a result, different types of paper will be produced with more diverse properties and applications [16-19]. Mechanical pastes are used to produce different types of paper, such as newspapers, magazines, cartons, and paper napkins. Of course, the whiteness of mechanical paper is less, and this feature limits their use in some cases. As a result, it is necessary to improve their optical properties by using oxidizing or reducing chemicals. The methods and chemicals required are similar to those described for bleaching waste paper [20].

About the future of paper recycling

Any section about the future of recycling should be based on full knowledge of the current situation and its adaptation to future needs. The issues required by the industry are as follows:

- 1- The need to produce standard products with stable quality so that the product meets the needs of consumers and has a buyer in the market [21].
 2. The need to create small paper industries as a result of less need for large investments. Thus, the variety of products in the market will be greater and the satisfaction of a wide range of different consumers will be provided.
 3. The need to connect industries with each other and with consumers, something that is being researched with the advent of global information networks.
 - 4- Minimizing the damages of the industry to the environment due to the importance of the issue and due to the increasing pressures of the people and politicians and environmental protection communities. All of the above will affect the waste paper recycling industry. Compared to products made from first-hand khimers, recycled fiber products have lower quality properties and characteristics due to the constant change in the quality of materials [22]. In fig.2 illustrate the how paper is recycled: step-by-step process and benefits).
- Environmental debates are often emotional and have less scientific underpinnings. It should be noted that what is environmentally damaging in terms of production and consumption in this country may be extremely harmful to the environment in another country. Although waste paper was once used in the recycling industry solely for economic reasons, today the environmental aspect has become more controversial. From this point of view, important environmental issues include the management of non-renewable resources, waste disposal, pollution and global warnings. In addition, there are concerns about the accumulation of waste in the world. While the industry cannot do much to solve this problem. But care must be taken not to overstate the problem. Non-renewable sources are non-renewable sources. And

they produce fuel for transportation. The industry tends to produce light products using minimal raw materials. In the paper industry, making lightweight paper from first-hand pulp is easier than recycled pulp.



Figure 2: How Paper is Recycled: Step-by-Step Process (and Benefits Too)

Disposal of solid waste

A recent report in the UK contains interesting information about the amount of solid household waste. According to the report, the amount of this type of waste in the UK is around 20 million tonnes. That is, about one ton per house per year, the composition of the percentage of this waste is shown in the figure.

The interesting thing is that the numbers are in proportion to the weight, while the big problem is the volume of waste. The study shows that in general the amount of waste paper in waste is increasing. Another point is that paper is a degradable waste. If the temperature, pH, humidity, and other conditions are favorable, the paper will decompose chemically and biologically [23].

Environmental pollution

The main sources of pollution in the paper industry depend on the type of factory. In comparison, the amount of recycling in factories is higher than in recycled paper mills. The detection of these contaminants depends on how the factory is managed and the type of pollutant measuring devices. The subject of economics, environment and management are closely related. There are a number of key issues in pollution that need to be addressed. These issues are at the level of the detergents produced and their effect on the environment.

How to discharge factory effluents and enter the lake, slow, fast or sea water flow are important factors. In controlling environmental pollution and the permissible levels of pollutants, some models use economics, which is not true [24].

Of course, it is necessary to formulate environmental laws and regulations based on the scientific principles of environmental protection. Recycling plants must be able to reduce their level of pollution to the level of pulp mills. The cost of achieving this goal varies from place to place and depends on a variety of factors.

Recently, various paper products have been applied to environmental adhesives to determine that they are "harmless".

An example is the "Blue Angel" symbol, which is common in Germany. This mark indicates that the product does not contain waste paper. The subject of the environment is more complex and far-reaching, and it is better to track and evaluate each product from "birth to death."

That is, we monitor it from factory production to consumer use, recycling and then destruction by burial or incineration. In Europe, the issue of environmental labeling is considered. One suggestion is that whenever a label or mark is placed on a product, the product should be re-evaluated from an environmental point of view every three years, these three issues should be considered [25]:

- 1- How are the initial standards formulated?
2. How do we reconcile the 10 to 30 year investment of an industry with annual or quarterly evaluations?
3. How do we make sure manufacturers consistently adhere to these standards?
4. Conventional consciousness dictates that this label be given to products that are not harmful to the environment. Industry must also cooperate in the production and distribution of its products in compliance with environmental standards. Depending on the geographical extent of the developed standard, it may be a regional or global standard [26].

In this way, politics and economics and trade will be involved in the issue of the environment. Careful development of standards is essential and officials should not misinform consumers.

The aim is to convince the industry to respect the environment and the health of the product in the production of its products. In this case, the quality of raw materials used in the factory is also very important. Although this has not yet been fully proven, but public opinion seems to support and oppose recycling and recycled products. As a result, for this reason as well as for economic reasons, the process of recycling cellulosic fibers from waste paper and preparing recycled products will have an upward trend.

The need for research in the field of recycling

Extensive research should be done in the field and appropriate answers should be found to the existing questions.

- 1- Reducing the volume of waste and materials with the design and standard of new technology and more control over the quality of products and consumption culture.
- 2- The term and improvement of recycling technologies through a wider understanding of the sources of recyclable materials and the production of

marketable products that are preferred by buyers and consumers.

3- Designing methods for more coordination between the collectors of recyclable consumables, converters, distributors and buyers.

4-Wider study of environmental effects of recycling from different aspects

5-Designing comprehensive and efficient systems for wastewater treatment and reducing the volume of liquid and solid wastes to zero or converting these harmful substances into completely safe materials.

For economic reasons, industry is inevitably trying to reduce the volume of waste and harmful to the environment. In the future, the paper industry will use recycled glass fibers as a raw material and will strive to produce products that are no different from first-hand pulp products by adhering to standards and efficient technologies.

Consumers should also consider such things as the suitability of the product specifications with the intended application, the appropriate price and the possibility of continuous product availability in the market? Whether the raw material is recycled or made from first-hand pulp, industry must create the belief in society that it cares about the environment [27].

The future of recycling

Due to economic and environmental reasons, the use of waste paper as a raw material for the paper industry has a bright future and by 2005 it will reach new frontiers. Compared to first-hand fibers, the use of recycled fibers is almost double the growth. The packaging sector is the most important consumer of recycled paper and cardboard. These figures clearly show the growing future of the paper recycling industry. Much of this growth, and the realization of the context that was not yet the subject of the environment, was not currently of great concern to the people and politicians. That period was the main motivation for economic issues [28].

The construction and operation of a cellulose fiber recycling plant and the production of recycled paper would be cheaper, the growth of technology has not been ineffective in accelerating this process, because technology has made the production of all kinds of waste products from waste paper. Advocates of natural resources, the growth of the recycling industry must be greater. Homes and offices are the most important sources of waste paper. To use these resources successfully, effective collection methods must be designed and the necessary awareness and motivation must be created in the people. In a world where many future issues are not the method, there is confidence that the importance of waste paper as a valuable raw material will be added for the production of paper and

cardboard. Of course, they try to introduce environmental protection and conservation of natural resources as the main motivation in this process, but economic reasons and motivations will still be the main focus of efforts and research [29].

The status of paper and cardboard recycling in the world and the position of Iran

Introduction Municipal waste consists of various components such as paper and cardboard, of which paper and cardboard make up a significant percentage. Therefore, not paying attention to paper and cardboard, and recycling it, wastes national capital (economic resources).

Lack of dependence on the entry of pulp) and also causes damage to the environment (reduction of waste production and reduction of pollution) and deforestation, which in turn will have other effects on the environment. The diverse uses of paper products in printing, packaging, hygiene, decoration have increasingly made the need for cellulose products an unavoidable necessity. In recent years, due to the lack of natural resources and prevention of the effects of environmental degradation, paper recycling from waste paper has been considered.

Paper is the second most valuable and recyclable component after perishable and compostable solid waste. About 80% of all paper and cardboard used is recyclable and reusable. Recyclable paper and cardboard in municipal waste generally includes newspapers, books, magazines, printed, advertising and commercial papers, office correspondence, printing papers, cardboard and wrapping paper. Homes, offices and schools are the most important sources of waste paper. The best way to collect it is through the doors of homes, offices and schools before mixing it with other waste. Separation from the origin was first made in 1985 in the former West Germany in the case of residential dormitories.

For optimal use of waste paper as second-hand fibers, it is necessary to classify different types of paper in terms of quality. Most of the collected waste paper becomes a type of packaging paper. According to the Recycling Organization, the amount of paper and cardboard recycled in Iran was about 186 thousand tons per year, which in the world in 2009 was about 181.6 million tons. It is hoped that due to the purposeful planning of these huge resources, it will make a significant contribution to the supply of raw materials for the paper industry. According to FAO statistics, the amount of recycled paper imports (2009) in Iran was 426 tons, which is 54945334 tons in the world, and in the export sector of Iran, the share was 1421 tons, while the amount of recycled paper exports in the world was 55910849 tons. According to available statistics, about

3.5 million tons of waste is produced daily around the world, of which our country contributes about 40,000 tons per day.

According to the available statistics in 1378, the per capita amount of municipal waste production in Iran was about 820 grams and in total in the cities of our country about 32 thousand tons of waste was produced per day. According to the results of physical analysis of municipal waste in Iran, on average, about 10.9% of this waste is paper and cardboard. Research in the country shows that only by recycling 25% of the paper and cardboard in the production waste, 100,000 tons of recycled paper can be obtained annually. This activity means the survival of 1,700,000 trees per year.

The United States 30% of the total paper It consumes the world, and out of a total of 521 paper mills in the United States, 450 mills use waste paper to produce paper, and more than 95 million tons of waste paper are recycled each year to produce new paper. Note that all American newspapers are waste paper and recycled, and the American press is not allowed to use new paper. Also, all government agencies in the United States are now required to purchase 60 percent of the paper they need from recycled paper.

In this country, the production of recycled paper is so much that it sells a percentage of it. India also consumes 50% of its recycled paper. Japan separates half of its 30 million tonnes of paper waste from municipal waste in various ways, contributing \$ 2 billion a year to its waste collection and disposal. Today, in countries such as the Netherlands and Switzerland. And Japan recycles more than 50 percent of used paper. Using waste paper reduces the energy required to produce one ton of paper by three-quarters. 50% of the fibers used in the world are recycled, the production of some products (such as cardboard congressional layer) is based on waste paper.

In the production of newsprint, desirable properties such as low thickness, high density and good folding, due to Using waste paper. The properties of waste paper, like any other raw material, are very important and affect the quality of the product and the processing conditions of the product.

The current situation of supply sources of raw materials for the country's paper industry in recent years, on the one hand due to increasing population growth and consequently increasing demand and on the other hand a sharp decline in forest resources of pulp and paper industries that depend on forest trees to supply raw materials And - due to declining forests and wood resources - are facing serious problems in the supply of cellulosic raw materials. Currently, the most important lignocellulose raw materials that can be used in the country's cellulose industry are: industrial and commercial forests of the north, wood and plantation

forests, paper recycling and agricultural waste, among which forest resources have the largest share and imported long fiber pastes. And sugarcane agricultural waste (bagasse) and then other sources are in the next ranks [30].

The amount of production and consumption of paper in Iran The factories producing all kinds of paper in the country are: Printing and writing paper and newspaper with a nominal capacity of 208,000 tons per year by Pars Paper, wood and Mazandaran paper companies, Gharb paper and carbon loess, industrial papers, packaging with a capacity of 530 thousand tons per year by Choka, Kahrizak and Kaveh factories, Iran Papyrus, Mazandaran wood and paper, Part and Fars paper, Eshtehard Tehran, various cardboard and toilet paper with a nominal capacity of 35 thousand tons per year by factories Latif, Khuzestan silk and emerging are produced. Unfortunately, there are no official statistics on the annual consumption of paper in Iran. Unofficial statistics estimate the consumption of various types of paper and paper products at one to one and a half million tons, of which only 30% is domestic production.

According to the country's customs statistics, the value of paper imports in the first seven months of 1987 compared to the same period in 1986, increased by about 16.5 percent, while during the same period its export value decreased by more than 32 percent, also in the first seven months of the year 87, 560 million and 989 thousand and 541 kilograms of paper worth 631 million and 657 thousand and 12 dollars were imported into the country for various types of consumption. This amount in the first seven months of 1986 was 566 million 859 thousand 624 kg worth 541 million 979 thousand 673 dollars, which although decreased in terms of weight of six million kg, but in terms of value shows an increase of 16.5 percent.

According to the World Food and Agriculture Organization in 2002, the per capita consumption of paper and cardboard in the United States, Canada, Japan, Germany, and South Korea was 307.54, 281.44, 249.66, 219.47, 16/16. 172 kg and in Turkey, Saudi Arabia, Egypt and Pakistan were 35.39, 19.97, 13.24 and 8.88 kg, respectively.

Per capita consumption of paper and cardboard in Iran is 15 to 16 kg. Due to the increase in the country's population and the increase in the consumption of paper products, it is expected that the demand for various paper products will increase in the coming years. Lack of forest and wood resources Lack of forest and wood resources in our country is a bitter and undeniable fact that as a result has led to a decrease in production capacity and even in many cases the closure of wood factories in recent years, according to studies,

value the environment of forests is up to 400 times their value in wood production [31].

According to the statistics of the Forests Organization, the exploitation of northern forests during the last ten years has decreased from 2 million and 200 thousand meters to less than one million cubic meters, which means a fifty percent reduction in the supply of wood to the consumer market. Looking at the state of the country's northern forests - which cover only 5.7% of the country's area. And with this situation, the main domestic source of supply of wood and raw materials for wood and paper products - its sensitivity and vulnerability are clearly visible and the need to find a suitable replacement and rely on other sources and materials for the wood industry [32].

Production and consumption of waste paper in the world and Iran in 1990, global production of pulp and paper was 237 million tons and waste paper consumption were 85 million tons, which is approximately 35% of world production. But in 2009, out of the 359.3 million tons of world pulp production, 181.6 million tons was related to waste paper consumption (the amount of pulp production from waste paper). The rate of recycled paper consumption in the world was 50.6% (2009), while the consumption rate of recycled paper in 1999, 2000 and 2004 was 41.8%, 44% and 45.4%, respectively, according to Fao statistics from 359.3 Million tons of pulp produced in 2009, 181.6 million tons of recycled pulp (50.6%), 118.7 million tons of chemical wood pulp (33%), 28.5 million tons of mechanical wood pulp (7.9%), 9.2 million tons of semi-chemical wood pulp (2.5%), 3.6 million tons of soluble paste (1%), 17.8 million tons of other fiber paste (5%) [33].

According to information published by the FAO, the amount of Iranian recycled paper production from 2001 to 2010 is estimated at about 80,000 tons per year. According to the country's customs statistics, the value of paper imports in 1989 amounted to 1240469 tons worth 1.353 billion dollars. At least 26 million trees are needed to supply 1.5 million tons of paper needed by the country. In Iran, for paper recycling, the first factory was established in 1996 in Karaj, the second in 1995 under the name of Shargh Cardboard Making in Tehran and the third in Kahrizak in 1996. There are very few paper mills in the country that supply almost all of their raw materials from forest sources. On the other hand, the number of units that use waste paper is very limited in the face of the huge amount of waste paper produced.

It is worth mentioning that most of the mentioned units have operated on a workshop scale and there is no proper supervision regarding the health of their activities. In Japan, meanwhile, there are 380 paper mills that make up 92 percent of their raw materials

from waste paper. At present, more than 60 thick cardboard production units in this field have industrial licenses, in addition to which 40 industrial units are active in the field of egg comb making.

Salehabad factory in the south of Tehran and Mashhad paper recycling factory Waste recycling, including the conversion of waste paper into cardboard, has begun in recent years, and Kaveh Paper Industries Company is also active in the production of recycled paper. This company is the only company that has the technology to convert waste paper into paper. . The rest of the paper recycling plants do not actually produce paper, but turn waste paper into cardboard.

Also, Mazandaran Wood and Paper Industries Company is implementing a paper production project through paper recycling due to the lack of forest resources to supply the raw material of the factory and also for environmental purposes, and the contract for purchasing a pulp preparation line from waste paper with a The Italian company has concluded that according to the schedule, it will be operational by 2012. During which most of the required raw material is supplied and prepared in this way.

The use of recycled paper by this factory, in addition to reducing the cost, will reduce the harvest of wood from the forests and increase the production and profit of the company. In recent years, in our country, following the leading countries in the field of recycling, the project "Separation of waste at source" has been started in some metropolises such as Isfahan, Tehran, Shiraz, Mashhad, etc.

Unfortunately, despite the implementation of the necessary culture and public education, waste recycling and conversion in our country, in the first step has remained stable and immobile. It is safe to say that the biggest reason for the failure of the project is the lack of a proper and modern recycling system, including compost units and paper recycling units, and so on. As a result, despite the cooperation of the people, the segregated dry waste has become a mountain, which has caused us only many problems.

According to the latest physical analysis of waste in Tehran, on average, about 4.88% of this waste is paper and 4.48% is cardboard. In other words, 9.4% (658 tons) of landfill waste is paper and cardboard. Also, during the studies, 27 tons of waste paper and cardboard are produced daily in Golestan province, 40 tons in Isfahan, 150 tons in Mashhad and 15 tons in Sari. Also, the total collection of recyclable cellulosic materials in the country is only about 2%. Isfahan with 15.39% recycling of paper and cardboard in 2008 was in the best condition and Tehran and Shiraz with 38.5% recycling are in the next ranks.

Due to the shortage of wood raw materials in the country, it is one of the best alternatives to paper

recycling. Billions of dollars are spent annually on the production of disposable paper and supplies, and then billions of dollars are spent on collecting and disposing of them, provided that with the right investment to recycle them, not only damage to the environment is protected, but it is possible to reduce the harvest of forest resources and ensure their survival for the next generation.

The most important step in achieving a coherent recycling program is separation at source. The country's waste management authorities should develop a comprehensive plan and instructions for collecting and recycling waste for homes and offices, etc. Given that investment in paper recycling is not due to the high cost of producing small industrial units. In fig.3 try to show that the global waste paper recycling market 2020 and estimated to grow in near future.



Figure 3: Global Waste Paper Recycling Market 2020 and estimated to grow in near Future

The importance of paper recycling and its place in the economy of Iran and the world

To produce each ton of paper, we have to cut down 17 trees, each of which can convert an average of 6 kg of carbon dioxide into oxygen per year. But with paper recycling, the need to cut down trees is reduced by about a quarter. In addition, the process of producing paper from plant fibers of trees consumes 400,000 liters of water and 4,000 kilowatts of electricity. Therefore, the production of a ton of pristine paper has high environmental and economic costs, and its correct and optimal consumption in the first step and its reuse in the next step, is absolutely necessary. Recycling, in its common sense in waste management, means the reuse of disposable materials after special treatments have been applied to them [34].

Today, many items of municipal waste, which contain a significant volume, can be recycled. Paper, as one of the products of lush nature, natural forests and human

planting, today occupies a large share of household garbage bags and office and commercial centers, and is one of the valuable items of solid waste, which is called the "king of waste".

Recycling this valuable material and reusing it in certain applications not only reduces the cost of cutting down trees, converting plant fibers into paper and other production costs, but also economically important due to profitability and job creation. Has a special. The importance of paper recycling can be examined in general from the two perspectives of "the need to recycle waste paper" and "helping to preserve the environment and its economic benefits."

Today, cellulosic materials such as paper and cardboard make up a relatively large percentage of municipal waste. On average, 30% of municipal waste consists of cardboard, paper and plastic, which is considered as dry waste. 12% of this amount is paper. Environmentally, paper recycling reduces dependence on virgin paper and ultimately reduces deforestation and increases the chances of revitalizing bare forest areas. One of the consequences of reusing waste paper is to reduce the pressure on nature.

Wood is the product of the forest and the forest is a pledge of God to nature that human beings should strive to preserve and protect, and forests are considered as renewable resources. In today's world, the need for wood in every society is based on the degree of growth that society has reached. It is paper. The natural nature of paper and its ability to return to nature, has led to the prosperity of its use cycles, and in the simplest form of waste paper can be produced cardboard box cardboard, shoe box cardboard and many paper products can be used with these characteristics. Is to have a customer and when black. Today, the use of trees in industries such as paper making is no longer cost-effective, but it is the cellulose waste that is used in this industry.

The idea of paper recycling was created with general goals such as preventing the indiscriminate looting of natural resources, reducing energy consumption and reducing waste to reduce disposal costs and change consumption patterns. Eventually, the reduction of deforestation and the increase of the opportunity to revitalize the bare forest areas will increase. Paper is the fifth largest energy consumer industry in the world, which consumes more energy per ton of product than one ton of steel and iron products.

Also, this industry consumes more water per ton of product than other industries in the world. It creates a high level of air pollution. According to statistics obtained in industrialized countries, each person consumes an average of 164 kg of paper per year and in developing countries and average of 18 kg of paper per year. Slow paper consumption has long been a

measure of the development of communities. One of the consequences of reusing waste paper is to reduce the pressure on nature. Today, the best way to prevent deforestation for paper production is to recycle waste paper, including white paper, newsprint, exercise book, duplicator paper, Magazines and cardboard ... are suitable for recycling.

If we consider the time required for the growth and regrowth of forest cover used for paper production along with soil erosion and limited soil fertility, reduced oxygen production and carbon dioxide emissions plus several other negative consequences, the production of one ton of paper poses a number of risks to the environment, while producing one ton of recycled paper saves 50% in water consumption, 64% in energy savings, 74% in air pollution, and 90% in water pollution compared to production. It comes from primary sources. Job creation is also another economic benefit of paper recycling [35].

However, it is an accepted fact that the recycling process preserves forest resources and saves energy for the production of mechanical pastes. The national consumption rate of recycled paper in the world ranges from 5% to more than 100%. Studies show that worldwide, the consumption rate of recycled paper in the production of paper will reach about 54% by 2015. The increase in consumption of recycled paper will be 3.1 percent, which is more than the increase in paper production (2.2 percent).

There are about 3.866 billion hectares of forests in the world, of which 95% are natural forests and the other 5% of these forests are hand-planted. 7% per hectare is estimated forest cover, which has decreased to 46% with population growth and increased deforestation, and this estimate is expected to decrease by 34% by 2025. This means that almost every year, deforestation in natural forests will be 9.4 million hectares, and interestingly, this amount is twice as large as Switzerland in terms of area per year. But in Iran, per capita is 2% per hectare of forest cover.

Other consequences of these uncontrolled deforestation can be climate change, change in rainfall pattern, temperature change, soil erosion, reduced soil uptake capacity, impact on carbon and oxygen cycle. He pointed out the occurrence of dangerous floods, droughts, increasing wind speeds, migration and poverty, etc. in the world. Today, in countries such as the Netherlands, Switzerland and Japan, more than 50% of consumable paper is recycled. The use of waste paper reduces the energy required to produce one tonne of paper by three-quarters. 33% of the fibers used in the world are recycled. The production of some products (such as the cardboard layer) is based on waste paper in production. Newsprint has desirable properties such

as low thickness, high density and good fold ability due to the use of waste paper.

The properties of waste paper, like any other raw material, are very important and affect the quality of the product and the processing conditions of the product. In the United States, citizens dispose of 50 percent of their waste paper.

About 80% of the paper that is disposed of at home can definitely be recycled. But the remaining 20% cannot be placed in this cycle. Most paper bags collected by people are not all paper, but waste materials such as wire, staples, paper clips, and plastic that must be removed. In the UK, the use of waste paper to recreate a variety of cardboard papers has attracted the attention of experts due to limited lignocellulose raw materials and environmental problems and constraints. So that if the total of these papers in one year is considered per person, it is equivalent to cutting down 100 million trees.

A major problem is how to recycle and separate recycled paper from waste. Administrative and sometimes the general ignorance of the people, this process usually suffers from fundamental anomalies in economic, health and environmental aspects. In our country, there are special conditions in this regard, such as insufficient attention to the preservation of the environment and natural resources, which makes it necessary to pay more attention to recycling. Paper made from virgin fibers has the ability to be processed and recycled up to 6 times.

Benefits of using recycled paper

For one ton of new paper, 17 large trees should be cut down, but in the case of recycling, this amount is reduced to a quarter and the amount of energy and water required is also reduced [36].

The advantages of using recycled paper include the following:

- Easy replacement of recycled paper without loss of quality compared to fresh paper
- They are not different from white papers in terms of health
- Reducing environmental pollution of paper production, by reducing the consumption of chemicals
- Reducing the volume and weight of municipal waste and then reducing the need for land and facilities for collecting, transporting and disposing of waste

Each ton of paper is equivalent to cutting 3 hectares of forest per day and all over Iran we have more than this amount of waste paper. With proper recycling, a significant amount of money will be returned to the country's economic cycle and tree felling will be reduced. If paper recycling from Tehran waste is

increased to 75%, about three million tree trunks will be cut down annually, which will bring about 44 billion rials in economic savings [37].

An important part of household and industrial solid waste in the world is allocated to cellulosic materials, including paper and cardboard. In some countries with advanced packaging industries, the share of paper and cardboard in municipal waste is up to 25% of total waste. It is and is expected that this increasing trend will continue in the future. In recent years, with the growth of public awareness about the dangers of uncontrolled harvesting of forest wood resources and rising prices of raw materials, there is a good tendency to recycle used paper, out of a total of seven thousand tons of waste produced daily in Tehran.

About 10% or 700 tons of it is waste paper and cardboard, of which only a small part, ie 38%, is recycled. The diverse uses of paper products in stationery, packaging, hygiene, decoration and decoration have increasingly made the need for cellulose products an unavoidable necessity. After perishable and compostable solid waste, paper is the second most valuable and recyclable component of waste. Studies show that each ton of recycled paper is equivalent to 17 forest trees.

Recycling one ton of paper saves 6953 gallons of water, 463 gallons of oil, 587 units of air pollution reduction and 4077 kW of energy. In Iran, the per capita consumption of paper is more than 11 kg per year, which is supplied through wood, straw and waste paper or imported pastes. The production of one ton of pulp introduces about 40 kg of polluting waste into the environment. At present, paper recycling from waste in Tehran is not in a good condition and only about 0.4% of waste paper is recycled. Paper recycling plants have basic technology and their final product does not meet acceptable standards. Of the total recycled paper, large quantities have been used illegally, which after entering the food packaging cycle, reach uses such as paper and confectionery cardboard, egg combs, etc., which may have many health effects [38-42].

Paper pulp bleaching process

The absorption of light by the pulp and its color is mainly from the lignin contained in it. To achieve an acceptable level of whiteness, the remaining lignin must be removed from the dough. Therefore, there are two ways to whiten pulp:

- 1- Removing lignin (removing lignin)
- 2- Changing lignin

Bleaching can be done on chemical pastes by de-lignin zing, which causes the paper to bleach permanently. This process is carried out in several stages and usually by chlorine, chlorine dioxide, oxygen and other bleaching compounds. Due to environmental problems,

the use of chlorine gas for bleaching is likely to become obsolete over the next few years, and the use of chlorine dioxide will flourish. But in the long run, chlorine-free chemicals (oxygen, hydrogen peroxide and ozone) will replace chlorine dioxide.

In bleaching operations, the cleanliness of the resulting pulp is greatly increased due to the dissolution and removal of wood extracts and the removal of contaminants such as dust and wood debris. In the case of soluble pastes, the purpose of bleaching, in addition to removing lignin, is to use hemicelluloses. However, in the case of pulps used for making paper, hemicelluloses must be dissolved and eliminated. By preserving lignin, the dye usually gives a moderate whiteness to the paper and is suitable for mechanical and chemical pulps with high efficiency. The most common chemicals used in lignin-retained bleach are sodium dithionate and hydrogen peroxide.

Bleaching by removing lignin

Chlorine was discovered by Shale in 1774, and its decolorizing properties were announced in 1784 by Butole. But about a century after this date, the industrial production of chlorine was made possible by the electrolytic decomposition of sodium chloride, and after that, the consumption of chlorine became widespread in various industries. About fifty years later, chlorine began to be used as a bleach and bleach in the pulp industry. Of course, the use of calcium hypochlorite and sodium hypochlorite in other industries had already been tested. About twenty years after the discovery of shale, Tenant found that chlorine combined with dry lime to produce a coloring powder. This weave was more important in that it was easier to transport hypochlorite than chlorine gas [43-46].

Of course, later technology advanced and the direct use of chlorine gas in industry also began. In the early 1930s, with the advancement of bleaching technology, multi-stage bleaches including chlorine, alkali extraction and then hypochlorite became the way.

The multi-step bleaching method was relatively successful for sulfite paste but for Kraft paste with a decrease in cellulose polymerization and a decrease in dough resistance properties. With the use of chlorine dioxide in the bleaching of Kraft paste after 1940, another development took place in the bleaching of pulp, although the ability of chlorine dioxide as a bleaching agent was identified many years ago. But it took years to design the industrial production processes of this material and work with this explosive and corrosive gas in pulp and paper mills in a safe and secure manner. This was the beginning of the growth process of the production process of bleached Kraft paste and the reduction of sulfite paste production. Innovation in technology led to the design of new types

of bleaching systems; Such as displacement bleaching and gas phase bleaching the advantage of new processes is that the bleaching chemicals penetrate the dough, resulting in shorter bleaching times and higher concentrations of solids in the bleached liquids used.

Of course, these successes are not as consistent as continuous cooking successes, and the number of paint factories installed using new technology is small. In the early 1970s, color bleaching technology was on the verge of a new development. Studies have shown that chlorinated chlorinated organic compounds are present in the liquid used in bleaching units. At the same time, it was discovered that the amount of lignin in the dough could be greatly reduced by using an oxygen and alkali system. After laboratory tests, the technology was soon used on an industrial scale.

Today, unbleached dough is usually passed through an oxygen reactor. After this preliminary de-lignification step (oxygen bleaching), the dough is inserted into a suitable bleaching sequence. But the consumption of chlorine and other chlorinated compounds is less. With the development and modification of the decomposition methods, the detection of very small concentrations of chlorinated toxins in the decolorizing pops was routed. After years of decomposition methods, very low concentrations of chlorinated toxins were detected in the decolonization pubs.

After 1980, using these sensitive methods, toxic chlorinated compounds such as dioxins were detected at the fractional level per billion (ppb) even in papers made of bleached paste. Due to environmental concerns, the permissible amount of discharge of decontamination pubs and the permissible amount of toxic organic matter in them is decreasing day by day and in the future the relevant criteria will be more difficult.

However, the use of chlorine and other chlorinated bleach compounds is still ongoing, and bleaching methods without the use of elemental chlorine (ECF) or without the use of chlorinated bleach (TCF) have not yet been able to replace current bleaching methods. Hundreds of compounds have been identified in bleaching pops. Even if some substances, such as proxy acetic acid and sodium chloride, are used on a laboratory scale as bleach and lignin remover, they cannot be used in industrial bleaching. In addition to chemical agents, the possibility of using enzymes and other biological channels such as lignite's have also been considered in pulp bleaching. Barriers to enzymes include their low availability and their tendency to be absorbed at the fiber level. Enzymes are also difficult to recover and cost more to work with. Another way to bleach is to use enzymes that break the bond between lignin and polysaccharides. One disadvantage of this method is the reduction of hemicelluloses, including

xylene in the dough. Instead of enzymes, the use of so-called biomimetic catalysts has also been suggested in bleaching. In this regard, experiments have been performed using hemoglobin as an oxygen carrier. But compared to enzymes, these methods will not be practical [47-49].

General aspects of bleaching

Although removing the remaining lignin from the dough with bleaching agents is more selective and effective than baking the path, bleaching agents are expensive and it is very difficult to remove environmental pollutants from bleaching. As a result, it is necessary to continue de-lignification in the baking stage as much as possible. Although there are limitations in this case as well. . According to the viscometer findings, only a small amount of cellulose web spars occurs when the paste normally decolorizes with chlorine. The loss of carbohydrates is also moderate, but when from the oxygen-alkali mixture for the first time. The de-lignification step is used, at the very beginning of which there is a sharp drop in viscosity. In this case, both the cellulose dependence and the carbohydrate drop are severe. In the oxygen de-lignification step, about 50% of the remaining lignin in the unbleached paste can be removed.

The rest of the lignin should be removed from the dough with other bleaching compounds. The mechanism of action of bleaching agents is somewhat known. In addition to chemical reactions, physical and morphological factors also play an important role. Much of the existing knowledge about chemical reactions, especially their mechanism, owes much to working with simplified systems and model combinations. It is believed that the structure of the model compounds is similar to the structure of the lignin left in the dough.

Of course, sometimes the results of this type of model are very different from experimental observations in bleaching processes.

For example, most model experiments are performed in organic states, while these experiments in aqueous media (actual bleaching conditions) yield different results.

In recent years, much attention has been paid to determining the structure of the remaining lignin. Undoubtedly, knowledge of the detailed structure of the residual lignin and the nature of the carbohydrate lignin bond will help to understand the mechanism of de-lignification and, consequently, to select the best bleaching conditions.

At present, these differences cannot be explained precisely. It can also be said that the dense structure of lignin Kraft and its cross-linking with carbohydrates is an important factor in this difference. During the

formation of sulfite dough, the structure of lignin changes less and strong acidic groups of acidic sulfones enter this structure.

These groups, which are also present in the remaining lignin of unbleached dough, are separated in all pH ranges and become hydrophilic.

Helps in the acidic phase of chlorination. But in grafted dough, only acidic groups, phenolic hydroxyl groups and a number of carboxyl groups are ionized only in the alkaline phase, thus contributing to the solubility of lignin [50-53].

Lignin Reactions

Chloroglia: Chlorine reactions with an organic substrate are ionic or radical. The reactions of lignin with the aromatic structures of lignin are mainly of the substitution and oxidative type and also to some extent additive to the double bonds of the lateral branches. Chlorine and its reactive components are electrodes and preferentially attack negative positions. Such pregnant positions are created by substitutions.

For example, as well as free and ethereal hydroxyl groups, activate the ortho and para-positions of the aromatic nucleus. Similarly, double bonds of side chains conjugated to an aromatic ring, such as steel structures, are subject to electrostatic attacks. Chlorination causes the exchange of a number of hydrogen atoms in the aromatic nucleus and the simultaneous formation of hydrogen chloride. Another result of the electro-electrical attack is displacement of the lateral branch.

The Goal of Lignin Reactions in Kraft Pulping

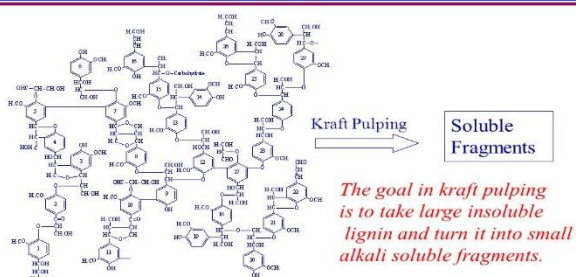


Figure 4: Agenda Lignin Structure - Linkages Lignin Reactions

To some extent, lignin deposition. Under normal chlorination conditions, at least a fair amount of the chlorine used is rapidly consumed in the exchange reactions. The other half of chlorine or less is used in oxidation reactions, which are also rapid reactions that occur in the early stages of bleaching. Chlorine oxidation, as described, occurs in the case of free and ethereal phenolic hydroxyl groups, but, although the aromatic structures are severely degraded, the bonds

between the monomeric units are only partially broken, and most of the reaction products in They are polymeric. In fig.4 the agenda lignin structure - linkages lignin reactions is illustrated.

Extraction reactions

Extract materials left in the dough, especially if they are chlorinated, damage the quality of the dough. As a result, it is essential to perform the bleaching in a manner that minimizes the amount of material extracted. It is also important to avoid reactions that produce toxins or harmful resins. However, due to the variety of compounds available and sometimes harmful, even in very small amounts, the system is very complex and difficult to control. Chlorine usually reacts with unsaturated compounds such as stable fatty acid esters in broadleaf paste.

In particular, the residual extracts in broadleaf paste, after chlorination (chlorination), are converted to double chlorinated compounds. It is very difficult to remove this type of mixture from the dough in the next stages of bleaching. Unlike chlorine, chlorine dioxide does not participate in additive reactions; instead, it oxidizes.

By creating carboxyl groups in the dough, its hydrophilicity is improved and more reaction products are dissolved in water. This is why if chlorine dioxide is used instead of chlorine in the first stage of bleaching, the amount of extractive material in the bleached paste is reduced. The chlorine content of the remaining extracts is also low. Oxygen painting before the chlorination step is also useful because this step prevents the formation of chlorinated extracts [54].

Liquids consumed after bleaching

Leaving pulp bleaching effluents in nature is a serious environmental problem that has recently been considered. It is easy to reduce the effluents of the non-bleached paste industry, or to select and meet certain criteria, including closed pulp washing systems. Although the volume of pulp effluent effluents has been significantly reduced in nature in recent decades, it has been found that it is still the major environmental pollution caused by these effluents. The volume of paper pulp bleach effluents can be reduced.

- 1- More de-lignification, for example, by improving the circulation of cooking liquid in the digester.
- 2- Oxygen decolorization, which made it possible to use the effluent in the preparation of cooking liquid and regenerate chemicals.
- 3- Uneven flow systems that reduce the volume of effluents and increase the percentage of their solids.
- 4- Replacing chlorine with chlorine dioxide

5- Improving the final bleaching steps by using oxygen, hydrogen peroxide and ozone steps.
6- Improving the side processes for purification and treatment of decolorizing effluents as well as using more efficient systems for neutralizing activated sludge.

Most of these criteria are now met in new pulp and paper mills, but not enough. In particular, it is necessary to find ways to improve the selectivity of oxygen delamination. To accurately assess the environmental effects of discharge of decolorized effluents in nature and streams and rivers, to determine the exact chemical composition of effluents and their biological effects [55].

It is very necessary. Common and traditional parameters for assessing these hazards are biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), and color and acute toxicity. BOD is a simple measure of the amount of degradable organic matter. By measuring the TSS, BOD effluents of North American and Scandinavian pulp mills over the past two decades, it has been found that despite almost doubling the production capacity, the amount of toxic and harmful substances in the effluents of these mills is approximately Halved. Since 1980, licenses for pulp and paper mills have been extended solely by conducting acute poisoning tests on fish, invertebrates and algae. In previous years, more emphasis was placed on the accumulation of harmful gases and substances in the environment at low concentrations and with long-term emerging effects.

A new parameter to be introduced is TOCI (Total Organic Chlorine) which was later replaced by AOX (Absorbent Organic Adhesive Halogen). AOX contains all chlorinated organic matter without regard to the specific effects of each. But the most dangerous compounds with serious environmental effects are the light molecule and lipophilic compounds with low concentrations in AOX. In addition to organic matter, chlorate ions produced from chlorine dioxide also have destructive effects on brown algae in bleaching reactions.

Yellowing of high-yield dough's

High-yield pastes can be whitened to a large extent but temporarily. Decreased whiteness or "yellowing" phenomenon is an inherent property of lignin-based pastes, and much research has been done to stabilize the whiteness of these pastes. But so far, no practical, appropriate and economical method has been found to solve this problem, and white instability is still a weakness of high-yield pastes such as CTMP, TMP, and GW. However, carbohydrates and extracts are also used to color high-yield pastes they share, but the main cause of this undesirable phenomenon is lignin. The

color of the dough also occurs in the absence of light, but intensifies in the presence of light and near UV waves with a wavelength below 400nm. Like the coloring of high-yield dough in the dark, the coloring in the presence of light is accelerated by oxygen, and the humidity does not have much effect on it. Our knowledge of the complex phenomenon of coloring paper and high-yield pulp is incomplete, but it is clear that those lignin structures that absorb at 300-400 nm wavelengths have a greater share in this undesirable phenomenon. According to the first reaction (case A), in the presence of oxygen and light, a hydrogen is released from the conjugated structures carrying the phenolic hydroxyl groups.

Carbonyl- α groups in lignin side chains have been suggested to play a key role in pulp staining. According to case B, a carbonyl- α group in the phenolic or non-phenolic structure of lignin is excited by radiation. Then, this component is combined with a structure with a free phenolic hydroxyl group, which results in benzyl alcohol radical. Eventually, the radical becomes the primary carbonyl structure due to re-oxidized oxygen. As a result, according to this mechanism, the carrier structures of the carbonyl group act as optically sensitive components.

Eventually, C is a modified pathway according to which the excited carbonyl group transfers its energy to an oxygen molecule in the ground state (triplet). The resulting singlet oxygen then takes a hydrogen atom from a phenolic hydroxyl group.

The whiteness stability of high-yield pastes is significantly enhanced by the reduction of carbonyl lignin groups to alcohol groups to ether or esterify phenolic hydroxyl groups. But this attitude has no industrial application. Other methods, such as the use of stabilizers that block effective oxygen, UV absorbers and antioxidants, are still being tested in the laboratory. Although the positive effect of these methods and materials on the whiteness stability of high-yield pastes has been proven, but for economic and technical reasons? So far, none of them have found industrial application.

Isolation of lignin

After removing the polysaccharides by hydrolysis from wood free of extractives, the lignin remains an insoluble mass. Lignin can also be hydrolyzed and removed from the wood, or it can be converted to soluble derivatives. For this purpose, other acids are also added. There is an important drawback to the general application of the method, which is that the structure of lignin changes dramatically during hydrolysis. Polysaccharides can also be removed from completely softened wood by enzymes. This method is tedious, but "cellulolytic enzyme lignin" (CEL) retains

its original structure to a large extent unchanged. Lignin can also be extracted using dioxin containing water and hydrochloric acid, but in this case, too, there are significant changes in the structure of lignin. In addition to the enzymatic cellulolytic lignin, Bjorkmann lignin, also called "milled wood lignin" (MWL), is the best-known lignin and is often used in studies of lignin structure. When wood is ground dry in a ball mill or in the presence of non-swollen solvents (such as toluene), the cellular structure of the wood is broken and, as a result, part of the lignin (usually more than 50%) is suspended. Ratio) is separated by extraction with a mixture of water and dioxin. Milled wood lignin always has a carbohydrate content. By hydrogenation of alcohol with hydrogen peroxide in the presence of the enzyme peroxide, a synthetic lignin called "hydrogenation polymer" (CHP) is obtained. In addition, a new lignin, called ship-owned lignin (RSCL), has recently been developed from cypress wood cells. RSCL is a carbohydrate-free coniferous lignin. Soluble lignin derivatives are formed by combining the web with a solution of sulfur dioxide and hydrogen sulfite ions at high temperatures.

Also, when wood is combined with sodium hydroxide at a higher temperature (1700c), it is better to mix it with a mixture of sodium hydroxide and sodium sulfide. Lignin is obtained in the form of alkaline lignin or Kraft lignin (lignin sulfate). Lignin is converted to soluble derivatives in alkaline solutions at 1000 ° C as a result of a solution of hydrochloric acid.

The needle lignin of leaves can be determined by weighting. Normal coniferous wood has about 26 to 32% lignin, while the amount of compressed wood lignin contains 35 to 40% of the lignin in broadleaf is partially dissolved during acid hydrolysis.

Therefore, the figures obtained by gravimetric method should be corrected by taking into account "acid-soluble lignin" and using UV spectroscopy. Direct UV spectroscopy methods have also been developed to determine the amount of lignin in wood and pulp. Normal broadleaf wood contains about 20 to 28% lignin, although in tropical broadleaf the amount of lignin is more than 30%. Tensile wood contains 20 to 23% lignin [56].

Conclusion

Due to its long-standing and fundamental role in transmitting knowledge and knowledge, paper will play an important role in promoting the cultural level of societies. It should be noted that today, despite all the new advances and achievements of human beings in the field of information and communication technology, which have grown rapidly in recent years, paper still retains its traditional position and irreplaceable role in science, culture and society. A

strategic commodity plays an unparalleled role in the educational and administrative systems of countries and the expansion of the fields of culture and information, and as statistics show, the amount of demand, production and consumption of paper in the world has maintained its increasing trend in proportion to the growth and development of societies.

Today, the per capita consumption of paper and cardboard is considered as one of the indicators for evaluating the development of countries. To produce each ton of paper, we have to cut down 17 trees, each of which can convert an average of 6 kg of carbon dioxide into oxygen per year. But with paper recycling, the need to cut down trees is reduced by about a quarter. In addition, the process of producing paper from plant fibers of trees consumes 400,000 liters of water and 4,000 kilowatts of electricity.

Therefore, the production of one ton of pristine paper has high environmental and economic costs, and its correct and optimal consumption in the first step and its reuse in the next step, is absolutely necessary. Recycling, in its common sense in waste management, means the reuse of disposable materials after special treatments have been applied to them. Paper is the fifth largest energy consumer in the world, consuming more energy per ton of product than one ton of steel and iron products. Also, this industry consumes more water per ton of product than other industries in the world. And creates a high level of climate pollution.

According to statistics obtained in industrialized countries, each person consumes an average of 164 kg of paper per year and in developing countries an average of 18 kg of paper per year. Paper consumption has long been a measure of the development of societies. One of the consequences of reusing waste paper is to reduce the pressure on nature. Today, the best way to prevent deforestation for paper production is to recycle waste paper, including white paper, newsprint, exercise book, duplicator paper, Magazines and cardboard are suitable for recycling.

If we consider the time required for the growth and regrowth of forest cover used for paper production along with soil erosion and limited soil fertility, reduced oxygen production and carbon dioxide emissions plus several other negative consequences, the production of one ton of paper.

It poses a number of risks to the environment, while the production of one ton of recycled paper results in a 50% reduction in water consumption, a 64% reduction in energy consumption, a 74% reduction in air pollution, and a 90% reduction in water pollution compared to its production. From primary sources to job creation is also another economic benefit of paper recycling. However, it is an accepted fact that the recycling process preserves forest resources and saves energy for

the production of mechanical pastes. The national consumption rate of recycled paper in the world ranges from 5% to more than 100%. Studies show that worldwide, the rate of consumption of recycled paper in the production of paper will reach about 54% by 2015. The increase in consumption of recycled paper will be 3.1 percent, which is more than the increase in paper production (2.2 percent).

In fact, paper and paper industry, as an industry, is the fifth largest energy consumer in the world, consuming more energy per ton of product than one ton of steel and iron products. Also, this industry consumes more water per ton of product than other industries in the world and creates a high level of climate pollution. According to statistics, in industrialized countries, each person consumes an average of 164 kg of paper per year, and in developing countries, an average of 18 kg of paper per year. An important part of household and industrial solid waste in the world is dedicated to various types of cellulosic materials, including paper and cardboard. In some countries with advanced packaging industries, the share of paper and cardboard in municipal waste is up to 25% of total waste, and this trend is expected to continue in the future. In recent years, with the growth of public awareness about the dangers of over-harvesting of forest wood resources and rising prices of raw materials, there is a good trend towards recycling used paper.

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