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An Economic And Environment Study Of Recycling Of Waste Papers Found From Hotels Of Dehradun City

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ABSTRACT

Today, the thinking of paper recycling is our urgent need as we have the limited natural resources. The manufacturing of new papers is done by the wood of green trees. To fulfill the requirement of new papers, the trees have to be cut. These papers are manufacture in paper industries which are responsible for air, water and land pollutions. Recycling of used papers will decrease the demand of new papers and it is also saved the fuel oil, consumption of electricity and water. It also saves the wastage of landfill space and forest areas. In this manuscript, the economic and environmental study has been due to the waste papers obtained from the hotels of Dehradun city. It is observed that 8.755 tons papers are used by the hotels of Dehradun per day and all these papers are thrown in garbage. This garbage produces a problem for the waste management department. If

these waste papers are not thrown in garbage, then direct cost of these waste papers is about 1 lakh only. But if these papers are recycled and converted into the handmade papers, the revenue generation by directly and indirectly in many forms become more than 1 crore. The review of this manuscript represents how recycling can save our environment, forest, and also helpful for our economy. Thus we should aware the people for recycling of waste papers and also inspire to less use of papers.

Keywords: Economic and Environment contribution, Recycling of waste papers, Hotels of Dehradun, Air Pollution, Water pollution, Landfill space,

Introduction

The process of recycling of waste papers is an old technology but presently, many new improvements have been done. New paper manufacturing is not beneficial for our natural resources but mandatory for economy of our country. In this manuscript, it is shown that how recycling may help to improve the economy of our country. Recycling of waste papers can save the life of green trees, and forest. It conserves the electric power and fuel oil used by the paper mill industries. The recycling of one ton papers can save the life of 26 trees. The technologies of recycling of the used materials can reduce the negative effects on the environment. It may decrease three types of pollution i.e., air, water and land pollution. Conservation of natural resources is the first benefit of recycling and second is to decrease the harmful compounds in the environment. Reuse process of papers decrease the consumption of wood and green trees [1, 5]. As per CEPI 2010 in Europe, 16% paper is made by the recycling of solid waste and 11% paper is created from squander materials. Recycling of waste papers per unit paper consumption represents the recycling rate. In India, reuse and recycling rate of the materials are very low. The people are not aware about the socio and economic benefits of recycling of waste papers and other materials [2,3]. Many researchers are doing work to know about the direct and indirect effects of recycling on environment/climate. In recycling process of waste papers, the tensile strength, mechanical quality, feeble in elastic of paper is decreased during drying process of pulp and paper [6, 7, and 8].

Paper recycling

Recycling of the waste papers decrease the consumption of natural wood, water, oil fuel, forest area and land fill space etc. Some people thought that in recycling of waste papers, a large amount of energy is used but actually the electric energy is required for very short time. Only beater which beats to the pieces of shredded papers requires electric energy. Thick paper or board is prepared without any use of any type of energy. The drying process of recycled papers and board may be done in natural Sun light. Any type of fuel oil, crude oil and coal are not required. In recycling process, the emission of carbon dioxide, greenhouse gasses and many harmful gasses are not occurred [28, 29]. The water which is used during the manufacturing of paper is also produce the water pollution. The chemicals which are using during the manufacturing process of papers are washed in recycling process. These chemicals are dissolved in water and it becomes polluted. However, this polluted water may be used in many ways like harvesting in ground and after some process in planting. Recycling is also useful to prevent land pollution. The land in which the waste materials are dumped become useless, it is called land pollution [23,24]. There is a difference between hydrophilic properties of the fibers of the recycled fibers than primary fibers [26,27].

Need of paper recycling

"Necessity is the mother of invention" right now, recycling of used and waste papers are our need. Thus, we have to study and implement the innovative ideas on recycling. If we recycle one ton waste papers, it can save the life of 24-28 green trees, prevents the dispersion of 36 tons of CO_2 & 267 kg. pollutant gases, electric power saves about 4100 kWh, 1750 liters of fuel oil, 38.8 tons of water, 3 - 4 m^3 of waste landfill area and destroy of 85 m^2 of forestry area is protected [11,12]. The use of foreign dependency is also reduced which helps to save the foreign currency.

Pulp fibers properties during recycling

After recycling of waste papers, the handmade papers are prepared. The thick handmade papers and multi layers papers behave like a wood board and plywood. The challenge for the manufacturer of handmade papers and boards are to justify the customer satisfaction. At present the utilization of waste

papers, news papers, are only in the form of packaging materials but can be produced many types of quality products [9, 10]. The normal increment in recuperation paces of utilized paper items will require an impressive utilization increment of reused filaments in greater evaluations. To advance extended utilization of recuperated papers, understanding the basic idea of reused filaments and the distinctions from virgin strands are essential. Many reusing examines have happened at research facility to recognize the adjustments in fiber properties in the wake of reusing. Sensibly rehashing procedure of reusing and deinking process can change the properties of handmade papers. A few changes in fiber structure, cell divider properties, and holding capacity is conceivable during the way toward reusing. Like mechanical mash (The mash which is set up by mechanical technique) is artificially and truly not the same as synthetic mash (the mash which is utilized synthetic concoctions) at that point reusing impact on those outfits is additionally unique. Similarly, drying and rewetting process can also change the property of recycled papers. The boding strength due to again and again recycling between the molecules of fibres is decreased [13, 14]. Several studies have shown good recyclability of mechanical fibres [17, 18, 19]. The repetition of beating process of fiber may be seven times but after every repeat, the bond strength of pulp is continuously decreased [20, 21, 22]. The bond strength between the molecules of pulp may be increased by the use of some adhesive and chemicals like gwargum, resin etc.

Effects of beating process on pulp fibers

In process of recycling of waste papers, the first and important step is beating. During the manufacturing of new paper in paper mill industries, the bonding between molecules of cellulose is created strong by the use of many types of chemicals. When handmade papers are manufactured, the waste papers are shredded and it mixed with the water. The shredded papers are rotating with the water and remaining water is filtered [30,31]. During filtration, the adhesive chemicals are flow with the waste water. In this process, no adhesive is available in filtered pulp which is used to manufacture handmade paper. Again and again beating process do weak the bonding between the molecules of fiber and cellulose [32,33].

Effects of drying process of the recycled pulp

For reusing procedure of waste paper, rewetting of shredded used papers is required. After filteration of pulp, it is dried by electrical heating process or in sun light. In drying process of pulp, little pores in fibres are made. Thus the density of the handmade papers becomes low. The low density of paper creates the absorption property in dried handmade paper. Some percentage of sound and light are absorbed by theses papers. These types of papers can be used at the places like auditorium etc to remove eco. If the pores between the molecules of drying pulp are filled by some molecules of other heavy materials, the density of the paper is increased [35, 36]. The drying procedure applied a perceptible weight on paper [37, 38].

Effects on properties of fibers after recycling of paper

During the recycling of waste papers, the papers are crushed and beaten. The fundamental properties of molecules of the pulp of cellulose are changed. The outcome is that the surface of paper becomes rough. However, the surface may become again smooth and fine by using of pressure. Similar constraints are appropriate for depiction of the properties of paper of auxiliary strands. The use of waste paper indicated the optional strands have altogether different properties from the birthplace filaments. Because of continued reusing of filaments, the arrangement of outrageous nonhomogeneous blend of different old strands is happened and the expanded quantity of utilization phases, the strands variation irrevocable, die and modify their possessions [39, 40]. Water retention, filaments expanding and a fractional recovery of properties of birthplace strands are created because of continued slushing and beating. The continued thrashing and exposure to air of pulp are created lessening of growing capacity, holding capacity and mechanical properties due to the again and again recycling process. The higher recurrence of dewatering and drying procedure of handmade paper air penetrability and smearing properties are created [41, 42].

Types of analysis of quality of fibers:

In repeated recycling process of waste papers, the quality of the cellulose is decreased. In beating and drying process, the properties of molecules of pulp are changed. The analysis in quality of pulp after the recycling process is done by Fiber Quality Analyze (FQA). This analysis are done by two methods, one is imaging fiber analyzer (IFA) and fiber length analyzer (FLA). SEM and TEM are

also used to analyze the characteristics of fibers [19,43].

Paper ageing

Recycling of paper is progressively utilized not just for the results of transient utilization (paper, sterile paper, etc.), yet additionally, the creation of the more good quality papers. The investigation of the recycled papers, which can change the procedure of maturing, is in this way significant. The maturing and properties of the reused papers might be expanded or changed by the utilization of organization of various materials. The reusing is likewise another type of the paper maturing. It grounds the paper adjustments, which brings about the corruption of their bodily and manual properties. The reusing reasons a synthetic, warm, natural and automated annihilation [4, 44]. The impact of the maturing of paper is the debasement of fiber, hemifibers and lignin macromolecules, the diminishing of short sub-atomic divisions, the level of polymerization decline, yet in addition the decrease of the mechanical and optical properties [25,34]. Because of several oxidation forms keto-and aldehyde bunches are framed [15,16]. At the quickened paper maturing the diminishing of DP is fast in the main phases of the maturing, later decelerates [45,46].

Trial results are frequently dubious and novel active model for clarification of fiber debasement at different circumstances was recommended [47,48]. The concurrent impact of the reusing and maturing has the comparative effect at the dehydrating temperatures of 80 °C (decline around 27.5 %) and 100 °C (decline about 27.6%) in respect of virgin mash, lower adjustments were at the temperature of 120 °C (decline about 21.5%). The maturing of the reused paper bases the reduction of the mash fiber, yet the paper stays great possessions [49,50].

Material and Method

This study is done for the analysis of waste papers obtained from the hotels of Dehradun city of India. As per data available on website, there are 302 hotels, in which 4 star hotels are 19 in this city. The accommodations of these hotels are about 8755 beds as per data given in website of State Tourism department. If the undeclared data are also considered, the capacity of accommodation becomes 9500 beds. The quantity of used papers collected from the hotels of Dehradun is given in Table 1

Observations

Table 1: The quantity (kg.) of used papers found from the hotels of Dehradun City in year 2020.

Type of Hotel	Number of selected hotels	Average number of rooms per hotel	Number of rooms	Waste Paper in Kg. (per day)
4 stars	19	35	665	665
3 stars	233	30	6990	6990
Others	50	20	1100	1100
Total	302	28.99	8755	8755

The present manuscript is a case study based on the papers used by the hotel of a city and analysis has been done with respect to environment, pollution, energy and economic prospects.

First, the amount of recyclable used papers collected from the hotels of Dehradun was estimated. The calculation of the quantity of waste paper was done by this assumption that a hotel bed/room spends average 1 kg paper in the form of toilet paper, for packaging of food in room service, facility of news paper & magazines providing in each room separately, carton boxes used in packing of cold drink, water bottle etc. and this consumption of paper is about double in five star hotels. Thus the consumption of waste papers in Dehradun city hotels is 8755 kg per day. Hence it was assumed that hotel rooms of a city can generate 8.755 tons of recyclable used papers per day. Thus, the quantity of used paper generated by the hotels in Dehradun was 3195.575 tons/year.

Results and Discussion

The above table represents that if the waste papers provided by the hotels in Dehradun are recycled and converted in to handmade papers for reuse, we can save the life of 80898-94360 trees, protect the environment from 121320 tons of CO_2 & 899790 kg pollutant gasses, conserve electricity 13817000 kWh,

5897500 litres fuel oil, 130756 tons of water. We can save the land fill and destruction of forest area is 10110-13480 m^2 & 286450 m^2 respectively. After processing the recycling papers, dependency on the foreign papers will be decreased which save our foreign currency. As per table 1, it can be seen that in a year 2020, the total quantity of used papers obtained from the hotels of Dehradun city is about 3195.575 tons in a year.

Table 2: Benefits in various aspects due to used papers obtained from the hotels of Dehradun in a day.

Type of Hotels	Weight of used papers (tons)	Number of saving trees	Saving amount of electricity (kWh)	Saving amount of water in ton	Saving amount of fuel oil (Liters)	Amount of gasses in ton	Amount of CO_2 gas in tons	Area of landfill space (m^2)	Saved area of forest (m^2)
4 star	0.665	15.96-18.62	2726.5	25.8	1163.75	177.55	23.94	1.995-2.66	56.525
3 star	6.99	167.76-195.72	28659	271.2	12232.5	1866.3	251.64	20.97-27.96	594.15
Others	1.100	26.4-30.8	4510	42.68	1925	293.7	39.6	3.3-4.4	93.5
Total	8.755	210.12-245.14	35895.5	339.68	15321.25	2337.55	315.18	26.26-35.02	744.175

Table 3: Economical benefits in a day by recycling of waste papers of hotels in Dehradun City

Type of Conservation	Hotels (4*)	Hotels (3*)	Other Hotels	Total
Number of trees @ 30k	478800 - 558600	5032800 - 5871600	135300000	6303600-7354200
Electricity@Rs. 5/- per kWh	13632.5	143295	22550	179477.5
Water@ Rs. 1 per liter	25800	271200	42680	339680
Fuel Oil@ 70/- per liter	81462.5	856275	134750	1072508.5
Landfill area@ Rs. 10k per m^2	1995-2660	20970-27960	3300-4400	26260-35020
Forestry area@ 3k per m^2	169575	1782450	280500	2232525
Total	771265 - 851730	8106990- 8952780	135783780- 135784880	10154051-11213411
Scrap papers(Rs.10k per ton)	6650	69900	11000	87550

Table 3 shows that if waste papers obtained from the hotels of Dehradun City sell directly without any processing its worth is about Rs. 87550/- but if these

waste papers are recycled, it provides direct and indirect economic benefit about Rs. 1.015-1.1213 Crore. Thus the recycling methods of waste papers provide more than hundred times fund than direct sell of waste papers. The above study is only done by the cost of saving the life of trees, cost of saving fuel oil, cost of conserved water, cost of conserved electricity, and cost of landfill area and forest space. If we consider the cost of all conserved things, it becomes hundred times more than the direct cost of scarp of papers. If we also consider the cost of products of handmade papers, the conserved amount becomes more than given in above tables. If it is taken seriously by every country, it may become more helpful for the conservation of environment and pollution etc. It is also great help to improve the economy of any country as conservation of fuel oil means conservation of foreign exchange. As per one report, Turkey recycles 70% waste papers per year and saves about 3.8 U S D of the country with environment protection and economy improvement [50].

Conclusion

From the above analysis, it is concluded that in this modern life, the use of papers will be increased day by day and demand of new papers is increasing continuously. The new papers production will be responsible for many types of problems. The solution of these problems is recycling of waste papers. In beginning, the new papers were manufactured by agricultural waste and rags. The quality of these types of papers was not so good. To increase the smoothness of the surface and tensile strength of the paper, it is primarily manufactured from the 100 % wooden fiber. A lot of amount of used papers are found from the hotels of Dehradun city. If these papers are sold directly, the worth of one year used papers is less than one lakh. Now the demands again put up by the hotels and paper mills manufacture new papers. For new paper manufacturing, wood from trees, electricity, water and oil fuel consumption, land fill, and forest area are required. The costs of all the requirements are mentioned in table 3. If the waste papers are recycled, the requirement of new papers will be decreased. Now the effective cost of the waste papers obtaining in a year from the hotels of Dehradun after processing become about Rs. 1 crore. The other effects like air, water and land pollution, emerging of harmful gases, loss of forest and environment loss etc. are the indirect benefits to the society. One assumption about the handmade paper is that the strength and surface of

these papers are not so good but by the use of different composition of agricultural waste and eatable ingredients, the quality of the recycled papers may be increased. The handmade papers may be used in packing material, as a soft board (a replacement of wooden board and plywood) and also to prepare handmade paper products like carry bags, file covers, document files, note pads, wedding cards, visiting cards etc. used papers may be converted into any type of paper like security paper, glossing paper, bloating paper, sound and light absorbing papers, sound and light reflected papers, printing papers etc. By inspiring the society for use of recycled papers, we can help to protect the forest, environment and economy of our state and country directly and indirectly.

Conflict of interest statement
None

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